AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF PUPIL RESPONDING AND TEACHER REACTING ON PUPIL ACHIEVEMENT

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CHAPTER ONE

THE PROBLEM

A lack of knowledge:

There is a paucity of research information showing which specific teacher behaviour variables cause desired outcomes of instruction. The literature on teacher effectiveness provides few guidelines which the practising teacher might use to improve the quality of his or her instruction.

The fact that research directed at the improvement of teaching methods has produced few results is widely recognized by writers concerned with the area, and statements drawing attention to this lack of knowledge have been made repeatedly during the past few years (Gage, 1968a; Lawrence, 1965; Medley and Mitzel, 1959; Nuthall, 1968; Rosenshine and Furst, in press; Schulman, 1970; Wittrock, 1967; Yager, 1966). For example, Yager (1966, p.236) claimed that,

> 'Little research has been accomplished to show specific differences in outcomes of instruction which result from teacher actions.'

Such statements proliferate despite clear recognition of the crucial importance of the information which is lacking (Gage, 1968a; Heil and Washburne, 1961; Kleinman, 1966; Medley and Mitzel, 1959). For example, Medley and Mitzel (1959, p. 245) suggested that,

> 'If the main objective of the professional part of teacher education is to teach teachers how to teach, it is highly desirable (to say the least) that clear-cut research evidence be obtained showing how the teacher must teach in order to bring about optimum pupil growth, and that such findings be made a part of every teacher's preparation.'

Reasons for the lack of knowledge:

The fact that research on teaching has a history which goes back several decades has been pointed out by Lawrence (1965), while Gage (1968a) noted that research on teaching has been going on almost as long as research on learning. The lack of knowledge about teacher effectiveness, then, does not appear to be a function of the age of the subject.

In addition, the situation exists despite a considerable volume of research which attempts to provide the necessary data. This is particularly true of the last two decades, during which there has been a marked increase in the number of classroom interaction studies undertaken. Simon and Boyer (1968, 1970) summarized 80 systems for the observation of classroom interaction, while Rosenshine (1970a) pointed out that he was aware of 40 observational systems not cited by Simon and Boyer. Most of these systems have been developed during the last decade.

The reason for the lamentable lack of knowledge about the effects of teacher behaviour results from the fact that research has not been of the right kind to provide the information which is needed. The central problem has been succinctly stated by Wittrock (1967) who claimed that educational psychologists have done too little rigorously controlled research in the school setting. This seemingly simple statement strikes at the heart of the problem and is worthy of some elaboration.

Research on teaching may fairly be dichotomized into studies which have been rigorously controlled and studies which have been done in school settings. It is virtually never a combination of the two elements. Educational psychologists have either carried out rigorously controlled 'pure' research, in the artificial laboratory setting, or loosely controlled 'applied' research, in the classroom setting. Pure laboratory research lacks what Schulman (1970) called external validity, while loosely controlled classroom research lacks what Schulman called internal validity.

Research conducted in the laboratory, with the precision and control which this setting affords, gives rise to results which may be considered true or internally valid, because they are replicable and verifiable. However, these results apply, with any certainty, only in the laboratory with the materials and methods used there.

To the extent that the materials and methods used in the laboratory differ from the materials and methods used in the classroom, laboratory studies lack external validity for the classroom situation. Because the conditions in the two situations normally differ widely, extrapolation from laboratory findings to the classroom is not legitimate, as has been recognized by a number of writers (Ebel, 1969; Furst, 1967; Hilgard, 1964; Lantz and Medley, 1967; Schulman, 1970).

Unfortunately, recognition of this problem has had little impact on the kinds of research undertaken. Educational psychologists are too often content to extrapolate from the findings of the laboratory to the classroom, without doing the additional research (as described by, for example, Hilgard, 1964) which is necessary to show that the laboratory findings hold up in the classroom setting. Schulman (1970, p. 376-7) stated that,

> 'The differences between the human learning laboratory and the typical classroom are numerous. The differences between the animal learning laboratory and the classroom are far greater. Researchers have been all too quick to generalize even from the latter setting to classroom behaviour.'

Research on teacher effectiveness conducted in the classroom setting has, to date, lacked the precision and control necessary for internal validity. The growing number of observational studies in the classroom, which attempt to relate teacher behaviour to pupil learning, are, almost without exception, of a correlational nature. The problems inherent in correlational studies have been pointed out by a number of writers (including Campbell, 1968b; Gage, 1968a; Gage 1968b; Rosenshine and Furst, in press; Stolurow, 1965). The essential problem is that the correlates of teacher effectiveness are not necessarily the causes of teacher effectiveness.

Training teachers to use behaviours which have been shown to be correlated with teacher effectiveness will give rise to improved instruction only if the behaviours are themselves the causes of teacher effectiveness, or if the behaviours give rise to other behaviours which are causal. To illustrate this point we may take the example of teachers being trained to praise their pupils' responses. Training teachers to use frequent praise will give rise to improved instruction if praise causes pupils to achieve highly, or if the use of frequent praise results, for example, in a reduction in criticism, which in turn raises pupil achievement. On the other hand, it is possible that praise is correlated with teacher effectiveness because it is also correlated with some unknown causal variable, such as a particular personality type. If this is the case, and if training teachers to praise their pupils does not alter teacher personality, we can expect no improvement in pupil performance.

Because correlational studies are unable to unequivocally indicate which of the variables correlated with teacher effectiveness are the causes of teacher effectiveness they lack internal validity. As

Rosenshine and Furst (in press, p. 1.7) said,

> 'The results of process-product studies must be treated with caution because the studies are correlational, not experimental. The results of such studies can be deceptive in that they suggest causation although the teacher behaviours which are related to student achievement may be only indicators of a complex of behaviours that we have not yet identified.'

Stolurow (1965) has gone so far as to suggest that, since there are probably more ineffective than effective ways to teach, observational studies of teaching behaviour are likely to result in the wrong ways of teaching being learned, rather than the right ways.

It may be noted, at this point, that the hypothesis that teacher behaviour is, to some degree, caused by pupil behaviour cannot be ruled out at the present time. Turner (1967) discussed this point of view, and while the evidence he presented is certainly not conclusive, it is at least provocative. Good (1969, 1970) has shown that pupils identified as low achievers by their teachers received less opportunity for classroom responding, less positive feedback, and more negative feedback than pupils identified as high achievers. This suggests the possibility that response opportunities and type of feedback may be a function of the pupil achievement level, rather than that the pupil achievement level is a function of the response opportunities and type of feedback.

Needed research:

The previous discussion does not deny the importance of laboratory studies and observational 'process-product' studies in the search for teacher effectiveness. Rather, it serves to limit the usefulness of such studies. Laboratory studies and observational studies serve to provide hypotheses which may be investigated under conditions enhancing both external and internal validity, namely, controlled experiments in the classroom setting. Only through such studies will unequivocal information be forthcoming. Rosenshine and Furst (in press) concluded that the most important studies yet to be undertaken are experimental studies, and that hypotheses drawn from other types of research can, in fact, be validated only through such studies.

Some important variables:

A substantial proportion of the observational research on teaching has been of a purely descriptive nature, providing normative data on the teaching process. One such study was carried out by Bellack et al. (1966).

Bellack and his co-workers described the teaching process in terms of four moves named structuring, soliciting, responding, and reacting. Structuring moves set the context for the subsequent interaction by beginning or ending interaction, and by indicating the nature of the interaction. Soliciting moves are moves intended to elicit a verbal, attentional, or physical response while responding moves occur in relation to these soliciting moves by providing the required response. Reacting moves occur in relation to the other three moves, but are not directly occasioned by them. For example, the teacher's response to a pupil's answer is not directly occasioned by that answer, and is a reacting move.

Bellack found that a substantial proportion of the interaction, which takes place in high school social studies classes, is made up of teacher soliciting moves, pupil responding moves, and teacher reacting moves. In the classrooms Bellack observed 28.8 per cent of the total moves were teacher soliciting moves, 25.0 per cent were pupil responding moves, and 24.3 per cent were teacher reacting moves. That is, 78.1 per cent of the total moves observed by Bellack were made up of these three types. The next largest category found by Bellack was pupil reacting, which accounted for only 5.7 per cent of the total moves.

Hoetker (1967), working with junior high school English classes, substantiated Bellack's findings. Hoetker found that teacher soliciting moves accounted for 32.3 per cent of the total moves, pupil responding moves accounted for 30.4 per cent of the total moves, and teacher reacting moves accounted for 27.0 per cent of the total moves. That is, 89.7 per cent of the total moves were accounted for by teacher soliciting, teacher reacting, and pupil responding moves.

If these studies accurately reflect what occurs in a normal classroom, and there is no reason to suspect that they do not, then it is clear that teacher soliciting, pupil responding, and teacher reacting make up the major part of the interaction occurring between the teacher and the pupils in the typical school lesson.

Not only do these behaviours occur frequently in the classroom, but, in addition, psychological theory suggests that they are important determiners of learning. It is accepted that some form of active pupil response is necessary if learning is to take place, because learning is an active process. While the nature of the response necessary for optimal learning is not agreed upon, giving rise to arguments as to whether responses need to be constructed, overt, and so on, few would deny that a response of some kind is crucial.

Some writers have criticized teachers for not requiring, or permitting, their pupils to respond frequently enough. For example, Andreas (1968) claimed that teachers talk too much while pupils do not respond often enough. Andreas went on to conclude that the most needed reform in education was to balance the response element with the stimulus element.

Because belief in the value of pupil responding is widely accepted, and teachers are being criticized for not having their pupils respond often enough, one would expect a large research literature showing that pupil responding is related to pupil achievement. In fact, little research has been done, especially research conducted in the classroom setting, as the next chapter will show.

The relationships between positive and negative reinforcement and learning have been convincingly demonstrated in a large number of studies dealing with infra-human subjects, as they have with human subjects in the artificial laboratory situation. Only relatively infrequently, however, have the relationships between teacher reacting (a source of both positive and negative reinforcement) and pupil achievement been investigated in the classroom. Those studies which have been undertaken in the classroom have almost all been of a correlational nature, and hence suffer from the problems inherent in that methodology.

It is clear, then, that pupil responding and teacher reacting are variables which need further study because:

1. They are common classroom behaviours and, as such, are likely to be influential in facilitating learning, other things being equal.
2. Psychological theory suggests that they are important in facilitating learning, but the research to date has not been adequate to clearly establish their effects in the classroom setting.

<u>Outline of the study</u>:

In the present study, pupil responding and teacher reacting variables were manipulated under experimental conditions in the classroom situation, thus enhancing both internal and external validity. The effects of these manipulations on pupil achievement were investigated by testing hypotheses drawn from both laboratory and observational studies.

Three 35 minute experimental lessons on the red deer and the tahr[1], which had been carefully planned to avoid extraneous teacher behaviour, were taken by the writer with intermediate school, Form II classes of average ability. A posttest of achievement, providing six scores, was administered following the lessons. Predicted posttest scores were calculated from the regression of a number of pretest measures (such as verbal ability, prior content knowledge, non-verbal ability, etc.) on the six posttest scores. Residual achievement scores, calculated by subtracting the predicted posttest scores from the scores actually obtained, were used in analyses of variance to determine treatment effects.

1 Also spelt thar.

CHAPTER TWO

REVIEW OF RESEARCH AND HYPOTHESES

Organization of the review:

The review has been divided into (a) experimental studies and (b) observational studies. Each of these sections has been further divided into (i) pupil responding studies, (ii) teacher reacting studies, and (iii) studies relevant to both pupil responding and teacher reacting.

Criteria for inclusion:

In order to eliminate those studies with little or no relevance for the review, the following criteria for inclusion were laid down.

First, studies included in this review all deal with independent variables which may be directly related to overt teacher behaviour. That is, the teacher behaviour variables in the studies included in this review are, what Rosenshine (1970b) has called, low-inference variables. Such variables may be measured objectively, and do not require subjective judgement by the person making the measurement. Low-inference variables are counted and not rated.

This criterion was laid down because of the importance of having information about variables which are anchored directly in observable teacher behaviour, if the variables are to be used to improve teaching.

Flanders (1967, p. 260) has noted that,

> 'Ideas about teaching which cannot be related to overt actions are less likely to maintain a consistent meaning when the talking stops and the teaching starts.'

Failure to appreciate this point of view has lead writers to make nebulous statements about teacher effectiveness. For example, Hamachek (1969, p. 343) stated,

> 'A good teacher is a good person. Simple and true. A good teacher rather likes life, is reasonably at peace with himself, has a sense of humor, and enjoys other people. If I interpret the research correctly, what it says is that there is no one better-than-all-others type of teacher. Nonetheless there are clearly distinguishable 'good' and 'poor' teachers. Among other things, a good teacher is good because he does not seem to be dominated by a narcissistic self which demands a spot-light, or a neurotic need for power and authority, or a host of anxieties and tremblings which reduce him from the master of his class to its mechanic.'

Such statements are meaningless when the talking stops.

Second, studies included in this review all evaluate successful teaching in terms of a test of pupil achievement.

Gage (1963) has discussed the problem of trying to select a global criterion of teacher effectiveness, and suggests, instead, the use of a number of micro-criteria which may be investigated individually. This point of view is supported by findings that a given teacher may be good at obtaining one outcome of instruction while being poor at obtaining another (Yager, 1966).

Achievement, which is one of the most important criteria of teacher effectiveness, was selected as the criterion for the present study, and, consequently, only those studies which also utilize some test of achievement as the criterion of teacher effectiveness have been included in the review. This is not to deny the validity of criteria other than achievement in teaching research, but to recognize that different laws may be needed to explain the successful attainment of different criteria. Specifically excluded from the review by this criterion are studies using attitudes, creativity, and critical thinking as criteria of teacher effectiveness.

Third, studies included in this review all deal with materials which at least approximate meaningful verbal material, because this is the type of material dealt with in the present study, and usually dealt with in school situations.

It has been suggested that different kinds of materials may be learnt and retained according to different laws (Ausubel, 1968). Consequently, studies involving materials such as rote nonsense syllable learning and paired associate learning have been excluded from the review.

Because of the difficulty involved in unambiguously defining the term meaningful verbal learning, application of this criterion has, at times, been lenient. Where doubt about the meaningfulness of the material used in a particular study existed, the study was included in the review rather than excluded from it.

Fourth, studies included in this review all deal with subjects in Stan ard 2 (Grade 3) and above. Studies dealing with subjects in the kinder-garten and primer grades have been excluded from the review.

The writer agrees with Campbell and Barnes (1969) when they sugge that the research to date seems to indicate that different teacher behavio may facilitate desired outcomes of instruction at different class levels. As the present study deals with Form II pupils, in a fairly formal teachi situation, it was decided to exclude from the review studies dealing with pupils in their earliest years of schooling, where teaching methods are generally much less formal. It was decided to make the cut-off point at the end of Standard 1, because this is generally recognized as the end of the primer grades in our schools. When a child enters Standard 2 he encounters a more formal learning setting than he has previously encoun ered.

Studies dealing with more than one class level, some classes being above the cut-off point and some below it, have been included in the revi where at least half the subjects were above the cut-off point.

<u>Experimental studies</u>:

<u>Responding</u>: Studies on the effects of different conditions of pupil re ponding are rare, despite the importance attached to an active pupil res-ponse in the programmed learning paradigm, and the obvious importance of a theory of vicarious learning for the classroom, as pointed out by Nuthall (1968).

Van Wagenen and Travers (1963) 'taught' 96 4th., 5th., and 6th. Grade subjects German vocabulary, and investigated the effects of different conditions of pupil responding on achievement. The subjects were taught in 'classes' of eight, with the 'teacher' soliciting responses only from the odd numbered subjects. Thus, the odd numbered subjects were required to respond to one quarter of the teacher's solicitations, while the even numbered subjects were not required to respond at all.

It was found that those subjects who had responded scored significantly higher on an achievement test of the German vocabulary taught than did the subjects who had not responded ($p < .05$). Further investigation of the results suggested that the supremacy of the responding group was restricted to the particular items to which they had responded. That is, the responding subjects did no better on the items to which they had not responded than the subjects who did not respond at all. The study also showed that the subjects who were not called on to respond showed a greater decline in achievement over the three days of the experiment than did the responding subjects.

The general findings of this study were supported in a similar study by Travers et al. (1964) with 288 4th., 5th., and 6th. Grade subjects ($p < .001$). However, in this study, unlike the earlier one, it was found that the responding subjects performed better on both the items to which they had responded during the lessons, and the items to which they had not responded during the lessons.

Despite the fact that Van Wagenen and Travers stress the importance of research which retains the desirable features of the laboratory experiment, while simulating characteristics of the classroom, their research, like the Travers et al. study, falls far short of the ideal. The method used to teach the vocabulary, in both studies, is more like paired associate learning than meaningful verbal learning in the classroom. Were it not for the difficulty of unambiguously defining meaningful verbal learning, both studies might have been eliminated from the review on the grounds that they fail to meet the third criterion for inclusion.

The same problem occurs in a study by Rosenbaum (1962). Groups of four subjects, from Grades 5, 6, and 7, were shown 25 objects, such as an iron, a chair, and an egg, arranged in a five by five matrix. Each subject was given a sheet of paper with the name of each object in its correct place on a similar matrix. The subjects were required to circle the name of each object as the experimenter pointed to the object itself. Of the four treatments used in the study three are relevant to the review. In treatment one, the subjects simply circled the object pointed to. In treatment two, all subjects in the group responded by saying the name of the object aloud, in unison, before circling the name. In treatment three, a designated subject said the name of the object aloud, after which all members of the group circled the name.

Results indicated that the subjects from treatment one, who simply circled the name, did less well on a recognition test of the objects used than the other subjects. When the subjects in treatment three were divided into (i) those subjects who had been asked to respond by saying the name of an object aloud and (ii) those subjects who had not been asked to respond by saying the name of an object aloud, it was found that both groups did significantly better on the posttest than treatment group one ($p < .05$). However, there were no other significant differences, which fails to support the previously described studies of Van Wagenen and Travers (1963) and Travers et al. (1964). The subjects called upon to say a word aloud in treatment three, did not score significantly higher on the posttest than the rest of the group who learnt vicariously. In addition, the vicarious learning pupils from treatment three scored higher on the posttest (although not significantly) than the pupils from treatment two who responded every time.

Michael and Maccoby (1961) presented a 14 minute film on civilian defence against atomic bombing, to just over 1,000 high school juniors and seniors in class groups of about 20 pupils. One variable studied was participation. Some subjects simply saw the film. Others saw the film and answered questions during four participation sessions, three of which occurred during breaks in the film and the fourth following the film. The questions asked were 15 of the final 30 posttest items, and they covered the preceding section of the film. Some of the participating subjects were required to write their answers, while the others were required to think their answers out.

Results indicated that the group participating through answering questions, either overtly or covertly, did better on the posttest than the group which simply saw the film. Further analysis indicated that this effect was limited to the specific posttest items which had been practised during the participation sessions. There were no significant differences between the overt and covert participation groups.

Maccoby et al. (1961) presented, what they assumed to be, a dull ten minute film on world mapping concepts from ancient times to the Air Age, to just under 1,000 air force trainees in class sized groups. Half the subjects simply viewed the film. The other half answered ten review questions during three review periods, two of which occurred during breaks in the film and the third following the film. The questions were answered overtly and feedback in the form of the correct response was provided. Half the subjects were told they would be tested to raise their level of motivation.

Results showed that the pupils in the participation group performed significantly better on the posttest questions which they had practised, but, in addition, under conditions of low motivation, they also performed better on the posttest questions which they had not practised.

The two previous studies deal with instruction through a medium which is relatively rare in our schools, and is hence atypical.

In addition, the gains shown on the items practised by the participation groups cannot be unequivocally explained. It is not clear whether the gains accrue from participation as such, or simply from extra contact with the material being learnt.

In a study by Rippey (1966) nine statistics students were randomly assigned to a treatment in which they worked through a programmed book on Fortran programming, writing their answers to the programme questions in a notebook. This group received no comment from its instructor, except on procedural matters at the beginning of instruction. Ten other subjects had the frames from the book read to them, or projected by means of an overhead projector. Students in this group were called upon, at random, to answer the programme questions aloud, with the instructor providing feedback by indicating whether or not the answer given was correct.

All six posttest measures of achievement showed the programmed learning group to be inferior to the 'teacher' taught group. However, only one of these differences was significant at the .01 level of confidence, although one other difference did reach the .1 level of confidence.

While this study suggests that pupils in a class-like situation, with intermittent responding, learn more than pupils in a programmed learning situation, with continuous responding, the results must be treated with caution. The sample size of 19 subjects is totally inadequate, especially in view of the fact that no account was taken of initial aptitude or ability, except to say that all subjects were naive.

To summarize, it is evident that experimental studies have not clearly demonstrated the importance of responding as a variable in learning. Generally, a group which practised posttest items during participation periods did better on those posttest items which had been practised, but only infrequently has the responding group also done better on the posttest items which were not specifically practised.

Reacting: Hurlock (1925) investigated the effects of praise and reproof on arithmetic performance. 106 4th. and 6th. Grade pupils were divided into four matched groups on the basis of their performance on a test of addition.

Hurlock found that a group praised for the excellence of its test performance the day before, and encouraged to do better, performed significantly better on an addition test, after four days of such treatment, than a control group which simply sat the tests. A reproved group, and an ignored group in which the pupils simply observed praise and reproof being given to other subjects, did not score significantly higher than the control group.

In this study the children were called to the front of the room and praised or reproved, as a group, before the other members of the class. This practice is extremely rare in the modern classroom, which limits the usefulness of the study for the present day. Even more serious is the fact that the praise and reproof given in the study were unrelated to actual performance. Because each of the groups was matched for performance on the addition test given on the first day of the study, those pupils who were reproved on the second day were equal in performance to those who were praised. Teachers do not praise and reprove in a random fashion, but according to their evaluation of the pupil's response. The effects of such random praise and reproof are presumably vastly different from the effects of the reasoned praise and reproof found in a normal classroom. It should be noted that the reproved group equalled the performance of the praised group on the second day of the study, both groups showing a marked improvement over the first day.

Dollins et al. (1960) investigated the effects of different schedules of praise on the work output of children designated low in adjustment. Three groups of 25 4th. Grade pupils, scoring at or below the 30th. percentile on a personality test, were used in the study. The pupils in each group were given three minutes each day, for 30 days, to work on problems of addition and subtraction. One group received praise, in a manner consistent with the teacher's usual practices, on two out of three days, a second group was praised on one out of three days, and a third group did not receive praise at all.

Work output at the end of the six weeks, as measured by the numbe of correct items done, was highest for the group receiving praise on tw of the three days and lowest for the group not receiving praise at all, but the results were not significant.

In this study, as in the previous one, praise was awarded or not awarded irrespective of the actual performance of the pupils.

To summarize, it is evident that experimental studies have not clearly demonstrated the effects on achievement of praise and reproof as they are normally used in the classroom.

Reacting and responding:

Amidon and Flanders (1961) gave 560 8th. Grade students a dependence-proneness test. The 140 pupils scoring highest on this test were taught geometry, in groups of 20, by a role playing teacher. With half the subjects the teacher acted a direct teacher role and with the other half he acted an indirect teacher role.

Compared with the direct teacher role, the indirect teacher role maximized categories 2, 3, and 4 of Flanders' Interaction Analysis Categories (FIAC) (Flanders, 1970), while minimizing categories 5, 6, and 7. These categories are described in Table 2. 1. Observation of the teacher's performance, using FIAC, showed clear differences between the two treatments in the desired directions.

TABLE 2.1

FLANDERS' INTERACTION ANALYSIS CATEGORIES (FIAC): FROM FLANDERS (1970)

Teacher Talk	Response	1. Accepts feeling. Accepts and clarifies an attitude or the feeling tone of a pupil in a non-threatening manner. Feelings may be positive or negative. Predicting and recalling feelings are included. 2. Praises or encourages. Praises or encourages pupil action or behaviour. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "Um hm?" or "go on" are included. 3. Accepts or uses ideas of pupils. Clarifying, building, or developing ideas suggested by a pupil. Teacher extensions of pupil ideas are included but as the teacher brings more of his own ideas into play, shift to category five.
		4. Asks questions. Asking a question about content or procedure, based on teacher ideas, with the intent that a pupil will answer.
	Initiation	5. Lecturing. Giving facts or opinions about content or procedures; expressing his own ideas, giving his own explanation, or citing an authority other than a pupil. 6. Giving directions. Directions, commands, or orders to which a pupil is expected to comply. 7. Criticizing or justifying authority. Statements intended to change pupil behaviour from non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
Pupil Talk	Response	8. Pupil-talk - response. Talk by pupils in response to teacher. Teacher initiates the contact or solicits pupil statement or structures the situation. Freedom to express own ideas is limited.
	Initiation	9. Pupil-talk - initiation. Talk by pupils which they initiate. Expressing own ideas; initiating a new topic; freedom to develop opinions and a line of thought, like asking thoughtful questions; going beyond the existing structure.
Silence		10. Silence or confusion. Pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

Results indicated that the indirect treatment produced significantly higher geometry scores than the direct treatment with intelligence controlled, with pre-achievement controlled, and without any control for intelligence and pre-achievement ($p < .01$). No significant differences were found when the total group of 560 subjects was used in the analysis, according to Amidon and Flanders. However, Flanders (1970) claimed the results were 'barely significant' at the .05 level of confidence.

This study is very interesting because it is a true experiment. It is a pity that further studies of a similar nature have not been done in the intervening ten years since it was published. The study unfortunately fails to establish what the critical teacher behaviours actually are. For example, did the presence of praise facilitate achievement for the dependent prone student group, or was it the absence of criticism, or perhaps some combination of both variables?

Flanders (1970) reported that short experimental studies in social studies failed to show significant differences in adjusted subject matter gains for the direct and indirect treatments. This study was reported in a paper now out of print (Flanders, 1960) and has not been seen by the writer.

Schantz (1964) reported a study described in more detail by Flanders (1970). Both sources have been consulted for the summary which follows. A role playing teacher taught three science units to 61 4th. Grade pupils selected from the top and bottom quintiles of ability.

As with the Amidon and Flanders (1961) study, roles were direct and indirect teacher influence.

Results indicated that the high ability pupils taught by the indirect method had higher achievement on a posttest given directly after the third lesson ($p < .07$), and a delayed posttest given two weeks after the lessons ($p < .05$). The differences for the low ability subjects favoured the direct teaching method but were not significant.

To summarize, experimental studies have not shown clearly that gross variables, which include both teacher reacting and pupil responding, are related to achievement.

Observational studies:

Responding: Rosenshine (1970b) reported a study by Sharp (1966). Student talk showed a small nonsignificant negative correlation with pupil achievement in high school biology. The writer has not seen the original study and few details are available.

Reacting: Silberman (1957) reported a study in which the teachers of 49 Grades 3 to 6 classes were observed for two, half-hour periods by each of six observers who used a system adapted from Withall (1949).

Results showed that growth in reading was not significantly related to praise, defined as the number of supportive statements tallied. Neither was reading growth significantly related to reproof, defined as the number of reproof statements tallied and adjusted to give each series of observations an equal weighting. A composite praise by reproof score, obtained by multiplying the praise and reproof scores, also failed to show a significant relationship with reading growth.

Medley and Mitzel (1959) reported a study which apparently used the same data as the Silberman (1957) study (although this is not explicitly stated) and so is not independent of that study.

They found that emotional climate was not related to reading growth. A high score on the emotional climate index indicates a classroom in which expressions of warmth and friendliness and pupil supportive statements are common, while expressions of reproof and sarcasm are rare.

Brown (1960) observed 318 3rd. Grade pupils using an adaptation of the observation system developed by Withall (1949). For his analysis of the results Brown divided the pupils into three achievement groups.

He found that a pupil centred climate (high emotional climate index) was significantly related to arithmetic reasoning for underachievers and overachievers, but not for average achievers ($p < .05$). In addition, a pupil centred climate was significantly related to arithmetic computation for underachievers and overachievers, but again not for average achievers ($p < .05$) Pupil centred climate was not related to paragraph meaning or word meaning for any of the three achievement groups.

Powell (1968) tested the hypothesis that indirect teacher influence is positively related to achievement. Classrooms were observed using FIAC during the 3rd. Grade, and again during the 4th. Grade, and achievement was measured using standardized tests of arithmetic and reading achievement. Powell used the i/d ratio (FIAC categories 1 plus 2 plus 3 divided by FIAC categories 6 plus 7) and variations on it. The i/d ratio is clearly a ratio of positive to negative teacher reactions.

Results suggested that the pupils who had been with the same indirect teacher for three years were superior in arithmetic achievement to children who had been with the same direct teacher for three years ($p < .05$). There were no significant differences between the two teaching styles for reading achievement. Whether these pupils had an indirect or direct teacher in their fourth year appeared to have no effect on achievement.

A number of doctoral dissertations and other unpublished reports are quoted in the literature as lending support to, or failing to lend support to, the thesis that positive teacher reactions are conducive to achievement, while negative teacher reactions are detrimental to achievement. These studies are briefly mentioned along with other studies about which little information is available to the writer. Anthony (1967), Morrison (1966)[1], Penny (1969), and Spaulding (1965) are cited as supporting the thesis while Cook (1967) is cited as finding nonsignificant results.

1 This study used the same data as the Flanders (1970) 6th. Grade study and so is not a separate replication.

Reacting and responding: Flanders (1970) reported the results of four studies carried out using FIAC, and Rosenshine (1970b) reported some additional breakdowns of this material not reported by Flanders. Both sources were consulted to provide the material for the summary which follows.

16 8th. Grade mathematics classes, 15 7th. Grade English-social studies classes, 30 6th. Grade general classes and 16 4th. Grade social studies classes were observed. In the 4th., 7th., and 8th. Grade classes pupil achievement was measured using an achievement test designed to measure the objectives of a two-week unit taught by each teacher. In the Grade 6 class achievement was measured with a composite score, composed of language and number skills from a nationally standardized achievement test.

In Flanders' system, a tally, describing the ongoing teacher and pupil behaviour in terms of FIAC, is made every three seconds. The following variables of relevance to this study were correlated with the achievement measures taken in each class (see Table 2.1 for descriptions of the behaviours). The variables are described verbally and then in terms of FIAC by the numbers in the brackets. For example. (1) indicates the sum of the tallies in FIAC category one, (3-3) indicates the sum of the tallies in FIAC category three which immediately follow another tally in the same category and (8-6) indicates the sum of the tallies in FIAC category six which immediately follow a tally in FIAC category eight.

1. Praise (2)
2. Sustained acceptance (3 - 3)
3. Indirectness (1 plus 2 plus 3)
4. Restrictiveness (6 plus 7)
5. Restrictive feedback (8 - 6 plus 8 - 7 plus 9 - 6 plus 9 -7)
6. The i/d ratio (1 plus 2 plus 3 divided by 6 plus 7)
7. Questions (4)
8. General indirectness (1 plus 2 plus 3 plus 4)

Flanders used the term indirectness to describe what has here been termed general indirectness after Rosenshine (1970b).

Praise, sustained acceptance, and indirectness are measures of positive teacher reactions, restrictiveness and restrictive feedback are measures of negative teacher reactions while the i/d ratio is a ratio of positive to negative teacher reactions. Questions provides a measure of pupil participation while general indirectness is a combined measure of pupil participation and positive teacher reactions.

Table 2.2 gives the correlations between each of the eight variables and achievement, for each of the four grades. Inspection of these correlations suggests that positive teacher reactions facilitate pupil achievement, while negative teacher reactions are detrimental to pupil achievement. Pupil participation, as indicated by the number of questions asked, appears to bear little relationship to pupil achievement.

TABLE 2.2

CORRELATIONS BETWEEN CERTAIN CATEGORIES FROM FLANDERS' INTERACTION ANALYSIS CATEGORIES AND ACHIEVEMENT. FROM FLANDERS (1970) AND ROSENSHINE (1970b)

Variable	Grade 4	Grade 6	Grade 7	Grade 8
1 [2]	-0.13	0.36 [1]	-0.23	0.30
2 [2]	0.19	0.30	0.40	0.19
3 [3]	0.12	0.37 [1]	0.41	0.30
4 [2]	-0.24	-0.04	-0.61 [1]	-0.34
5 [2]	-0.34	-0.32	-0.50 [1]	-0.43
6 [3]	0.33	0.12	0.47	0.41
7 [2]	-0.19	0.11	-0.06	0.44
8 [2]	-0.08	0.26	0.25	0.45

[1] Significant at the .05 level of confidence

[2] From Flanders (1970) with probabilities from Rosenshine (1970b)

[3] From Rosenshine (1970b)

In separate analyses of the data for the 7th. and 8th. Grades (Flanders, 1964) i/d ratios were used to select the most direct and the most indirect teachers. It was found that pupil achievement was higher in the classes of the six most indirect mathematics teachers than in the classes of the five most direct mathematics teachers ($p < .01$). The same relationship was found when the classes of the six most indirect English-social studies teachers were compared with the classes of the four most direct English-social studies teachers ($p < .01$).

La Shier and Westmeyer (1967) supported the Flanders' findings using the FIAC. La Shier and Westmeyer found a significant correlation between median achievement gain, corrected for initial ability, and teacher indirectness as measured by an I/D ratio (FIAC categories 1 plus 2 plus 3 plus 4 divided by categories 5 plus 6 plus 7). The study involved ten student teachers teaching a six week biology unit to 8th. Grade pupils, and results were accepted as significant at the .05 level of confidence.

Furst (1967) reanalyzed the data collected by Bellack et al. (1966) using FIAC. The Bellack et al. data consisted of four lessons on an economics unit taken by 15 teachers at the high school level. The teachers were divided into three groups on the basis of the achievement of their classes corrected for pupil intelligence and class size.

Results indicated that the three classes with achievement levels higher than could be expected by chance, in comparison with the remaining 12 classes, had more indirect than direct teacher behaviours, more positive than negative immediate feedback to student talk, and mor extended pupil talk.

Soar (1966) collected information in 55 Grades 3 to 6 classes over a one year period. Vocabulary, reading, and arithmetic achievement were the three achievement measures among a number of product variables investigated. The FIAC was one of two observation instruments used to collect information about classroom process variables. The process information was factor analyzed to produce a nine factor solution, from which factor scores, on each of the nine factors, were calculated for each of the classrooms. Mean residual gain scores were calculated for each of the classes on each of the achievement measures and the nine factor scores were correlated with the mean residual gain scores for each classroom.

Results showed that a factor named teacher criticism showed significant negative correlations with arithmetic concepts and arithmetic problems ($p < .05$) and arithmetic total ($p < .01$), but not with the other achievement scores. A factor which looked much like teacher indirectness showed very small and nonsignificant correlations with all achievement measures. Student talk and student talk prolonged loaded negatively on a factor termed teacher talk versus extended pupil talk, which showed consistent but nonsignificant negative correlations with pupil achievement.

Soar (1967) reported a continuation of the 1966 study which suggested that at least some process variables probably exhibit a curvilinear relationship with achievement. For example, Soar found that intermediate levels of teacher indirectness appeared to produce the greatest pupil achievement. Both Soar (1968) and Flanders (1970) have discussed the possibility of curvilinear relationships between teacher behaviour and pupil achievement.

Perkins (1965) studied 36 achieving pupils and 36 underachieving pupils in 14 5th. Grade classes, using an observation system similar to FIAC.

He found that teacher uses student's idea, which is a form of mild positive reacting, loaded on a factor which was related to gains by achievers in reading vocabulary, arithmetic reasoning, arithmetic fundamentals, and spelling and to gains by the whole class in arithmetic reasoning. Teacher does not accept student's answer, a form of mild negative teacher reacting, was also loaded on this factor and, in addition, on a second factor which was related to gains by achievers in arithmetic reasoning and spelling. Two forms of negative teacher reacting, teacher does not listen or support and teacher criticises, loaded on a factor which was related to losses by underachievers in reading comprehension and spelling, losses by underachievers, achievers, and the total class in mechanics of English, and gains by all three groups on reading vocabulary. Teacher lectures, which is an index of low pupil participation, also loaded on this factor.

Wright (1968), in a study reported in Wright and Nuthall (1970), observed 17 Standard 2 teachers teaching three ten minute lessons on a nature study topic. Of 37 process variables correlated with pupil achievement, corrected for prior knowledge and aptitude, the following are of interest to this review.

A variable termed thanks and praise was significantly correlated with pupil achievement ($p < .05$). A variable termed redirection to another pupil also showed a positive correlation with achievement at the same level of significance. A question is redirected when the teacher after receiving a response from one pupil, passes the question on to another pupil for comment. Wright suggested that redirecting questions may function as a responding variable by increasing the amount of pupil participation, and also by widening the distribution of questions. Wright felt that if each pupil were expecting to have a question redirected to him he would be preparing a response to that question. Two variables named pupil talk and extended pupil talk showed nonsignificant correlations with achievement.

A number of doctoral dissertations and other unpublished reports are quoted in the literature as lending support to, or failing to lend support to, the thesis that indirect teaching (variously defined) is positively related to achievement. These studies are briefly mentioned along with other studies about which little information is available to the writer. Campbell (1968a), Nelson (1964), and Schirner (1967) are cited as supporting the thesis while Birkin (in press) and Snider (1966) reported nonsignificant results.

The observational studies reviewed here show a moderately consistent relationship between positive teacher reactions (indirect teaching) and high pupil achievement, and conversely between negative teacher reactions (direct teaching) and low pupil achievement. However, as Flanders (1970) has noted, the studies shed little light on a very significant question. Does indirect teaching cause more pupil learning or do pupils who learn more cause their teachers to be indirect?

The relationship between responding and achievement is much less clearly established. Few observational studies looked at this variable at all, and those which did often included it as part of a gross variable, such as an I/D ratio. Results from observational studies concerned with responding have generally been nonsignificant and mixed. Such a situation provides little as a basis for research hypotheses.

Hypotheses: Where possible, the hypotheses which follow are based on the studies reviewed. However, it has been necessary, in places, to fill in the gaps left by insufficient research with assumptions which seem reasonable on commonsense psychological grounds.

First, it was assumed that some form of pupil responding is essential for pupil achievement which, as has been previously pointed out, is widely accepted in psychological theory.

Second, it was assumed that the pupil responses need not be overt to facilitate learning. This assumption receives some support from the studies reviewed. For example, Michael and Maccoby (1961) found that covert responding was not inferior to overt responding, and so on.

Third, it was assumed that the level of covert responding or the level of attending behaviour could be raised or lowered according to the conditions under which pupils were required to make overt responses to the lesson content. This assumption receives support from the Travers et al. (1964) study where the responding pupils learnt more than the pupils not required to respond, even on questions to which they had not been asked to respond overtly. Presumably this was because their level of covert responding was raised on questions they were not asked to respond overtly to by the requirement to respond overtly to other questions. Similar support is given by the Maccoby et al. (1961) study and Wright's (1968) interpretation of the effects of redirecting solicitations.

Hypothesis one: Hypothesis one was formulated according to the following reasoning.

First, when pupils are unable to predict when they will be required to respond overtly to the lesson content, and all pupils are required to respond overtly an equal number of times, they should feel constrained to respond overtly to all, or most, of the teacher's solicitations in anticipation of being asked to respond overtly. That is, under conditions in which overt pupil responding is required of all pupils who cannot predict when they will be asked to respond overtly, attending behaviour should be maximized.

Second, when pupils can predict when they will be required to respond overtly to the lesson content, all pupils being required to respond overtly an equal number of times, they should not feel constrained to respond covertly to all teacher solicitations, but only to those solicitations to which they know they will be asked to respond overtly. They are thus free to fail to respond covertly to a larger proportion of the total number of teacher solicitations than are the pupils who cannot predict when they will be required to respond overtly.

Third, when pupils are not required to respond overtly at all, but overt response frequency is determined by the individual pupils, some pupils should not feel constrained to respond covertly at all. Provided some pupils are responding overtly to the teacher's solicitations other pupils are entirely free to fail to attend to the lessons.

Hypothesis one: Mean residual achievement will be higher in classes taught under conditions in which overt responding is required equally of all pupils and occurs in a random sequence (condition x) than it will be in classes taught under conditions in which overt responding is required equally of all pupils but occurs in a predictable sequence (condition y) and classes taught under conditions in which overt responding is not required of all pupils, pupils being free to choose whether to make overt responses or not (condition z).

If the reasoning behind hypothesis one is sound there should be differences in the patterns of responses to the posttest items under conditions (x) and (y). Pupils should do equally well on posttest items relevant to the overt responses they made during instruction and posttest items not relevant to the overt responses they made during instruction under condition (x). Under condition (y) pupils should do better on posttest items relevant to the overt responses they made during instruction than they do on posttest items not relevant to the overt responses they made during instruction.

However, it is possible that, under condition (y) in hypothesis one, pupils will be highly motivated on the lesson questions they know they will be asked to respond overtly to, and will thus score very highly on the posttest items relevant to these questions. At the same time they may be poorly motivated on the lesson questions they know they will not be required to respond overtly to and will thus score very poorly on the posttest items relevant to these questions. Thus, when the two types of items are summed in condition (y) in hypothesis one, the mean residual score may not differ from the mean residual score obtained when the two item types are summed for condition (x), in which the pupils did, say, moderately well on both item types.

In order to enable unequivocal interpretation of the effects of conditions (x) and (y) in hypothesis one hypothesis one (a) was formulated.

Hypothesis one (a): When each pupil's posttest items are divided into (i) those items relevant to the overt responses he made during instruction and (ii) those items not relevant to the overt responses he made during instruction, the pass rates on the two item types will differ under conditions (x) and (y) in hypothesis one. The pupils in condition (x) should do equally well on both the type (i) and type (ii) items, while the pupils in condition (y) should do better on the type (i) items than the type (ii) items.

Hypothesis one assumes that there will be differences in the frequency with which pupils choose to respond overtly under condition (z). This is tested in hypothesis one (b).

Hypothesis one (b): Under condition (z) in hypothesis one there will be differences in the frequency with which pupils choose to make overt responses.

Not only should there be differences in the frequency with which pupils choose to respond overtly under condition (z), but these differences should also be positively related to achievement. This is tested in hypothesis one (c).

Hypothesis one (c): Under condition (z) in hypothesis one the pupils who choose to frequently respond overtly will have a higher mean residual achievement score than the pupils who choose to rarely respond overtly.

It is possible that the most frequent responding and the least frequent responding groups from condition (z) will differ on a number of variables other than residual achievement. For example, the least frequent responding pupils may have lower pretest scores than the most frequent responding pupils. Thus, the raw posttest scores could differ for the two groups while the residual scores are not significantly different. This is tested in hypothesis one (d).

Hypothesis one (d): Under condition (z) in hypothesis one the pupils who frequently respond overtly will differ on a number of pretest and/or raw posttest measures from those pupils who rarely respond overtly.

Hypothesis two: After the study had been begun, and some data had been collected to test hypothesis one, two classes had to be dropped from the section of the study they had originally been planned for and a treatment had to be found to take with these classes (see p.86). Because the data collected to that point suggested that the responding variable was weak, it was decided to formulate an hypothesis which compared extreme responding groups.

Hypothesis two: Mean residual achievement will be higher for a group of pupils who are required to make overt responses to teacher solicitations in an unpredictable sequence, than it will be for a group of pupils who are prevented from making any overt responses to teacher solicitations.

This hypothesis is clearly supported by the findings of several of the studies reviewed (Amidon and Flanders (1961), Furst (1967), La Shier (1967), Maccoby et al. (1961), Michael and Maccoby (1961), Rosenbaum (1962), Schantz (1964), Travers et al. (1964) and Van Wagenen and Travers (1963)). Of the other relevant studies reviewed, none shows a significant negative relationship between pupil responding and pupil achievement.

To establish whether pupil responding facilitates achievement by increasing achievement on the items actually practised, as in the Van Wagenen and Travers (1963) study, or through a more generalized effect, as in the Travers et al. (1964) study, hypothesis two (a) was formulated.

Hypothesis two (a): When each responding pupil's posttest items are divided into (i) those items relevant to the overt responses he made during instruction and (ii) those items not relevant to the overt responses he made during instruction, the pass rates on the two item types will differ.

It is clear that hypothesis two (a) need not be tested if hypothesis two is not supported.

Hypothesis three: Hypothesis three is based on the same assumptions about overt pupil responding as the first two hypotheses. A programmed text version of the lessons was planned for administrative reasons (see p. 76), but it was decided that it could be used as a further test of the responding variable. Hypothesis three is in opposition to the Rippey (1966) study but, as has been pointed out, this study suffered severely from lack of control over ability and aptitude, and the number of subjects used was very small. The hypothesis is in line with the general hypothesis that overt responding facilitates pupil achievement.

Hypothesis three: Mean residual achievement will be higher for a group of pupils who learn through a programmed text version of the lessons, requiring continuous overt responding, than it will be for a group of pupils who learn through class lessons, requiring only intermittent overt responding.

Hypothesis four: Hypothesis four is clearly related to the research reviewed. The positive relationship between positive teacher reactions and pupil achievement has been found in studies by Amidon and Flanders (1961), Brown (1960), Flanders (1970), Furst (1967), Hurlock (1925), La Shier (1967), Perkins (1965), Powell (1968), Schantz (1964), Wright (1968), and a number of doctoral dissertations. While a number of studies failed to find significant results, none contradicts the general finding with significant negative relationships.

The decision to include mild negative reactions occasionally, where appropriate, is based on the assumption that praise and blame have a curvilinear relationship with achievement, as has been suggested by Soar (1968) and Flanders (1970) and discussed in the review of research. Rosenshine (1969, 1970b) has also stated that there is nothing to suggest that the teacher should not use mild forms of criticism when appropriate.

Hypothesis four: Mean residual achievement will be higher for a group of pupils who receive positive teacher reactions to their overt responses, where appropriate, and occasional mild negative teacher reactions to their responses, where appropriate, than it will be for a group of pupils who receive minimal teacher reactions to their responses.

To establish whether positive teacher reactions facilitate achievement through the reinforcement of specific responses or through a more generalized effect hypothesis four (a) was formulated.

Hypothesis four (a): When each pupil's posttest items are divided into (i) those items relevant to the overt responses he made during instruction and (ii) those items not relevant to the overt responses he made during instruction, the pass rates on the two item types will differ for the reacting and no reacting groups.

That is, if positive reacting acts to reinforce particular responses, and so raises achievement on posttest items relevant to those responses, the two treatment groups should differ on the type (i) items but not on the type (ii) items. On the other hand if positive reacting has a more generalized effect the treatment groups should differ on both item types.

It is clear that hypothesis four (a) need not be tested if hypothesis four is not supported.

CHAPTER THREE

THE MATERIALS USED

Choice of class level:

It was decided to work at the Form II level within the intermediate school system for the following reasons.

First, to minimize the effects of any between-schools differences in experiment one, it was planned to take each of the responding treatments in each school used. With three responding treatments, three classes were required in each of three schools. This made it possible to sum the treatments across the three schools so that any between-schools differences, acting across all classes within a school, would be cancelled out when treatment effects were compared. Few primary schools in the city have as many as three classes at the same class level, while all the intermediate schools in the city have six or more classes at each class level.

Second, because the study necessitated giving all children standard lessons and tests, it was essential to have a relatively homogeneous sample of pupils with respect to ability. With a heterogeneous sample the materials would have been too difficult for some while being too simple for others. This could have resulted in confounding of the results through ability level/treatment interactions. The more homogeneous the sample the less were such interactions likely to interfere with the results. Where a primary school has three classes at the same class level there are marked differences in ability within classes where the classes are unstreamed, and marked differences in ability between classes where the classes are streamed. While the intermediate schools in the city have different streaming policies, it was generally possible to get three classes of approximately equal and average ability within the one school.

Third, working in intermediate schools made it relatively easy to keep the size of the experimental classes constant, where this was necessary. Because of the interchange system at the intermediate level, intermediate schools always had a spare room available to cater for children withdrawn from the experimental classrooms which were larger than the size required.

Fourth, the Form II level was chosen in preference to the Form I level because the data collection was planned to begin early in the school year. It was felt that it would be desirable to use pupils who had settled down to the intermediate school environment, rather than those who were making the transition from the primary school to the intermediate school.

Choice of topic: A topic about the red deer and the tahr was chosen for the following reasons.

First, it was assumed that the pupils would know very little about these animals. To avoid contamination of the posttest of achievement results, through differing levels of prior knowledge, the experimental lesson topic needed to be unfamiliar to all pupils prior to the lessons being given. Because information about these animals is not taught as part of the regular nature study/science syllabuses in the primary and intermediate schools, it was assumed that the topic would be, as far as possible, uniformly unfamiliar to all pupils.

Second, the difficulty level and interest level of this topic could be easily manipulated. Material which was uniformly too interesting and/or easy, or conversely, uniformly too difficult and/or dull would have obscured treatment effects. It was possible to offset the interest children have in animals such as the red deer and the tahr by the introduction of detailed and specific information of a kind unlikely to stimulate a child's interest. By introducing content which ranged from simple vocabulary to more abstract concepts it was possible to provide a fairly wide range of difficulty in the material.

Third, the topic could be easily covered in three class periods of 40 minutes, without unwieldy materials. To avoid disrupting class routines any more than necessary, it was essential that the experimental lessons be no longer than 40 minutes, which is the usual length of an intermediate school class period. The design of the study made three days the maximum time available for the coverage of the lesson content.

Fourth, the topic could be made worthwhile. To facilitate co-operation from the schools invited to participate in the study, it was desirable that the lesson content should be worth learning and not a waste of the pupils' time. By basing the topic on established principles of zoology this criterion could be easily met.

The lessons: In order to control as many extraneous variables as possible the lessons were planned in fine detail. All the information to be provided and its sequencing within the lessons, all materials to be used and their sequencing within the lessons, the wording of questions, teacher reactions to pupil responses, and so on, were predetermined making it possible to repeat the same lesson on different occasions.

The New Zealand Department of Education (1954) primary school nature study syllabus, Understanding the World, was consulted, and the basic principles contained in the senior division section on mammals were abstracted as a basis for the experimental lessons. As this syllabus is no longer used in the primary and intermediate schools it was felt that it would help provide lessons which, while worthwhile, would not be beset with the problems of widely differing levels of prior knowledge. The four principles abstracted are as follows.

1. Animal structure is suited to environment and thus has survival value.
2. Animal behaviour is related to structure and environment and thus has survival value.

3. Exotic animals are often introduced to new countries for economic and other reasons.
4. The introduction of exotic animals may have undesirable consequences through upsetting the balance of nature.

Reference works on the red deer and the tahr were consulted and material illustrating the four principles was gathered. The principle references consulted were Anderson and Henderson (1961), Darling (1937), Donne (1924), Ellenberger et al. (1956), Harris (1967), New Zealand Forest Service (1968), Roberts (1968), Sandars (1951) and Wodzicke (1950).

To allow five minutes following each lesson, for the removal of equipment from the classroom, it was decided that the experimental lessons should be of 35 minutes duration. Thus, with three lessons, each of 35 minutes duration, a total lesson content of 105 minutes duration was required.

Four pilot lessons, with an estimated duration of 35 minutes each, were prepared giving 140 minutes of pilot lessons. This procedure made provision for the elimination of some lesson content should it prove unsatisfactory, and it also allowed for frequent revision of the content covered.

The pilot lessons were given to two average ability Form II classes at school A. Tape recordings were made of these lessons and weaknesses which showed up on the tape recordings were corrected. For example, difficult sections of the lessons were made easier by the provision of additional information, questions which were unsatisfactory were reworded, and so on.

The revised lessons were given to two average ability Form II classes at school B. Tape recordings of the lessons were again made and used to make minor adjustments. In addition, the pilot form of the posttest of achievement, which will be discussed below, was administered to the pupils on the Monday following the lessons, which were given on Tuesday through to Friday. The difficulty indices of the posttest items were calculated using the formula:

$$\frac{R}{N} \quad x \quad \frac{100}{1}$$

Where R equals the number of pupils passing the item

N equals the number of pupils attempting the item, which, in this case, is the total number of pupils because all pupils attempted all items as the test was untimed.

The difficulty indices were then used to make adjustments to the lesson content. For example, a posttest item which almost every pupil was able to get right, was made more difficult by removing from the lessons a number of the revisions relevant to that particular item. By adding extra revisions very difficult items were made easier. Table 3.1 indicates the difficulty indices of the items in the pilot posttest when it was given following the revised lessons. It can be seen from this table that many of the items were very easy, largely as a result of the frequent revisions previously mentioned. Consequently, the most frequent

TABLE 3.1

DIFFICULTY INDICES OF THE ITEMS IN THE PILOT POSTTEST WHEN IT WAS GIVEN FOLLOWING THE REVISED LESSONS AND THE FINAL LESSONS

Difficulty Index Range	Per cent of items following the revised lessons	Per cent of items following the final lessons
90 plus	23.0	11.5
80-89	16.0	16.0
70-79	16.0	15.0
60-69	10.0	11.0
50-59	14.5	12.0
40-49	9.0	11.5
30-39	6.0	9.0
20-29	3.5	8.0
10-19	2.0	4.5
9 minus	0.0	1.5

change made was to cut down the number of revisions, although in some cases extra revisions were added.

The pilot posttest contained a number of questions designed to measure the pupils' ability to use the principles covered in the lessons. These questions required the pupils to generalize from given information, using the principles from the lessons, to answer questions about the chamois. This section of the posttest was poorly done, with 46 per cent of the items falling below a difficulty index of 50 being of this kind. It was decided to include some practice at this activity in the lessons, and a sample of these posttest questions was included in the second revision of the lessons. 18 questions, covering all the examples of the four principles, were included in this section, which was added to the end of the lessons.

It was also decided to expand the information given about the chamois, by including some facts which were not required to answer the questions, to provide an additional learning task. This information was placed on a large card, along with the information necessary to answer the chamois questions, and the pupils were instructed to read the material twice, with a view to answering the questions which were to follow. However, because the information was never mentioned again, it provided a learning activity different from the other sections of the lessons. It was felt that pupils, who knew that they would not be called upon to respond to the questions about the chamois, might not even bother to read the material on the card, and that consequently this material could provide a sensitive measure of treatment differences because it had to be read to be learned since it was never discussed.

With these revisions included, the material was rewritten to give three 35 minute lessons which were given to two average ability Form II classes at school C. On the Monday following the lessons, which took place on Wednesday through to Friday, the pilot posttest of achievement was again administered. The difficulty indices of the posttest items were calculated and, as these were satisfactory, the lessons were retained unchanged and became the final version. The difficulty indices of the pilot posttest items, when the pilot posttest was given following the final version of the lessons, may be seen in Table 3.1.

The complete lesson plans and photographs of the materials used in the lessons may be found in Appendix A.

The programmed text: A programmed text version of the lessons was also prepared. Originally, the programmed text was planned to cater for the pupils withdrawn from large classes in experiment one (see p.76). The programmed text enabled these pupils to (a) be engaged in a useful activity while the experimental pupils were being given the lessons and (b) sit the posttest with the experimental pupils, because they had covered the content measured by the posttest.

However, it was realized that if a programmed text were prepared, it could also be used as a strong test of the responding variable in which pupils responding to all solicitations were compared with pupils responding to only a proportion of the total number of solicitations.

The programmed text version of the lessons was designed to follow the ordinary lessons in every possible detail, to make comparison between the two instructional methods legitimate. The programmed text was self contained, each text having photographs of the coloured pictures and copies of the maps and drawings used in the lessons. The pupils recorded their answers in a small disposable booklet provided with the programme.

The complete programmed text may be found in Appendix D.

The posttests:

The posttest of achievement: To measure what the subjects had learned during the lessons, a posttest of achievement was developed. It was decided that this test should measure as much of the lesson content as possible, and measure this content as finely as possible. That is, not only was it considered desirable to have a question on each section of the lesson content, but it was also considered desirable to have questions which discriminated as finely as possible between subjects with differing levels of knowledge.

The following multiple choice question helps to illustrate this point.

In which part of a ruminant's stomach is the cud made?

A. Belly

*B. Honeycomb

C. Manyplies

D. Paunch

Assuming a hypothetical case in which guessing played no part, subjects who knew that the cud was made in the honeycomb, or who knew the functions of the other three parts of the stomach, would get the item right. All other subjects would get the item wrong even though they might have widely differing levels of knowledge. A subject who did not even know the names of the parts of a ruminant's stomach would get the same score as one who knew all the names of the stomach parts, and the functions of any two parts other than the honeycomb. To discriminate between pupils with various amounts of knowledge a number of carefully graded items are required.

The reasons for prefering a large number of finely graded items are as follows.

First, it was felt that small lapses in attention, due to treatment differences, would be more likely to be detected where all the pieces of information given in the lessons had a corresponding posttest item.

Second, with every lesson question having a corresponding post-test item, the performance of pupils on the posttest items relevant to the questions they had been asked during the lessons could be compared with their performance on the posttest items not relevant to the questions they had been asked during the lessons, thus making it possible to test hypotheses one (a), two (a) and four (a).

Third, where everything taught is measured in the posttest, content validity, which is the most important kind of validity for an achievement test, is clearly established.

The above considerations predetermined the type of posttest items to be used. Multiple choice type items are rather lengthy per unit of information so they were not considered. Even without the time factor it would have been very difficult to get the content coverage required using multiple choice type items alone. Ebel (1965) has pointed out that the number of independently scorable pieces of information per thousand words of test or per hour of testing time tends to be considerably higher for true/false items than for multiple choice items. The same advantage accrues from the use of constructed response items which, in comparison with true/false items, are free from the problem of guessing. It was therefore decided to use constructed response and true/false items to get the necessary content coverage, and to maximize the use of constructed response items to avoid the problem of guessing.

A table of specifications was prepared by drawing up a list of the information taught in the lessons. As far as possible this list included all the information covered, even if it were only peripherally relevant to the lessons. The pilot posttest was prepared from this table of specifications in the following manner.

First, as many sections of the table of specifications as possible were measured using constructed response items. These items required the pupils to provide a missing word, number, or date to complete a sentence or answer a question. To help overcome spelling problems a list of 40 words was prepared, 20 of the words being relevant to the test questions and 20 being irrelevant words serving to make the items more difficult. Each pupil was given a copy of this list with his test booklet.

Second, sections of the table of specifications which were difficult to measure using constructed response type items were measured using true/false items. The pupils circled T if they agreed with a given statement, F if they disagreed with it, and X if they did not know if the statement was true or false.

Third, to measure the pupils' ability to use the principles taught in the lessons, items which may be considered as expanded true/false items were prepared. A large card showing a map of the chamois' habitat in the South Island was placed at the front of the room. The test booklet provided the information that the chamois was introduced to the South Island from Central Europe, that it is a ruminant, and that it has a gestation period of seven months. Statements about the chamois were given and the pupils were required to mark T if they considered the statement true, F if they considered it false, C if they thought it was impossible to tell whether the statement was true or false with the information given, and X if they did not know the answer. To illustrate this type of item one question asked the pupils to consider the truth of the statement 'The chamois is a better climber than the tahr.' The pupils were expected to circle F by generalizing from the principle that animal structure is suited to environment and the fact that the chamois' habitat (as indicated on the map provided) is less mountainous than the tahr's.

The pilot posttest was given to the two classes given the revised lessons at school B, on the Monday following the completion of the lessons. The item difficulties were then calculated as previously described (p. 50). Table 3. 1 shows the difficulty indices obtained. It may be seen that the difficulty indices tend to be high, indicating a preponderance of easy items, although guessing on the true/false items will have inflated the indices.

Anstey (1966) has discussed the optimum difficulty of test items. He suggests that, for a test with high intercorrelations between the items, as this test should have, items spread evenly over the scale of difficulty, and giving a flattened distribution of scores, are desirable.

To achieve the desired distribution of difficulty the lessons were rewritten as previously discussed (p. 50). When the posttest was administered to the two classes at school C given the final version of the lessons, the difficulty indices in the right hand column of Table 3. 1 were obtained. These figures were considered satisfactory in view of the slight inflation through guessing, and the final version of the posttest was prepared.

Two alterations were made to the pilot posttest but otherwise it remained in its original form in the final version.

First, to measure the information about the chamois which was added to the lessons, but not discussed in them (see p. 52), ten constructed response type items were prepared and added to the posttest.

Second, it was decided, on administrative grounds, to alter the format of the items measuring the pupils' ability to generalize the principles taught in the lessons from their original format, to the plain true/false format. With three item types, as in the pilot posttest, three sets of instructions were required. Because the test was untimed it was necessary to wait for the slowest pupil to finish all the items of one type before the instructions for the next type could be given. With some pupils working very slowly it was much more convenient to have only two item types.

The final posttest provided four separate scores as follows:

Posttest one:

68 constructed response items plus 15 true/false items, measuring the content of lesson one and giving a total score of 83.

Posttest two:

76 constructed response items plus 22 true/false items, measuring the content of lesson two and that part of lesson three not dealing with the chamois, giving a possible score of 98.

Chamois posttest:

Ten constructed response items measuring the information about the chamois read by the pupils but never discussed in the lessons.

Generalization posttest:

31 true/false items measuring the ability of the pupils to generalize the principles taught in the lessons.

The items relevant to each of these posttest scores were arranged in blocks to facilitate separate scoring, the separate scores being obtained for two reasons.

First, it was felt that posttest items measuring different skills should be looked at separately. Three skills are measured by the posttest as a whole, and separate scores are provided for each of these skills. Posttests one and two measure the pupils' ability to recall factual information which was discussed in the lessons, while the chamois posttest measures the pupils' ability to recall factual information which was provided, but not discussed in the lessons. The generalization posttest measures the pupils' ability to use limited information and a set of learned principles to answer questions, and thus measures a higher level of learning than the factual recall measured by the other tests.

Second, it was felt that the treatments in the study might take some time to have any effect on the pupils. That is, it was felt that the pupils might not perceive the treatment differences until they had been operating for some time. For this reason, it was decided that the items measuring the factual recall of material discussed in the lessons should be divided into two sections, the first measuring the content of lesson one (posttest one) and the second measuring the rest of this content (posttest two).

Thus, if treatments took some time to have an effect on the pupils, this would show because the significance of the achievement differences between the treatment groups would be greater on posttest two than on posttest one.

The four separate scores were also combined in two ways giving six scores in all.

Posttest one plus two:

The items included in posttests one and two were summed to give a measure of learning on the total content of the lessons excluding the content dealing with the chamois. The possible score for this section was 181.

Total posttest:

A total score was obtained by summing posttest one, posttest two, the chamois posttest, and the generalization posttest, the possible score being 222.

The true/false items were scored one if they were right, nought if the subject indicated that he did not know the answer and minus one if they were wrong. An equal number of the statements were true and false to guard against response biases.

Answers to the constructed response items were generally scored either right or wrong with the spelling requirements being lenient, even though the word list previously discussed (p.56) was provided in the final version of the posttest. If the word required could be pronounced from the letters provided by the pupil, the item was scored correct. However, some items were scored one, one half, or zero depending on the quality of the answer. The answers scored one half were those which showed that the subject had the idea correct, but had not expressed it in the desired manner. For example, a subject who said that we can tell a male red deer from a female red deer by his horns (instead of antlers) was scored one half. In some cases a number of answers were acceptable, or worth half credit. All acceptable responses were recorded on a scoring key to ensure that marking was consistent.

The final version of the posttest, along with the scoring standards, may be found in Appendix B.

As a check on the reliability of this instrument a split-half reliability coefficient, corrected by the Spearman Brown formula, was computed. A random selection of six papers from each of the 19[1] classes which were given the lessons and sat the posttest were used, three boys and three girls being selected from each class. The resulting reliability coefficient, based on the total score, was .92 which is considered very satisfactory in view of the homogeneity of the sample.

The posttest questioning scale:

In order to measure the pupils' perceptions of the different treatments the posttest questioning scale was prepared.

This scale consisted of seven letter categories A to G on a chart. The extreme categories and the middle category were described verbally. For example, category A was described as indicating a person who is very often asked questions in class, while the G category was described as indicating a person who is

[1]Four of these classes were not used in the analysis of results (see p. 89 and p. 94).

hardly ever asked questions in class. The pupils were asked to indicate which of the seven categories best indicated how many questions they had been asked during the experimental lessons. Responses were scored one for A through to seven for G.

This scale, which from here on will be termed the Question Estimate, may be found in Appendix B.

The pretests:

To take the pupils' ability, attitudes, prior knowledge, and expectation of being questioned into account a number of pretests were given prior to the lessons being taken.

The pretest of achievement:

While an attempt was made to prepare a lesson series which would be relatively new to all pupils, as discussed above, it was realized that some pupils would inevitably know more about the lesson content than others prior to instruction. It was consequently decided to use a pretest of achievement to measure these differences.

The possibility of giving the posttest of achievement before and after the lessons, and working with gain scores, was rejected on administrative grounds. It was clear that the type of posttest planned would take a considerable time to administer and that it would not be possible to give the posttest and the other pretests, which would still be required, in a reasonable time. A separate pretest of achievement was therefore planned.

78 five choice multiple choice test items, giving a wide sampling of the lesson content,were prepared. The five choices consisted of a 'don't know' choice plus four possible answers. The 'don't know' choice was included because the posttest was planned to be largely of the constructed response format. It was felt that pupils who were reluctant to guess on the posttest would tend to use this category thus giving the pretest better predictive validity. Because it was felt that many of the items were too difficult for naive Form II pupils 18 items which appeared very difficult were eliminated.

The remaining 60 items were given to three experienced intermediate school teachers, who were asked to indicate those items which, in their opinion, were too difficult for even ten per cent of average ability Form II pupils to answer correctly.

Items which two of the three teachers agreed were too difficult were eliminated. Items which one of the three teachers considered too difficult were eliminated when the writer was of the opinion that they were too difficult, and retained when the writer was of the opinion that they were of reasonable difficulty.

The remaining 36 items were put in a booklet following the attitude test, to be discussed below, and administered to the two classes at school A given the pilot lessons, on the Monday prior to the lessons being given.

The items were analyzed using Anstey's D method (Anstey, 1966) and the test was revised on the basis of these results. One item with a difficulty index of above 95 was eliminated as too easy, and five items with difficulty indices below 15 were eliminated as too difficult. One item with a discrimination index of .03 was eliminated, as was one with a discrimination index of .39 and two poor distractors which could not be altered. The remaining 28 items had difficulty indices ranging from 15 to 88, and discrimination indices ranging from .50 to 1.54. Five of the distractors in four of the remaining items were modified with a view to improving the items. The eight eliminated items were replaced with eight items from the original pool, utilizing those items which only one teacher had indicated as too difficult.

The revised test was administered to 212 average ability Form II pupils from two classes at each of schools A, B, and C. The results were again analyzed using Anstey's D method. 27 items with difficulty indices between 20 and 85 and discrimination indices above .50 were selected for the final version of the pretest. One of these items was of 50 per cent difficulty, 16 had difficulty indices above 50, and ten had difficulty indices below 50. To balance the spread of difficulty, three items with difficulty indices above 15, but below 50, and discrimination indices above .4 were added to the test giving 30 items in all.

The items were arranged in order of difficulty, and the position of the correct response arranged so that each of the choices A, B, C, and D was correct either seven or eight times.

The complete pretest of achievement may be found in Appendix C, along with a table showing the item statistics for each item in the revised pretest.

The attitude test:

On the assumption that pupil attitudes to the topic would influence the amount learnt from the lessons, an attitude test was prepared to take into account differences in prior pupil attitudes.

20 Likert type items were prepared, each having five categories from strongly agree to strongly disagree. Ten of these items were designed to measure the pupils' general attitudes to nature study and nature study type activities (Scale A). For example, 'I think people who spend a lot of their spare time watching birds and other animals could be doing more interesting things.' The other ten items were designed to measure the pupils' more specific attitudes to studying animals like the red deer and the tahr, rather than other branches of nature study (Scale B). In these items some characteristic of the red deer and the tahr was juxtaposed with a different characteristic of some other nature study topic. For example, 'I would rather learn about mammals than about birds.'

These items were placed in the pretest booklet before the pretest of achievement to avoid any halo effect which could have resulted had the children sat the attitude test after having sat the pretest of achievement. The scale A and B items were alternated, and the items were worded so that half were scored highly for a positive response and half were scored highly for a negative response to avoid any response biases. Each item was scored either 5, 4, 3, 2 or 1. The two scales were administered to the two classes in school A along with the pilot pretest of achievement as previously discussed (p. 64).

The scores on the items were intercorrelated to see if the scales were measuring unified variables. The Scale B items were not consistently intercorrelated and this scale was discarded. The Scale A items all intercorrelated positively, with the exception that one item showed small negative correlations with two other items. This item also had the smallest correlation with the total score for Scale A, so it was altered. Two new items were added to cover the possibility that the altered item might be spoilt.

The revised scale was administered to the two classes at school B which were given the revised pretest of achievement and the scores were again intercorrelated. One of the new items showed negative correlations with some of the other items and so was eliminated from the scale. The other eleven items, which all intercorrelated positively, were retained for the final form. The correlations of each of these eleven items with the total score ranged from .39 to .65 with only two correlations falling below .50.

The final scale may be found in Appendix C, along with the correlation matrix for the revised scale.

The pretest questioning scale:

It was assumed that pupils with different teachers could have built up different expectations of being questioned, so the pretest questioning scale was produced to measure these differences, and also the frequency with which pupils claimed they would like to be questioned. The pretest questioning scale used the same chart as used for the posttest questioning scale which is described on p. 62. Prior to the lessons being given, the subjects were asked to indicate the category which best described:

1. The number of questions they were normally asked in class, from here on termed Question Expectation.
2. The number of questions they thought they would like to be asked in class, if they could choose, from here on termed Desired Question Frequency.

Responses were scored as for the posttest questioning scale (p. 63).

The scale may be found in Appendix C.

The vocabulary test:

A vocabulary test, which is the final trial form of the vocabulary section of the Verbal Aptitude Test (Keeling, in press), was used as a measure of verbal ability. This test contains the 50 items comprising forms A and B of the vocabulary section of the Verbal Aptitude Test. This test was chosen because:

1. It has a short administration time (15 minutes).
2. It is specifically designed for use with New Zealand pupils in Form II.
3. It has excellent item statistics.

A copy of this test may be found in Appendix C.

The Academic Promise Test Abstract Reasoning Test:

The Academic Promise Test Abstract Reasoning Test (Bennett et al., 1961) was used as a measure of non-verbal ability. This test was chosen as being one of the best tests of its kind available.

Other tests used:

It was found that some of the schools had administered tests to all the pupils in the school who were taking part in the study. Results from these tests were gathered where the results from that school were being analyzed separately. Results from the Progressive Achievement Tests: Reading Comprehension and Reading Vocabulary (Elley and Reid, 1969) and the A.C.E.R. Intermediate Test 'D' (Australian Council for Educational Research, 1958) were collected in this way.

The Verbal Aptitude Test (Keeling, in press) was administered in two of the schools used in the study as part of reliability, practice effect, and validity studies and the results of this test were also collected. The Verbal Aptitude Test consists of the two parallel forms of 25 vocabulary items previously mentioned and two parallel forms of 25 verbal analogies items.

CHAPTER FOUR

THE RESEARCH DESIGN AND DATA COLLECTION

General programme:

To test the hypotheses described in chapter two four separate studies were carried out. Each of these studies was basically similar, although there were minor differences between them which will be discussed below. The basic design was as follows:

1.	Tuesday	Pretesting	70-80 minutes.
2.	Wednesday	Lesson one	40 minutes.
3.	Thursday	Lesson two	40 minutes.
4.	Friday	Lesson three	40 minutes.
5.	Monday	Posttesting	70-80 minutes.

The basic pretesting consisted of:

1. The attitude test (untimed).
2. The pretest questioning scale (untimed).
3. The Academic Promise Test Abstract Reasoning Test (20 minutes).
4. The vocabulary test (15 minutes).
5. The pretest of achievement (untimed).

The basic posttesting consisted of:

1. The posttest of achievement part one - constructed response items (untimed).
2. The posttest questioning scale (untimed).
3. The posttest of achievement part two - true/false items (untimed).

Experimental design:

Experiment one: To test hypothesis one three treatments, designed to enable the subjects to predict or control to a greater or lesser degree when they would be called upon to make overt responses to the lesson questions, were developed. These three treatments were termed Random Responding, Systematic Responding, and Self-Selected Responding.

In the random responding treatment all questions and subsequent redirections in the lessons were addressed to the subjects at random. A small card, with one pupil's name on each side, was prepared for each question and each redirection in the lessons, an equal number of cards being prepared for each pupil in the class. These cards were placed in a tin and withdrawn at random, the questions being directed according to the order in which the names were withdrawn from the tin. The pupils were thus unable to predict or control when they would be called upon to respond, as this was a function of the chance drawing of a name from the tin. Because almost all questions in the lessons were redirected once, each pupil should have felt constrained to prepare a response to each question in anticipation of being asked to respond, either to the initial question or the subsequent redirection.

In the systematic responding treatment questions were addressed systematically around the room on the basis of seating position. That is, the first question was directed to the pupil seated at the back left hand side of the room, with subsequent redirections and questions being directed systematically around the room until the front right hand side was reached, from where the questioning returned to the back left hand side of the room. In this treatment pupils were clearly able to predict when they were to be asked to respond to a question but they could not control it. In this treatment pupils should not have felt constrained to prepare responses to solicitations to which they knew they would not be called upon to respond.

In the self-selected responding treatment questions were directed to pupils only if they had their hands up and an attempt was made to ask pupils in proportion to the number of times they raised their hands. Here pupils were able to control the amount of responding they did by the frequency with which they raised their hands.

The procedures to be followed were clearly explained to the pupils prior to the beginning of the first lesson and, in addition, the consequences of these procedures were pointed out. For example, the random responding groups were told how the names were to be drawn out of the tin, and that this would mean they would all have an equal number of turns but that they would not know when their next turn was coming. The actual wording used may be found in the lesson plans in Appendix A.

The design of this section of the study, which is a balanced squares adaptation of the latin squares design, may be seen in Table 4.1. The three experimental treatments previously described are listed in the left hand column and the three schools used for the study are found in the top row. The nine cells generated each represent a class given one or other of the experimental treatments. Because the writer had no control over the order in which particular classes were taken within each school, the order in which the three treatments were taken within each school was determined by randomly assigning one of the three treatment orders to each school. The numbers in the nine cells indicate the order in which the various treatments were taken within each school. For example, the random responding treatment was the second treatment taken at school one as indicated by the 2 in the top left hand cell.

Because each treatment appeared in each order, any effects resulting from the order in which the lessons were taken could not have influenced the sum of the treatments in the right hand column, provided such effects acted consistently across the schools. This was considered important because only one class was taken at a time in each school, the three treatments being spread over three weeks. It was therefore possible for the children from the first class taken, although asked not to do so, to tell the pupils in the other classes that

TABLE 4.1

EXPERIMENTAL DESIGN : EXPERIMENT ONE

	SCHOOL ONE	SCHOOL TWO	SCHOOL THREE	
TREATMENT ONE RANDOM RESPONDING	2	1	3	SUM OF TREATMENT ONE
TREATMENT TWO SYSTEMATIC RESPONDING	3	2	1	SUM OF TREATMENT TWO
TREATMENT THREE SELF-SELECTED RESPONDING	1	3	2	SUM OF TREATMENT THREE
	SUM OF SCHOOL ONE	SUM OF SCHOOL TWO	SUM OF SCHOOL THREE	

they were to be posttested, thus increasing their motivation.

It will be seen that any differences between schools, which act across all the classes within a school, show in the sums of the schools in the bottom row and not in the sums of the treatments in the right hand column. It was thus possible, for example, to vary the time of day at which the lessons were taken in each school without influencing the sum of the treatments. This design provided the maximum flexibility with the maximum control over extraneous variables.

Headmasters and teachers were asked to keep conditions within each school as uniform as possible. For example, the time at which the tests and lessons were taken in each school was left up to the individual headmasters, but they were asked to timetable the tests and lessons for the same time for each class where possible. Because the presence of the class teacher could have affected the behaviour of the pupils, the teachers in each school were asked to agree on a common policy of attendance during the lessons. The number of lessons attended was left up to the teachers as was the choice of which lessons to attend. Generally the teachers preferred to absent themselves from the lessons and all teachers cooperated in forming a common policy within each school. The teachers were asked not to answer any questions about the lesson content, not to mention the posttest to their pupils, and so on. Details of these requirements may be found in the note to teachers in Appendix E. This note was carefully discussed with the teachers when they were met, any questions raised were answered, and each teacher was left with a copy of the note.

As the independent variable in this section of the study was pupil expectation of being asked to respond, it was considered important to control class size, because the expectation of being asked to respond is higher in a small class than in a large class when the number of questions asked remains constant. While it was originally planned to keep class size constant across the schools, to keep the cell numbers approximately equal for the analyses of variance, the design permitted the class size to vary across the schools provided it remained constant within each school. Because it was found that class size varied from school to school the latter solution was decided upon, and the size of the experimental classes ranged from 24 to 27 in the different schools.

Pupils were withdrawn from classes larger than the desired number until the desired experimental class size was reached. It was planned that pupils would be withdrawn from the classes at random, although the possibility of removing pupils according to ability existed where classes deviated from the average ability level desired for the study. Substitute pupils were selected from among the pupils withdrawn from the classes to replace any experimental pupils who were absent from the first lesson. Thus, all classes within a school were equal in size up to the end of the first lesson. The pupils withdrawn from the experimental classes worked on the programmed version of the lessons with an assistant.

Experiment two: To test hypothesis two, two classes were each divided in half according to a table of random numbers, the boys and girls being divided separately to keep the ratio of boys to girls constant in each group. One half of each class was termed the Responding Group while the other half was termed the No Responding Group. The random responding lesson treatment was given to these classes, but all the questions were directed to the responding group none being directed to the no responding group.

In order to ensure that the pupils were fully aware of the treatment differences, the procedures to be used were carefully explained prior to the beginning of the first lesson. It was explained that when a question was to be asked a name would be drawn out of the tin. It was also pointed out that not everybody had his name in the tin and that some pupils would not be asked any questions at all. However, the pupils did not know which group they belonged to, prior to the lessons being given.

The general design of the study, which is a randomized group design, may be seen in Table 4.2. Because one half of each class was compared with the other half of the class, it was possible to be more flexible about timetabling, teacher presence, etc.

Experiment three: Hypothesis three was tested in a study identical to experiment two, except for the experimental treatments used. The two groups of pupils in this study were termed the Lesson

TABLE 4.2

EXPERIMENTAL DESIGN : EXPERIMENTS TWO, THREE, AND FOUR

	TREATMENT ONE	TREATMENT TWO	
CLASS ONE	1	1	SUM OF CLASS ONE
CLASS TWO	2	2	SUM OF CLASS TWO
	SUM OF TREATMENT ONE	SUM OF TREATMENT TWO	

Group and the Programme Group. The lesson group was given the random responding lesson treatment, while the programme group worked through the programmed version of the lessons in a separate room under the supervision of an assistant. The assistant, a female undergraduate, was given full instructions for administering the programme which may be found in Appendix C.

The programmed text and the lessons were identical in terms of the material covered, order of material presentation, and so on. In an attempt to keep the time spent working on the programme equal to that spent working on the lessons, the mean time taken to deliver the random responding treatment in schools B and D in experiment one was calculated, and set as the time available to the programme group. The time the programme group spent working on the material, excluding the time taken to give instructions and distribute the materials, was kept on a stopwatch. Pupils were stopped working, if they had not already finished, after 108 minutes. The time taken by the pupils who finished the programme within the time limit was noted on the booklets in which they wrote their answers, after which they carried on with any silent activity of their choosing.

Experiment four: Hypothesis four was tested in a study identical to the two previous studies, except for the experimental treatments used. The two groups of pupils in this study were termed the Reacting Group and the No Reacting Group. The random responding lesson treatment was given to these classes, although the number of redirections used was not limited to a set number, but varied according to the responses of the pupils. For example, if a pupil gave the correct response to the initial question it was not necessarily redirected, whereas a question was sometimes redirected several times if the correct response was not forthcoming. However, because one half of each class was being compared with the other half, conditions were the same for both treatment groups. The treatments differed in the manner in which teacher reactions were given to pupil responses.

Eight categories of teacher reaction to pupil responses were used. The first three categories are reactions to correct pupil responses.

1. Praise. This category included such reactions as 'Good', 'Very good', 'Very good indeed', 'That's right, well done', 'That's a very full answer', 'That's exactly what I was looking for', etc. Each praise statement was followed by the set statement of the correct answer from the lesson notes.
2. Confirmation. This category included such reactions as 'Yes', 'Correct', 'Right', 'Thank-you', 'I agree', etc. As with the praise reactions, each confirmation reaction was followed by the set statement of the correct answer from the lesson notes.
3. Positive answer statement. This category contained the set statement of the correct response from the lesson notes and nothing more.

Categories four, five, and six are reactions to incorrect pupil responses.

4. Supportive denial. This category included reactions such as 'That was a good try but it's not correct, I'm afraid', 'Not a bad effort but ...', 'On the right lines but ...', 'I won't say you're wrong but ...', etc., followed by the set statement of the correct answer from the lesson notes.

5. Denial. This category included reactions such as 'No', 'That's not right', 'That's incorrect', 'That's wrong', 'I disagree', etc., followed by the set statement of the correct answer from the lesson notes.

6. Negative answer statement. This category contained the set statement of the correct answer from the lesson notes and nothing more.

The final categories are reactions to don't know responses.

7. Urging-Reproof. This category included reactions such as 'Are you sure you don't know?', 'Would you like to have a try?', 'Haven't you got any ideas?', 'Are you dreaming?', 'Aren't you paying attention?', 'Weren't you listening to the question?', etc. This category was used sparingly, especially the reproving statements. The particular statement used was fitted to the behaviour of the pupil involved. For example, 'Aren't you paying attention?', was used only when the pupil showed clear evidence of not paying attention.

8. Answer statement. This category contained the set statement

of the correct answer from the lesson notes and nothing more.

An attempt was made to react to the responses of the reacting group in categories 1, 4, and 7, to avoid categories 3,6, and 8, and to use categories 2 and 5 sparingly. An attempt was made to react to the responses of the no reacting group in categories 3, 6, and 8, to avoid categories 1, 4, and 7, and to use categories 2 and 5 sparingly. Thus, the reacting group received frequent praise for correct answers, was supported when incorrect answers were given but was urged or mildly reproved when the situation warranted it. The pupils in the no reacting group received little of these forms of feedback, and generally had to infer the worth of their answers from the statement of the correct answer from the lesson notes.

Selection of schools:

Because experiment two was not planned until after the study had begun (see p. 86), it was originally planned to use five schools for the study, three for experiment one, and one each for experiments three and four.

It was felt that the normal school might have been atypical and so this school was dropped from the list of intermediate schools in the city. The headmasters of the five remaining schools which had not been used in the pilot studies, were contacted by telephone and the study was broadly explained. Each headmaster agreed, in principle, to his school participating in the study and arrangements were made to visit each school. The three headmasters of the schools which had been used in the pilot studies were also contacted and asked if their schools could be used in the study should it be necessary. It was explained that, if possible, the five schools which had not been used for the pilot studies would be used in preference to those which had already assisted. Each headmaster agreed to participate, but the headmaster of school A preferred not to participate, because his school had been used for a number of recent research studies. School A was consequently dropped from the list, leaving the five schools which had not taken part in the pilot studies (schools D, E, F, G, and H) to be used if possible, and schools B and C in reserve.

The headmasters of schools D, E, F, G, and H were visited, the details of experiment one were explained, and each headmaster was given a copy of the note to teachers which may be found in Appendix E. After each headmaster had confirmed his willingness to have his school participate in experiment one, it was explained that, of five schools potentially available for experiment one, only three were needed. The details of experiments three and four were briefly explained and each headmaster was asked if his school could be used for either of these experiments, should his school not be selected for experiment one. All headmasters agreed to participate in any part of the study and provided information on the streaming organization of their schools which was used to select the schools for the various experiments.

The most suitable schools for experiment one were those which could provide three classes which were:

1. Of roughly equal ability.

2. Of approximately average ability.

These criteria functioned to keep the between-classes-within-schools differences to a minimum, while also restricting the between-schools differences. The streaming organizations of the five schools may be seen in Table 4.3. It can be seen that, while all five schools had three classes of roughly equal ability, only at schools D and E were the parallel classes of approximately average ability. Schools D and E were therefore selected for experiment one. To complete the requirements for experiment one school F was also selected because it seemed the most suitable of the three schools with parallel 'bottom' streams. At school F only the top 25 per cent of the pupils in the school were excluded from the parallel classes (assuming equal class size), compared with 43 per cent and 50 per cent in schools G and H respectively. It was assumed that by selectively eliminating the pupils with the lowest pretest scores from the experimental groups, pupils of approximately average ability could be obtained for the experiment.

The headmasters of schools D, E, and F were contacted and told that their schools had been selected for experiment one, and the lessons were timetabled. The headmasters of schools G and H were also contacted and it was arranged to conduct experiment three at school G

TABLE 4.3

THE STREAMING ORGANIZATIONS OF THE SEVEN PROJECT SCHOOLS

	STREAM	NUMBER OF CLASSES
School D	A	1
	B	3
	C	2
School E	A	2
	B	4
	C	2
School F	A	2
	B	6
School G	A	1
	B	2
	C	4
School H	A	1
	B	1
	C	1
	D	1
	E	4
School B	A	1
(Replacement)	B	2
	C	1
	D	1
	E	1
School C	A	2
(Replacement)	B	4
	C	2

and experiment four at school H.

Shortly before the data were to be collected at school F, it was found that the present study clashed with another study being conducted at the school. Mr. B. Keeling of the University of Canterbury had arranged to use school F for reliability, practice effect, and validity studies on the Verbal Aptitude Test (Keeling, in press), beginning on 1 June. As the vocabulary test included in the pretest battery contained both Form A and Form B of the Verbal Aptitude Test, it was clearly undesirable to give this test before the Keeling study was carried out.

Three alternatives were open.

1. The study could have been continued as planned, leaving the vocabulary test out of the pretest battery.
2. The project could have been postponed in school F until after the Keeling study.
3. School F could have been replaced with another school and used for another section of the study.

The third alternative was decided upon.

The vocabulary test was expected to be one of the best pretests and it was felt that it should not be dropped from the pretest battery. Because the timetabling arrangements had already been made with school F, it was decided they should not be altered. The possibility of using school F for either experiment three or experiment four and replacing it with either school G or H was considered but decided against. School G was not very suitable for experiment one because of its streaming organization and, as all arrangements to carry out experiment three with the school had been made, it was decided school G should not replace school F. While the final plans for taking experiment four in school H had not been made, school H was unsuitable for experiment one because of its streaming organization.

It was decided that one of the replacement schools should be brought into the study and another treatment designed for school F. The headmaster of school B was contacted and the situation was explained. When the headmaster agreed to have his school participate, and it had been established that the streaming organization of the school made it suitable (see Table 4.3), school B replaced school F.

Because the problem just discussed was brought to the writer's attention only shortly before the first class at school F was to have been taken, this class had to be abandoned while new arrangements were made. Hypothesis two was formulated and experiment two was designed to be used with the two classes remaining at school F.

The Data Collection:

Experiment one: The tests and lessons were timetabled for the three schools in experiment one as described below. Because the timing of the lessons has some bearing on this experiment, the school day has been divided into four time periods described as 9.00 a.m., 10.45 a.m., 1.00 p.m. and 2.00 p.m. These times refer to the periods before morning interval, between morning interval and lunch, from lunch to afternoon interval, and after afternoon interval. Lessons or tests which took place during the same period are considered to have been taken at the same time, even though there may have been small differences in the actual timing.

School D: Dates: 17 February to 9 March.
Time: 9.00 a.m.
Classes: 3 'B' streams (Table 4.3).
Treatment order: As for school one, Table 4.1.
Experimental class size: 27.

School E: Dates: 17 February to 9 March.
Time: 10.45 a.m.
Classes: 3 'B' streams (Table 4.3).
Treatment order: As for school two, Table 4.1.
Experimental class size: 24.

School B: Dates: 14 April to 4 May.
Time: 9.00 a.m. with one 10.45 a.m. exception.
Classes: 2 'B' and 1 'C' stream (Table 4.3).
Treatment order: As for school three, Table 4.1.
Experimental class size: 24.

The data were collected exactly as described in the general section at the beginning of this chapter. In schools D and B no problems were encountered, but at school E the following problems may be noted.

1. The first class had to be abandoned when eight experimental pupils missed one or more lessons. With the sample size reduced by eight, and the possibility of further reductions through absences during the posttesting, it was decided to replace the class with the fourth 'B' stream.
2. The timing of the lessons was not held constant, with lessons being variously taken at 10.45 a.m., 1.00p.m., and 2.00 p.m. This was partly caused by the need to replace the first class, but also by the school changing the original timing for a number of reasons. For example, the school swimming sports were held, without warning, in the middle of the project, necessitating timetabling alterations.
3. It was necessary to posttest the replacement class and the second class together, resulting in overcrowding and generally unsatisfactory conditions.

   Because of these problems a decision was made to replace the school if possible.

The headmaster of school C agreed to participate when approached and, as his streaming organization was suitable (see Table 4.3), this school was used to replace school E. Because of timetabling difficulties on a Tuesday, the pretesting was done separately.

School C: Dates: 15 July to 17 July (pretests).
29 July to 17 August (lessons and posttests).
Time: 9.00 a.m. with one 1.00 p.m. exception.

TABLE 4.4

FINAL CELL NUMBERS IN EXPERIMENT ONE

	School D	School B	School C	Treatment Totals
Random Responding				
Boys	14	13	11	38
Girls	13	8	9	30
Total	27	21	20	68
Systematic Responding				
Boys	12	11	13	36
Girls	12	10	10	32
Total	24	21	23	68
Self-Selected Responding				
Boys	13	12	10	35
Girls	12	11	12	35
Total	25	23	22	70
Schools Totals				
Boys	39	36	34	
Girls	37	29	31	
Total	76	65	65	

Classes: 3 'B' streams (Table 4.3).

Treatment order: As for school two, Table 4.1.

Experimental class size: 27.

The data were collected as planned to complete this section of the study.

Table 4.4 shows the final cell numbers for experiment one.

<u>Experiment two</u>: The data were collected at school F from 7 April to 20 April using two of the 'B' streams (Table 4.3). The pretesting differed from the general plan given at the beginning of this chapter in one respect, but otherwise the study follows the general plan. The vocabulary test was not given in the pretest battery for the reasons previously discussed (p.86). In its place the results of the Verbal Aptitude Test were collected from Keeling at the end of June when they became available. It should be noted that, had these results been available earlier, and the analysis of experiment two completed sooner, the decision to replace school E might not have been made. Final cell numbers may be found in Table 4.5.

<u>Experiment three:</u> The data were collected at school G from 2 June to 15 June using the two 'B' streams (Table 4.3). The posttest questioning scale was not administered since it was not applicable to the programme group, but in other respects the data were collected according to the general plan given at the beginning of the chapter. Results from the Progressive Achievement Tests: Reading Comprehension and Reading Vocabulary and the A.C.E.R.

TABLE 4.5

FINAL CELL NUMBERS IN EXPERIMENT TWO

		Class One	Class Two	Treatment Totals
Responding	Boys	7	8	15
	Girls	8	8	16
	Total	15	16	31
No Responding	Boys	8	7	15
	Girls	9	7	16
	Total	17	14	31
Class Totals	Boys	15	15	
	Girls	17	15	
	Total	32	30	

TABLE 4.6

FINAL CELL NUMBERS IN EXPERIMENT THREE

		Class One	Class Two	Treatment Totals
Lessons	Boys	8	7	15
	Girls	8	8	16
	Total	16	15	31
Programme	Boys	9	8	17
	Girls	8	9	17
	Total	17	17	34
Class Totals	Boys	17	15	
	Girls	16	17	
	Total	33	32	

Intermediate Test 'D' were available for both classes and these were also collected.

Final cell numbers may be found in Table 4.6.

Originally it was planned to use a third class for this experiment and one of the 'C' streams (Table 4.3) was timetabled for 16 June to 22 June. However, it was not possible to complete the pretesting as planned and the class was dropped from the study.

Experiment four: The data were collected at school H from 8 September to 21 September using the 'B' and 'D' streams (Table 4.3). Because the time available for the pretesting was limited to 60 minutes at this school the Academic Promise Test Abstract Reasoning Test was dropped from the pretest battery. This test was dropped because:

1. Results from the other experiments indicated that it accounted for very little of the posttest variance not accounted for by the other pretests.
2. With an administration time of 20 minutes its elimination reduced the pretesting time by the required amount.

The pretest and posttest questioning scales were not given because the variable being investigated was not pupil responding. In other respects the data were collected according to the general plan described at the beginning of the chapter. Results from the Progressive Achievement Tests: Reading Comprehension and Reading Vocabulary were collected from the school and Keeling provided the results from the Verbal Aptitude Tests which were given at the school as part of the previously mentioned reliability, practice effect, and validity study.

Data were also collected with the 'C' stream (Table 4.3) but this had to be abandoned after 50 per cent of the no reacting group missed one or more lessons and/or the posttest making the data unusable because of the small cell numbers.

Final cell numbers may be found in Table 4.7.

Checking the procedures: All the lessons were tape recorded and the recordings were used to check that:

1. The treatments in each experiment were equivalent with respect to extraneous variables which might have influenced the results.
2. The treatments had differed in the desired direction on the independent variable.

One important extraneous variable investigated was content coverage. In experiments two and four, where one half of each class was compared with the other half of the class, both groups being given the lessons together, any errors of presentation affected both experimental groups equally and were thus irrelevant. However, in experiments one and three the experimental groups were given the treatments separately and it was therefore important to check the tape recordings for errors in content coverage.

The tape recordings of the lessons from experiments one and three were played through and checked against a duplicated copy of the lesson plans which had been prepared for each class. While

TABLE 4.7

FINAL CELL NUMBERS IN EXPERIMENT FOUR

		Class One	Class Two	Treatment Totals
Reacting	Boys	9	7	16
	Girls	8	8	16
	Total	17	15	32
No Reacting	Boys	8	7	15
	Girls	10	8	18
	Total	18	15	33
Class Totals	Boys	17	14	
	Girls	18	16	
	Total	35	30	

the presentation of the lessons was generally word perfect occasional slips were made. These slips were studied carefully to see if the intended meaning had been changed or if information had been added or left out. Where it was considered that the slip had not altered the intended meaning it was ignored, but where it was considered that it had altered the intended meaning it was noted on the transcript of the lessons. For example, if the question, 'What do we call a male red deer?' were asked as 'What is a male red deer called?' the meaning is unaltered and no error was noted. However, if the summary statement, 'Red deer fawns are born in June in England which is six months later than in New Zealand' were given as 'Red deer fawns are born in June in England' information has been left out and an error was noted. The time taken to deliver the experimental lessons in experiment one was also noted as a measure of the equivalence of the treatments.

The booklets in which the programme pupils in experiment three wrote their answers were checked to see how far each pupil had got with the programme. By noting how many questions each pupil had completed it was possible to establish how much of the content he had covered.

To check that the treatments had in fact differed in the desired direction on the independent variable, the name of the pupil asked to respond to each question and each redirection was noted on the transcript of the lessons. From the transcript it was possible, for example, to calculate the number of questions directed to each pupil in the responding group in experiment two, while checking that the no responding group had not been asked any questions.

To check that the treatments had differed in the desired direction in experiment four the name of the pupil asked to respond to each question was filled in on the lesson transcript. The teacher reaction statement to each pupil response was coded, using the eight categories of teacher reaction previously described, and the code was noted beside the pupil's name. Categories 1 to 3, and 4 to 6 were considered to be hierachically organized and each reaction statement was placed in the highest category in which it could be considered to fall. For example, a complex reaction statement which contained elements of categories 1, 2, and 3 was placed in category 1. The only time a multiple code was used was when a category 7 reaction elicited another response from the pupil, in which case the second response was coded in addition to the first.

In experiment one the pupil's response was coded as right, wrong, or don't know on the lesson transcript. The response was ticked if it were close enough to the desired response to have been accepted as correct in the lesson, and crossed if it were not close enough to the desired response to have been accepted as correct in the lesson. Responses were marked D. K. if the pupil was unable to attempt a response. From the transcripts it was thus possible to establish the percentage of pupil responses falling in the right, wrong, and don't know categories for each of the treatments in experiment one.

TABLE 4.8

LESSON TIMES IN MINUTES, LESSON ERRORS, MEANS AND STANDARD DEVIATIONS OF PUPIL RESPONSE FREQUENCY, AND PER CENT PUPIL RESPONSES CODED RIGHT, WRONG, AND DON'T KNOW IN EXPERIMENT ONE:

		School D	School C	School B	Treatment Mean
Random Responding	Time	106.50	116.50	110.50	111.25
	Errors	1.00	1.00	2.00	1.33
	Mean Resp.	14.44	15.95	16.90	15.65
	S.D. Resp.	0.80	1.39	0.30	1.39
	Right	74.00	72.00	71.00	72.00
	Wrong	12.00	19.00	16.00	16.00
	Don't know	14.00	8.00	13.00	12.00
Systematic Responding	Time	105.00	103.25	102.50	103.50
	Errors	4.00	0.00	5.00	3.00
	Mean Resp.	14.71	16.24	15.04	15.29
	S.D. Resp.	0.62	0.44	0.37	0.81
	Right	67.00	63.00	70.00	67.00
	Wrong	17.00	21.00	18.00	19.00
	Don't know	16.00	16.00	12.00	15.00
Self-Selected Responding	Time	103.25	106.00	100.00	103.75
	Errors	1.00	5.00	1.00	2.33
	Mean Resp.	14.96	15.87	14.77	15.20
	S.D. Resp.	7.93	7.85	7.73	7.74
	Right	84.00	84.00	86.00	85.00
	Wrong	16.00	16.00	13.00	15.00
	Don't know	0.00	0.00	1.00	0.00
School Means	Time	105.00	108.50	104.25	
	Errors	2.00	2.00	2.66	
	Mean Resp.	14.70	15.23	16.32	
	S.D. Resp.	4.53	4.52	4.63	
	Right	75.00	73.00	76.00	
	Wrong	15.00	19.00	15.00	
	Don't know	10.00	9.00	8.00	

From Table 4.8 it can be seen that the time taken to deliver the random responding treatment in experiment one was slightly longer than the time taken to deliver the other two treatments, but generally the time taken is similar for each treatment and roughly constant for each class within each treatment. The maximum error count for one class is five which is negligible considering the many hundreds of pieces of information presented during the lessons. The percentage of pupil responses coded right, wrong, and don't know is similar for each school, and approximately equal within treatments, indicating that the lessons were of approximately equal difficulty for each class in the study.

That the percentage of pupil responses coded as right is much higher in the self-selected responding treatment than in the other two treatments is to be expected, since pupils do not put their hands up unless they think they know the answer to the question. In addition, the mean number of pupil responses is constant across the treatments.

That the self-selected responding treatment differed from the other two treatments can be seen by the larger standard deviation of pupil responses in comparison with the other two treatments. An investigation of the order in which pupils responded in the systematic responding treatment was made from the transcripts. This indicated that the questions had been directed in the desired manner, and that this treatment differed from the random responding treatment in the desired manner.

TABLE 4.9

RESPONSES MADE BY THE PUPILS IN THE RESPONDING AND NO RESPONDING GROUPS IN EXPERIMENT TWO

		Class One	Class Two	Treatment Groups
Responding Group	Mean Responding	24.13	23.00	23.54
	S.D. Responding	2.87	0.50	2.11
No Responding Group	Mean Responding	0.00	0.00	0.00
	S.D. Responding	0.00	0.00	0.00

From Table 4.9 it can be seen that the number of responses per pupil in experiment two varied in the desired direction. With a mean response frequency of 23.54 and a small standard deviation of 2.11 it is clear that each pupil in the responding group was asked to respond about 23 times. The table clearly indicates that the pupils in the no responding group were not asked to respond at all.

Table 4.10 shows the per cent of pupils completing the sections of the programme relevant to each of the four separate posttest measures. It can be seen that the section of the programme relevant to posttest one was the only section completed by all pupils.

However, some pupils who did not finish a section completed most of it. Table 4.11 shows the mean per cent of the programme material relevant to posttest one, posttest two, the chamois posttest, and the generalization posttest which was covered. For posttest one, posttest two, and the generalization posttest the figures were calculated by dividing the mean number of programme questions answered in each section by the number of programme questions in that section and converting to a percentage. For the chamois posttest a pupil who answered a programme question beyond the chamois content was counted as having covered the content while a pupil who did not reach the programme question immediately before the chamois content was counted as having covered none of the content. Two pupils who answered the programme question immediately before the chamois content, but not the programme question immediately after it, were counted as having covered half the content.

TABLE 4.10

PER CENT OF PUPILS COMPLETING THE PROGRAMME CONTENT RELEVANT TO POSTTEST ONE, POSTTEST TWO, CHAMOIS POSTTEST, AND GENERALIZATION POSTTEST IN EXPERIMENT THREE.

	Class One	Class Two	Total
Posttest One	100	100	100
Posttest Two	94	53	74
Chamois Posttest	82	53	68
Generalization Posttest	82	41	62

TABLE 4.11

MEAN PER CENT OF THE PROGRAMME MATERIAL RELEVANT TO POSTTEST ONE, POSTTEST TWO, CHAMOIS POSTTEST, AND GENERALIZATION POSTTEST COVERED BY THE PROGRAMME GROUP IN EXPERIMENT THREE

	Class One	Class Two	Total
Posttest One	100	100	100
Posttest Two	99	95	97
Chamois Posttest	88	53	71
Generalization Posttest	88	43	66

It can be seen that the programme pupils covered 100 per cent of the content relevant to posttest one and very close to 100 per cent of the content relevant to posttest two. However, only about 70 per cent of the content relevant to the chamois posttest and the generalization posttest was covered by the total programme group. It is clear that it is legitimate to compare the performance of the two treatment groups only on posttests which do not contain the chamois posttest or the generalization posttest if content coverage is to be held constant.

When this section of the study was originally planned it was considered impossible to allow the programme pupils as much time as they required to complete the programme, because of the problems involved in scheduling extra time, providing activities for the lesson group and the programme pupils who had finished, and so on. Without altering the basic plan, three 40 minute periods were available for the programme group to work on the programme material. Within this time, however, the group had to move from the regular classroom to the room in which they were to work on the programme, materials had to be distributed, and so on. It was therefore decided to allow the programme pupils the same amount of time as the lesson pupils would spend on the lessons. It was felt that it would then be possible to compare the performance of the two treatment groups:

1. With content coverage held constant but time spent working on the material varying. That is, a comparison of the two

treatment groups on the posttests for which both groups had covered the relevant content.

2. With time held constant but with the content covered varying. That is a comparison of the two treatment groups on all the posttests irrespective of the content covered.

However the time allowed for the programme group to work on the programme (p. 79) was an underestimate of the time it would take to give the lessons. The lessons took 113.00 and 115.00 minutes to complete in the two classes giving a mean lesson time of 114.00 minutes. Thus for the time factor to have been held constant an extra six minutes should have been available to the programme pupils, who worked for only 108 minutes. Because the time factor has not been held constant the second comparison is not possible. Therefore, the treatments will be compared only on posttests one, two, and one plus two.

The mean number of errors made in presenting the lessons in experiment three was two, the same number of errors being made with each class.

Table 4.12 shows that the treatments in experiment four differed in the desired direction, while being similar on extraneous variables. It can be seen that the pupils in both treatment groups were asked to respond an equal number of times and that the reactions to the responses fell in the desired categories.

TABLE 4.12

THE DISTRIBUTION OF EIGHT CATEGORIES OF TEACHER REACTING BY CLASSES FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR EXPRESSED AS A PERCENTAGE OF THE TOTAL REACTING STATEMENTS FOR EACH CLASS

	Class One		Class Two		Treatment Means	
	Reacting Group	No Reacting Group	Reacting Group	No Reacting Group	Reacting Group	No Reacting Group
Category 1	30.00*	1.00	31.50	0.00	30.50	0.00
Category 2	4.50	13.00	3.00	5.50	3.50	9.00
Category 3	1.00	25.50	2.00	30.00	1.50	27.50
Category 4	4.50	1.00	5.00	0.00	5.00	1.00
Category 5	2.00	2.50	1.50	2.00	1.50	2.50
Category 6	1.50	2.50	3.00	5.50	2.00	4.00
Category 7	1.00	0.50	2.50	0.50	1.50	0.00
Category 8	4.50	6.50	3.50	5.50	4.00	6.00
Categories 1, 4 and 7	35.50	1.50	38.50	0.00	37.00	1.00
Categories 3, 6 and 8	6.50	34.50	8.50	41.00	7.50	37.50
Categories 2 and 5	6.00	15.50	4.00	7.50	5.00	11.00
Mean Resp.	10.12	9.78	12.47	12.20	11.22	10.88
S.D. Resp.	0.6966	0.9428	0.9155	0.4141	1.4309	1.4309

* All figures subject to rounding errors

Analysis of Results:

Residual achievement. Each pupil's score, on each of the six posttest scores, was converted to a residual achievement score to remove the posttest variance attributable to individual differences, as measured in the pretests.

For each experiment the various pretests previously described were correlated with the six posttest measures. The pretests which showed consistent correlations with the six posttest scores, and explained at least one per cent of the total posttest variance, were included in multiple linear regression analyses on each of the posttest scores. The actual number of pretest measures used in the regression equations ranged from four to seven for the various experiments.

In each experiment predicted achievement scores, based on the regression equations, were calculated for each pupil on each of the six posttest scores, using the following formula.

$$P = i + b_1\, x_1 + b_2\, x_2 + b_3\, x_3 \,\ldots\ldots\ldots\, + b_n\, x_n.$$

where

P equals the predicted achievement score

i equals the intercept value

b_1 equals the regression coefficient for pretest one

x_1 equals the pupil score on pretest one.

Using the following formula, the predicted achievement scores were used to calculate residual achievement scores.

$$R = X - P$$

where R equals the residual achievement score

X equals the raw posttest score

P equals the predicted achievement score.

The residual achievement score is clearly the difference between the score a pupil could be expected to get on the basis of his pretest scores, and the score actually obtained. The residual achievement score represents the contribution, to the raw achievement scores, of all variables not measured in the pretest battery plus errors of measurement. Because of the comprehensive nature of the pretest battery, the high reliabilities of the tests used, and the rigorous control of extraneous variables, it is assumed that the residual scores, in large measure, reflect the posttest variance attributable to treatment effects.

The residual achievement scores were used in three way analyses of variance, the three factors being treatment, school or class, and sex.

Responding patterns: The lesson content, excluding the section of lesson three dealing with the chamois, was divided into 29 content sections, each of which had approximately 12 lesson questions and redirections associated with it. For example, the first section contained the names of the deer species in New Zealand, the number of deer species in New Zealand and the South Island, and the spellings and pronunciations of tahr. Any part of the lessons which dealt with this content was included in section one. Each pupil was asked to respond to one or more of the lesson questions associated with approximately ten of the 29 sections. Thus, for any given section approximately 35 per cent of the pupils had answered at least one lesson question associated with that section, while the remaining 65 per cent had not.

The posttest of achievement items were also divided into 29 groups, the items measuring the content of section one being grouped together, and so on. The true/false items were scored either right or wrong and marks were not deducted for incorrect responses. Each pupil's posttest of achievement was remarked to give 29 separate scores, one on each of the 29 sections. While the number of lesson questions was approximately equal for each section, the number of posttest of achievement items relevant to each section differed fairly widely. The number of lesson questions and posttest items associated with each of the 29 sections may be found in Table 4.13.

The lesson transcripts were investigated and the sections fn which each pupil had been asked to respond at least once were noted. For each of the 29 sections, a mean achievement score was calculated for:

1. The pupils who had been asked to respond to at least one lesson question relevant to that section.
2. The pupils who had not been asked to respond to a lesson question relevant to that section.

TABLE 4.13

THE NUMBER OF LESSON QUESTIONS AND POSTTEST ITEMS ASSOCIATED WITH EACH SECTION IN THE RESPONDING PATTERNS ANALYSIS

Section Number	Number of Lesson Questions	Number of Posttest Questions
1	15	16
2	12	3
3	10	2
4	10	9
5	14	7
6	10	10
7	10	8
8	14	3
9	11	9
10	8	4
11	16	6
12	12	6
13	11	3
14	12	5
15	13	3
16	10	7
17	13	7
18	10	3
19	14	4
20	12	6
21	17	4
22	10	5
23	12	10
24	13	5
25	10	14
26	14	2
27	14	4
28	12	8
29	13	8

The mean scores for the pupils who had been asked to respond to one or more relevant lesson questions were summed across the 29 sections giving a Responding Total, the same being done for the scores of the pupils who were not asked to respond to a relevant lesson question giving a No Responding Total.

While this is a fairly gross measure it was hoped that, by comparing the responding total with the no responding total, the effects of the different treatments could be unequivocally interpreted.

CHAPTER FIVE

THE RESULTS

General:

Because of the considerable amount of data to be presented in this chapter, as much information as possible has been placed in appendices.

Table 5.1 presents a summary of the pretest data gathered in each of the four experiments, indicates the pretests used in the regression analyses for each experiment, and shows the reasons for not using available pretest data.

The most common reason for not using a particular pretest in the regression analyses was that there were low correlations between that pretest and the posttest scores. Full details of the correlations between the pretests and the posttests in each experiment are presented in Appendix F.

The question expectation scores and the desired question frequency scores were not considered for the regression analyses in experiment one because it was felt that these measures may estimate the independent variable in the self-selected responding treatment.

TABLE 5.1

PRETESTS USED IN THE REGRESSION ANALYSES FOR EXPERIMENTS ONE, TWO, THREE, AND FOUR

Pretest Measure	Experiment 1	Experiment 2	Experiment 3	Experiment 4
Age	Yes	No (1)	No (1)	No (1)
A. P. T.	Yes	Yes	Yes	N. A.
Vocabulary	Yes	N. A.	Yes	Yes
Pretest of Achievement	Yes	Yes	Yes	Yes
Attitude Test	Yes	Yes	No (1)	Yes
Vocabulary (Verbal Aptitude)	N. A.	Yes	N. A.	Yes
Analogies (Verbal Aptitude)	N. A.	Yes	N. A.	Yes
P. A. T. Vocabulary	N. A.	N. A.	Yes	Yes
P. A. T. Comprehension	N. A.	N. A.	Yes	Yes
Question Expectation	No (2)	Yes	Yes	N. A.
Desired Question Frequency	No (1) (2)	Yes	No (1)	N. A.
A. C. E. R. Intermediate Test "D'	N. A.	N. A.	No (3)	N. A.

Yes - This pretest was used in the regression analyses

No.(1) - This pretest was not used in the regression analyses because it correlated less than .1 with the total posttest

No (2) - This pretest was not used in the regression analyses because it may estimate the independent variable

No (3) - This pretest was not used in the regression analyses because it had relatively low correlations with the posttests and scores were unavailable for 5 pupils

N. A. - This pretest was not available for this experiment

TABLE 5.2

A COMPARISON OF THE DESIRED QUESTION FREQUENCY SCORES FOR THE RANDOM RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE.

Group	Number	Mean	S.D.	t
Random Responding	68	3.10	1.39	
				2.09+
Self-Selected Responding	70	3.64	1.63	

+ significant beyond the .05 level

The question expectation scores show consistent though small correlations with each of the posttest measures, and would have been included in the regression analyses if it were not for this point. However, there are no significant differences between the question expectation scores for the three treatment groups which may thus be considered to be equivalent on this variable. There was one significant difference between the desired question frequency scores for the three treatment groups. The t test summary presented in Table 5.2 shows that the random responding and self-selected responding treatment groups differed at the .05 level on this variable.[1] However, the correlations between the desired question frequency scores and the posttest scores are mixed and close to zero indicating that this difference would not have influenced the results.

Because the correlations between the A.C.E.R. Intermediate Test 'D' and the posttest scores were relatively low, and

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[1] The t test formulae used throughout this study are:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

when S_1^2 and S_2^2 are significantly different and $n_1 \neq n_2$. The t value equals the average t value obtained using $n_1 - 1$ and $n_2 - 1$ degrees of freedom scores were not available for five subjects, this test was dropped from the regression analyses in experiment three. Presumably the pupils were streamed on the basis of the A.C.E.R. Intermediate Test 'D' scores, resulting in a restricted variability and lowered correlation.

Appendix G contains full information on the multiple regression analyses for each of the posttest scores in each of the experiments, but a brief summary of the multiple correlations obtained is presented in Table 5.3. The multiple correlations are generally larger in experiment two than in the other three experiments, probably as a function of the greater heterogeneity of the sample in this experiment, rather than the combination of pretests used. The multiple correlations for the chamois posttest are generally the lowest, probably largely because of the low reliability of such a short test. However, overall the multiple correlations are reasonably high in view of the relative homogeneity of the samples used in the experiments.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{\Sigma x_1^2 + \Sigma x_2^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

when s_1^2 and s_2^2 are not significantly different. The t value is obtained using $n_1 + n_2 - 2$ degrees of freedom.

when s_1^2 and s_2^2 are significantly different but $n_1 = n_2$ The t value is obtained using $n_1 - 1$ degrees of freedom.

TABLE 5.3

MULTIPLE CORRELATIONS BETWEEN THE PRETEST AND POSTTEST SCORES IN EACH OF THE FOUR EXPERIMENTS

	Experiment One	Experiment Two	Experiment Three	Experiment Four
Posttest One	0.55240	0.85313	0.52670	0.62473
Posttest Two	0.66993	0.79040	0.60737	0.62121
Posttest One plus Two	0.66305	0.84251	0.62211	0.63977
Chamois Posttest	0.30596	0.29378		0.53438
Generalization Posttest	0.36504	0.59405		0.51032
Total Posttest	0.65545	0.83468		0.66384

Full details of the means and standard deviations for each school (class), class (group), treatment, and sex on each pretest, posttest, and residual achievement score in each of the experiments, are presented in Appendix H. An inspection of these tables reveals that the classes used in experiment one are very similar in ability, as it was planned they should be.

Experiment one:

Hypothesis one. Hypothesis one predicted differences between the random responding, systematic responding, and self-selected responding treatments in favour of the random responding treatment. The analysis of variance summaries, presented in Tables 5.4 to 5.9, show that hypothesis one must be rejected in favour of the null hypothesis for each of the six posttest measures. While the mean residual achievement score is higher for the random responding treatment than for the other two treatments, on five of the six posttests, none of the differences reaches any acceptable level of significance.

Hypothesis one (a): Hypothesis one (a) predicted that there would be differences in the answer patterns to the posttest of achievement items in the random responding and systematic responding treatments in experiment one. The responding total (see p. 110) in the random responding treatment was 100.83, while the no responding total was 98.71. The respective scores for the pupils in the systematic responding treatment were 99.21 and 98.13. It is clear that these scores are very similar and that hypothesis one (a) is untenable.

TABLE 5.4

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	112.611	2	1.408
Between Schools	74.475	2	0.931
Between Sexes	362.237	1	4.529 *
Between Treatments by Schools	34.639	4	0.433
Between Treatments by Sexes	116.692	2	1.459
Between Schools by Sexes	140.778	2	1.760
Between Treatments by Schools by Sexes	61.727	4	0.772
Within Groups	79.982	188	
TOTAL	81.334	205	

* $p < .05$

	Mean	Variance
RANDOM RESPONDING	0.74	71.5976
SYSTEMATIC RESPONDING	-1.56	88.4755
SELF-SELECTED RESPONDING	0.71	83.3260
SCHOOL D	0.95	74.7007
SCHOOL B	0.07	79.0867
SCHOOL C	-1.27	91.7565
BOYS	1.16	77.2444
GIRLS	-1.37	83.7497

TABLE 5.5

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	130.477	2	1.561
Between Schools	336.168	2	4.023*
Between Sexes	554.765	1	6.639*
Between Treatments by Schools	40.550	4	0.485
Between Treatments by Sexes	135.872	2	1.626
Between Schools by Sexes	9.286	2	0.111
Between Treatments by Schools by Sexes	21.080	4	0.252
Within Groups	83.564	188	
TOTAL	86.512	205	

* $p < .05$

	Mean	Variance
RANDOM RESPONDING	1.46	68.0426
SYSTEMATIC RESPONDING	-1.38	95.6539
SELF-SELECTED RESPONDING	0.12	93.9674
SCHOOL D	1.92	84.8568
SCHOOL B	0.53	86.7146
SCHOOL C	-2.56	79.4838
BOYS	1.63	82.1535
GIRLS	-1.69	86.3308

TABLE 5.6

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	455.128	2	1.832
Between Schools	718.153	2	2.891
Between Sexes	1811.268	1	7.292*
Between Treatments by Schools	126.868	4	0.511
Between Treatments by Sexes	388.700	2	1.565
Between Schools by Sexes	217.046	2	0.874
Between Treatments by Schools by Sexes	113.302	4	0.456
Within Groups	248.397	188	
TOTAL	258.677	205	

* $p < .01$

	Mean	Variance
RANDOM RESPONDING	2.20	212.8161
SYSTEMATIC RESPONDING	-2.93	266.5183
SELF-SELECTED RESPONDING	0.83	290.0884
SCHOOL D	2.81	252.3242
SCHOOL B	0.60	250.7465
SCHOOL C	-3.84	258.0322
BOYS	2.79	240.1940
GIRLS	-3.05	264.6040

TABLE 5.7

ANALYSIS OF VARIANCE: DIFFERENCES IN CHAMOIS POSTTEST RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	2.862	2	1.480
Between Schools	0.489	2	0.253
Between Sexes	0.125	1	0.064
Between Treatments by Schools	0.454	4	0.235
Between Treatments by Sexes	0.559	2	0.289
Between Schools by Sexes	0.386	2	0.200
Between Treatments by Schools by Sexes	0.738	4	0.382
Within Groups	1.934	188	
TOTAL	1.839	205	

	Mean	Variance
RANDOM RESPONDING	0.24	2.0504
SYSTEMATIC RESPONDING	-0.06	1.5191
SELF-SELECTED RESPONDING	-0.12	1.9189
SCHOOL D	-0.06	1.9727
SCHOOL B	0.10	1.7965
SCHOOL C	0.02	1.7626
BOYS	0.05	2.0713
GIRLS	-0.02	1.5915

TABLE 5.8

ANALYSIS OF VARIANCE: DIFFERENCES IN GENERALIZATION POSTTEST RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	6.211	2	0.154
Between Schools	16.177	2	0.403
Between Sexes	411.897	1	10.261*
Between Treatments by Schools	3.842	4	0.096
Between Treatments by Sexes	45.385	2	1.131
Between Schools by Sexes	46.130	2	1.149
Between Treatments by Schools by Sexes	68.918	4	1.717
WITHIN GROUPS	40.143	188	
TOTAL	41.354	205	

* p<.01

	Mean	Variance
RANDOM RESPONDING	0.00	41.0551
SYSTEMATIC RESPONDING	0.17	46.8209
SELF-SELECTED RESPONDING	-0.22	36.9742
SCHOOL D	0.23	48.5088
SCHOOL B	0.39	33.8787
SCHOOL C	-0.73	40.4677
BOYS	1.25	43.8524
GIRLS	-1.45	34.7492

TABLE 5.9

ANALYSIS OF VARIANCE: DIFFERENCES IN TOTAL POSTTEST RESIDUAL ACHIEVEMENT FOR THE RANDOM RESPONDING, SYSTEMATIC RESPONDING AND SELF-SELECTED RESPONDING TREATMENTS IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	388.118	2	1.033
Between Schools	926.229	2	2.465
Between Sexes	3998.523	1	10.642 *
Between Treatments by Schools	115.806	4	0.308
Between Treatments by Sexes	187.733	2	0.500
Between Schools by Sexes	426.846	2	1.136
Between Treatments by Schools by Sexes	223.997	4	0.596
Within Groups	375.729	188	
TOTAL	389.525	205	

* $p < .01$

	Mean	Variance
RANDOM RESPONDING	2.43	305.0657 #
SYSTEMATIC RESPONDING	-2.21	470.3367 #
SELF-SELECTED RESPONDING	-0.12	395.8452
SCHOOL D	3.03	392.3667
SCHOOL B	1.10	379.6816
SCHOOL C	-4.54	377.4541
BOYS	3.54	362.9956
GIRLS	-3.91	395.2573

These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

Hypothesis one (b): Hypothesis one (b) stated that there would be differences in the number of overt responses made by the pupils in the self-selected responding treatment. When the most frequent responding half of each class is compared with the least frequent responding half this hypothesis is accepted at a high level of significance. The t test summary presented in Table 5.10 shows that the two groups differ beyond the .001 level.

Hypothesis one (c): Hypothesis one (c) stated that the most frequent responding pupils in the self-selected responding treatment in experiment one would have higher mean residual achievement scores than the least frequent responding pupils. Tables 5.11 to 5.16 present the analysis of variance summaries obtained when the most frequent responding half of each class was compared with the least frequent responding half.

The tables show that hypothesis one (c) is untenable and must be rejected in favour of the null hypothesis. The most frequent responding pupils did not score significantly higher on any of the six posttest measures than the least frequent responding pupils, although the residual achievement scores were in the predicted direction for each of the six posttest measures.

Hypothesis one (d): Hypothesis one (d) predicted that there would be differences between the most frequent responding and the least frequent responding groups in the self-selected responding treatment in experiment one, one some of the pretest or raw posttest measures.

TABLE 5.10

A COMPARISON OF THE FREQUENCY OF PUPIL RESPONDING IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Group	Number	Mean	S.D.	t
Most Frequent Responding	34	21.09	6.21	
				9.20#
Least Frequent Responding	34	9.41	4.04	

significant beyond the .001 level

TABLE 5.11

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	115.876	1	1.417
Between Schools	25.482	2	0.312
Between Sexes	490.103	1	5.994 *
Between Treatments by Schools	79.224	2	0.969
Between Treatments by Sexes	2.722	1	0.033
Between Schools by Sexes	25.146	2	0.308
Between Treatments by Schools by Sexes	3.754	2	0.046
Within Groups	81.772	56	
TOTAL	81.420	67	

* $p < .05$

	Mean	Variance
MOST FREQUENT	2.28	81.7330
LEAST FREQUENT	-0.30	80.9581
SCHOOL D	2.06	84.2546
SCHOOL B	1.20	68.3283
SCHOOL C	-0.38	97.1019
BOYS	3.73	67.7301
GIRLS	-1.75	82.8723

TABLE 5.12

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	23.894	1	0.264
Between Schools	52.681	2	0.582
Between Sexes	287.880	1	3.178
Between Treatments by Schools	229.556	2	2.534
Between Treatments by Sexes	1.966	1	0.022
Between Schools by Sexes	36.675	2	0.405
Between Treatments by Schools by Sexes	192.824	2	2.128
Within Groups	90.596	56	
TOTAL	95.680	67	

	Mean	Variance
MOST FREQUENT	0.72	71.6392
LEAST FREQUENT	- 0.18	120.8524
SCHOOL D	1.97	104.6321
SCHOOL B	0.01	113.5371
SCHOOL C	-1.33	68.9308
BOYS	2.34	77.5517
GIRLS	- 1.80	106.5178

TABLE 5.13

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	245.002	1	0.878
Between Schools	148.886	2	0.534
Between Sexes	1529.232	1	5.483 *
Between Treatments by Schools	573.737	2	2.057
Between Treatments by Sexes	0.062	1	0.000
Between Schools by Sexes	98.508	2	0.353
Between Treatments by Schools by Sexes	144.126	2	0.517
Within Groups	278.904	56	
TOTAL	288.410	67	

* $p < .05$

	Mean	Variance
MOST FREQUENT	3.00	243.5596
LEAST FREQUENT	-0.48	334.7656
SCHOOL D	4.03	312.9644
SCHOOL B	1.21	291.1787
SCHOOL C	-1.71	266.5879
BOYS	6.07	226.8312
GIRLS	-3.55	309.9553

TABLE 5.14

ANALYSIS OF VARIANCE: DIFFERENCES IN CHAMOIS POSTTEST RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	0.007	1	0.003
Between Schools	0.476	2	0.226
Between Sexes	0.222	1	0.105
Between Treatments by Schools	1.063	2	0.504
Between Treatments by Sexes	0.839	1	0.398
Between Schools by Sexes	1.244	2	0.590
Between Treatments by Schools by Sexes	2.069	2	0.981
Within Groups	2.109	56	
TOTAL	1.924	67	

	Mean	Variance
MOST FREQUENT	- 0.06	2.0052
LEAST FREQUENT	- 0.12	1.9052
SCHOOL D	- 0.21	1.6319
SCHOOL B	0.09	2.6087
SCHOOL C	- 0.14	1.6991
BOYS	- 0.03	1.9663
GIRLS	- 0.16	1.9369

TABLE 5.15

ANALYSIS OF VARIANCE: DIFFERENCES IN GENERALIZATION POSTTEST RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	1.358	1	0.036
Between Schools	7.691	2	0.201
Between Sexes	26.435	1	0.692
Between Treatments by Schools	0.951	2	0.025
Between Treatments by Sexes	246.356	1	6.444 *
Between Schools by Sexes	15.780	2	0.413
Between Treatments by Schools by Sexes	0.244	2	0.006
Within Groups	38.229	56	
TOTAL	36.780	67	

* $p < .05$

	Mean	Variance
MOST FREQUENT	- 0.06	38.5547
LEAST FREQUENT	- 0.33	36.1042
SCHOOL D	- 0.53	47.4800 #
SCHOOL B	0.58	20.9174 #+
SCHOOL C	- 0.60	43.5397 +
BOYS	0.44	45.8044
GIRLS	- 0.82	28.0781

These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

+ These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

TABLE 5.16

ANALYSIS OF VARIANCE: DIFFERENCES IN TOTAL POST-TEST RESIDUAL ACHIEVEMENT FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	285.653	1	0.725
Between Schools	145.078	2	0.368
Between Sexes	1999.710	1	5.073 *
Between Treatments by Schools	574.421	2	1.457
Between Treatments by Sexes	211.192	1	0.536
Between Schools by Sexes	127.175	2	0.323
Between Treatments by Schools by Sexes	161.926	2	0.411
Within Groups	394.218	56	
TOTAL	396.865	67	

* $p < .05$

	Mean	Variance
MOST FREQUENT	2.88	294.5598
LEAST FREQUENT	- 0.93	500.5391
SCHOOL D	3.29	465.1572
SCHOOL B	1.88	362.4324
SCHOOL C	- 2.45	369.9458
BOYS	6.48	323.6848
GIRLS	- 4.53	416.3481

The pretest scores for the two groups, which may be found in Appendix F, were compared using t tests. The two groups did not differ significantly on the following variables; age, Academic Promise Test Abstract Reasoning Test, vocabulary, pretest of achievement, attitude test, question expectation, or any of the six raw posttest measures. The only significant pretest difference was for desired question frequency in which the least frequent responding pupils had a higher mean score, indicating a desire for fewer questions, than the most frequent responding pupils. The t test summary for the desired question frequency scores is presented in Table 5.17. It seems that the pupils were able to predict how frequently they would respond when they were not constrained to do so.

Differences between posttest one and posttest two.

It can be seen from Tables 5.4 and 5.5 that the treatment F ratio for posttest two is very similar to the treatment F ratio for posttest one. It is thus clear that being exposed to the experimental treatments for one lesson made no difference to the effects of the treatments. Tables 5.11 and 5.12 indicate that, when the self-selected responding treatment alone is considered, and the most frequent responding pupils are compared with the least frequent responding pupils, exposure to the experimental treatments for one lesson reduced the effects of the treatments on the two groups.

Sex differences.

Five of the six analysis of variance summaries presented in Tables 5.4 to 5.9 show significant sex differences in favour of boys,

TABLE 5.17

A COMPARISON OF THE DESIRED QUESTION FREQUENCY SCORES IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Group	Number	Mean	S.D.	t
Most Frequent Responding	34	3.18	1.64	
				2.58+
Least Frequent Responding	34	4.15	1.46	

+ significant beyond the .05 level

and the sixth shows a nonsignificant difference in the same direction. It is clear that the boys have done better than the girls in this experiment when all three treatments are considered. The same trend holds up when only the self-selected responding treatment is considered. Three of the six analysis of variance summaries presented in Tables 5.11 to 5.16 show significant sex differences in favour of boys, and the other three show nonsignificant differences in the same direction. The significant treatments by sexes interaction in Table 5.15, in which the most frequent responding girls and the least frequent responding boys scored highly on the generalization posttest, is not supported by the other tables and is not interpretable.

School differences:

One of the six analysis of variance summaries presented in Tables 5.4 to 5.9 shows a significant school difference while two of the other summaries show school differences approaching significance at the .05 level. However, the trend does not hold up when the self-selected responding treatment alone is considered, none of the analysis of variance summaries presented in Tables 5.11 to 5.16 showing any significant school effect. Because there was no attempt to control differences between schools, but only to keep conditions constant within schools, school differences cannot be interpreted.

Experiment two:

Hypothesis two: Hypothesis two predicted that the mean residual achievement of the pupils who were required to make overt responses

TABLE 5.18

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	19.023	1	0.381
Between Classes	14.639	1	0.293
Between Sexes	42.310	1	0.847
Between Treatments by Classes	0.478	1	0.010
Between Treatments by Sexes	27.422	1	0.549
Between Classes by Sexes	0.292	1	0.006
Between Treatments by Classes by Sexes	138.720	1	2.777
Within Groups	49.952	54	
TOTAL	48.201	61	

	Mean	Variance
RESPONDING	0.93	56.2189
NO RESPONDING	- 0.17	40.8079
CLASS 1	0.85	43.9133
CLASS 2	- 0.11	53.5826
BOYS	- 0.39	57.9431
GIRLS	1.11	39.1720

TABLE 5.19

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	159.185	1	1.481
Between Classes	0.452	1	0.004
Between Sexes	121.379	1	1.129
Between Treatments by Classes	33.433	1	0.311
Between Treatments by Sexes	15.869	1	0.148
Between Classes by Sexes	0.052	1	0.001
Between Treatments by Classes by Sexes	103.840	1	0.966
Within Groups	107.472	54	
TOTAL	102.257	61	

	Mean	Variance
RESPONDING	1.99	101.1570
NO RESPONDING	- 1.07	101.2104
CLASS 1	0.23	116.1318
CLASS 2	0.70	90.2042
BOYS	1.83	138.3745 #
GIRLS	- 0.82	67.6703 #

\# These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

TABLE 5.20

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	288.262	1	1.070
Between Classes	9.945	1	0.037
Between Sexes	20.366	1	0.076
Between Treatments by Classes	41.905	1	0.156
Between Treatments by Sexes	85.015	1	0.315
Between Classes by Sexes	0.098	1	0.000
Between Treatments by Classes by Sexes	2.521	1	0.009
Within Groups	269.528	54	
TOTAL	245.945	61	

	Mean	Variance
RESPONDING	2.92	261.5378
NO RESPONDING	- 1.24	229.0452
CLASS 1	1.08	260.5706
CLASS 2	0.59	238.0819
BOYS	1.44	331.4512 #
GIRLS	0.29	172.6809 #

These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

TABLE 5.21

ANALYSIS OF VARIANCE: DIFFERENCES IN CHAMOIS POSTTEST RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	0.590	1	0.315
Between Classes	0.985	1	0.526
Between Sexes	0.955	1	0.510
Between Treatments by Classes	1.501	1	0.801
Between Treatments by Sexes	0.005	1	0.003
Between Classes by Sexes	0.664	1	0.355
Between Treatments by Classes by Sexes	0.420	1	0.224
Within Groups	1.873	54	
TOTAL	1.742	61	

	Mean	Variance
RESPONDING	0.13	1.7023
NO RESPONDING	- 0.05	1.8144
CLASS 1	0.16	2.1036
CLASS 2	- 0.08	1.3767
BOYS	0.15	2.5389 #
GIRLS	- 0.07	1.0202 #

These variances are significantly different ($p < .01$) and hence one of the assumptions underlying analysis of variance is violated.

TABLE 5.22

ANALYSIS OF VARIANCE: DIFFERENCES IN GENERALIZATION POSTTEST RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	0.258	1	0.009
Between Classes	28.962	1	1.010
Between Sexes	56.863	1	1.984
Between Treatments by Classes	2.789	1	0.097
Between Treatments by Sexes	7.986	1	0.279
Between Classes by Sexes	14.200	1	0.495
Between Treatments by Classes by Sexes	5.055	1	0.176
Within Groups	28.667	54	
TOTAL	27.281	61	

	Mean	Variance
RESPONDING	- 0.05	34.6299
NO RESPONDING	0.16	20.8552
CLASS 1	0.71	25.8977
CLASS 2	- 0.64	28.7634
BOYS	1.03	32.7321
GIRLS	- 0.86	21.3211

TABLE 5.23

ANALYSIS OF VARIANCE: DIFFERENCES IN TOTAL POSTTEST RESIDUAL ACHIEVEMENT FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	297.161	1	0.792
Between Classes	90.775	1	0.242
Between Sexes	169.789	1	0.453
Between Treatments by Classes	12.805	1	0.034
Between Treatments by Sexes	146.874	1	0.391
Between Classes by Sexes	23.975	1	0.064
Between Treatments by Classes by Sexes	10.162	1	0.027
Within Groups	375.252	54	
TOTAL	344.510	61	

	Mean	Variance
RESPONDING	3.01	362.4351
NO RESPONDING	- 1.13	328.3501
CLASS 1	1.94	409.5342
CLASS 2	- 0.13	283.6592
BOYS	2.62	470.8586 #
GIRLS	- 0.64	231.2578 #

These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

in experiment two would be higher than the mean residual achievement of the pupils prevented from making overt responses.

The analysis of variance summaries presented in Tables 5.18 to 5.23 show that hypothesis two must be rejected in favour of the null hypothesis. While the responding group had a higher mean residual achievement score than the no responding group, on five of the six posttest scores, none of the differences reaches any acceptable level of significance.

Hypothesis two (a): Because hypothesis two is untenable hypothesis two (a) was not tested.

Other differences: None of the tables shows a significant sex or class difference and there are no significant interactions. It can be seen from Tables 5.18 and 5.19 that the treatment F ratio for posttest two is larger than the treatment F ratio for posttest one, suggesting that exposure to the experimental treatments for one period may have increased their effects.

Experiment three:

Hypothesis three: Hypothesis three postulated that the pupils given the programmed text version of the lessons would have a higher mean residual achievement score than the pupils given the random responding version of the lessons. For the reasons covered in chapter four only posttests one, two, and one plus two are dealt with here.

Tables 5.24 to 5.26 show that this hypothesis is untenable. Each of the three analysis of variance summaries presented in Tables 5.24 to 5.26 shows a significant difference in favour of the lesson treatment.

TABLE 5.24

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE LESSON AND PROGRAMME TREATMENTS IN EXPERIMENT THREE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	401.805	1	7.269 #
Between Classes	0.177	1	0.003
Between Sexes	55.001	1	0.995
Between Treatments by Classes	354.140	1	6.407 *
Between Treatments by Sexes	4.181	1	0.076
Between Classes by Sexes	92.556	1	1.674
Between Treatments by Classes by Sexes	29.734	1	0.538
Within Groups	55.277	57	
TOTAL	63.881	64	

* $p < .05$

\# $p < .01$

	Mean	Variance
LESSON	2.61	74.5018
PROGRAMME	- 2.38	44.3513
CLASS 1	- 0.07	63.8592
CLASS 2	0.07	66.4137
BOYS	- 1.01	52.4380
GIRLS	0.98	75.3844

TABLE 5.25

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE LESSON AND PROGRAMME TREATMENTS IN EXPERIMENT THREE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	699.052	1	12.667 #
Between Classes	10.589	1	0.192
Between Sexes	9.720	1	0.176
Between Treatments by Classes	96.958	1	1.757
Between Treatments by Sexes	11.663	1	0.211
Between Classes by Sexes	6.938	1	0.126
Between Treatments by Classes by Sexes	116.084	1	2.103
Within Groups	55.189	57	
TOTAL	64.012	64	

# $p < .01$

	Mean	Variance
LESSON	3.42	50.8542
PROGRAMME	-3.12	56.7313
CLASS 1	0.41	73.2399
CLASS 2	-0.42	56.0315
BOYS	-0.45	58.3062
GIRLS	0.44	70.9811

TABLE 5.26

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE LESSON AND PROGRAMME TREATMENTS IN EXPERIMENT THREE

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	2160.815	1	14.625 +
Between Classes	13.502	1	0.091
Between Sexes	110.969	1	0.751
Between Treatments by Classes	821.702	1	5.561 *
Between Treatments by Sexes	1.883	1	0.013
Between Classes by Sexes	48.813	1	0.330
Between Treatments by Classes by Sexes	263.324	1	1.782
Within Groups	147.751	57	
TOTAL	185.044	64	

+ $p < .001$
* $p < .05$

	Mean	Variance
LESSON	6.03	180.9601
PROGRAMME	-5.50	129.4807
CLASS 1	0.34	196.5723
CLASS 2	-0.35	179.3834
BOYS	-1.47	130.7648 #
GIRLS	1.42	239.6714 #

These variances are significantly different ($p < .05$) and hence on of the assumptions underlying analysis of variance is violated

However, Tables 5.24 and 5.26 show significant treatments by classes interactions on posttests one and one plus two. Table 5.27 shows the residual achievement scores by classes for the programme and lesson groups in experiment three on posttests one, two, and one plus two. It can be seen that the lesson group from class one did better than the lesson group from class two while the programme group from class two did better than the programme group from class one.

Tables 5.28 to 5.33 show the t test summaries obtained when the treatments were compared by classes. It can be seen that there is a clear difference between the treatments in class one, all the t values being significant. On the other hand it can be seen that the two treatments are not significantly different in class two.

Other differences: There were no significant sex or class differences and no significant interactions other than the treatments by classes interactions previously mentioned. It can be seen from Tables 5.24 and 5.25 that the treatment F ratio for posttest two is larger than the treatment F ratio for posttest one. However, the fact that the programme pupils covered less than 100 per cent of the content relevant to posttest two makes it difficult to interpret this difference.

Experiment four:

Hypothesis four: In hypothesis four it was postulated that pupils receiving generally positive teacher reactions to their overt responses would have a higher mean residual achievement score than pupils receiving only minimal teacher reactions.

TABLE 5.27

RESIDUAL ACHIEVEMENT SCORES FOR POSTTESTS ONE, TWO, AND ONE PLUS TWO BY CLASSES FOR THE PROGRAMME AND LESSON GROUPS IN EXPERIMENT THREE

Test	Class One		Class Two	
	Mean	S.D.	Mean	S.D.
Posttest One:				
Lesson Group	4.89	6.87	0.18	9.84
Programme Group	-4.74	5.97	-0.02	6.63
Posttest Two:				
Lesson Group	5.03	6.85	1.71	7.26
Programme Group	-3.94	7.82	-2.30	7.38
Posttest One plus Two:				
Lesson Group	9.92	10.78	1.89	15.09
Programme Group	-8.68	10.30	-2.33	11.81

TABLE 5.28

A COMPARISON OF THE POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS ONE

Group	Number	Mean	S.D.	*t*
Lesson Group	16	4.89	6.87	4.30 #
Programme Group	17	-4.74	5.97	

significant beyond the .001 level

TABLE 5.29

A COMPARISON OF THE POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS ONE

Group	Number	Mean	S.D.	*t*
Lesson Group	16	5.03	6.85	3.50 *
Programme Group	17	-3.94	7.82	

* significant beyond the .01 level

TABLE 5.30

A COMPARISON OF THE POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS ONE

Group	Number	Mean	S.D.	t
Lesson Group	16	9.92	10.78	
				5.07#
Programme Group	17	-8.68	10.30	

significant beyond the .001 level

TABLE 5.31

A COMPARISON OF THE POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS TWO

Group	Number	Mean	S.D.	t
Lesson Group	15	0.18	9.84	
				0.07
Programme Group	17	-0.02	6.63	

TABLE 5. 32

A COMPARISON OF THE POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS TWO

Group	Number	Mean	S.D.	t
Lesson Group	15	1.17	7.26	1.55
Programme Group	17	-2.30	7.38	

TABLE 5. 33

A COMPARISON OF THE POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE PROGRAMME AND LESSON TREATMENTS IN CLASS TWO.

Group	Number	Mean	S.D.	t
Lesson Group	15	1.89	15.09	0.89
Programme Group	17	-2.33	11.81	

The analysis of variance summaries presented in Tables 5.34 to 5.39 show support for this hypothesis. The treatment F ratio for posttest one approaches significance at the .05 level, while the treatment F ratios for posttest two, posttest one plus two, and the total posttest are all significant at the .01 level of confidence. Although not significant the two remaining tables show differences between the reacting and no reacting treatments in the predicted direction.

Hypothesis four (a): Hypothesis four (a) predicted that there would be differences in the answer patterns to the posttest of achievement items in the reacting and no reacting treatments in experiment four. The responding total for the reacting group was 123.11, while the no responding total was 122.55. The respective scores for the no reacting group were 117.36 and 117.47. It is clear that there is no difference between the answer patterns except that the reacting group scored higher than the no reacting group.

Other differences: There were no significant sex or class differences. The significant interaction between classes and sexes found in Table 5.37 is not supported by the other tables and is not easily interpretable. The treatment F ratio is substantially higher for posttest two than for posttest one indicating that exposure to the treatments for one lesson may have increased the effects of the treatments.

TABLE 5.34

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	206.925	1	3.659
Between Classes	0.999	1	0.018
Between Sexes	3.330	1	0.059
Between Treatments by Classes	2.492	1	0.044
Between Treatments by Sexes	3.614	1	0.064
Between Classes by Sexes	51.910	1	0.918
Between Treatments by Classes by Sexes	1.141	1	0.020
Within Groups	56.551	57	
TOTAL	54.591	64	

	Mean	Variance
REACTING	1.80	41.6247
NO REACTING	- 1.74	62.4273
CLASS 1	0.12	58.3055
CLASS 2	- 0.14	52.0006
BOYS	- 0.21	55.0460
GIRLS	0.19	55.6801

TABLE 5.35

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST TWO RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	622.630	1	10.797 #
Between Classes	24.834	1	0.431
Between Sexes	0.395	1	0.007
Between Treatments by Classes	17.144	1	0.297
Between Treatments by Sexes	48.974	1	0.849
Between Classes by Sexes	55.046	1	0.955
Between Treatments by Classes by Sexes	24.049	1	0.417
Within Groups	57.665	57	
TOTAL	63.750	64	

# $p < .01$

	Mean	Variance
REACTING	3.04	50.6534
NO REACTING	- 2.95	59.6275
CLASS 1	0.64	62.1568
CLASS 2	- 0.75	66.1150
BOYS	0.12	65.4761
GIRLS	- 0.11	63.5341

TABLE 5.36

ANALYSIS OF VARIANCE: DIFFERENCES IN POSTTEST ONE PLUS TWO RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	1547.442	1	9.090 #
Between Classes	35.791	1	0.210
Between Sexes	1.431	1	0.008
Between Treatments by Classes	6.566	1	0.039
Between Treatments by Sexes	25.986	1	0.153
Between Classes by Sexes	213.860	1	1.256
Between Treatments by Classes by Sexes	35.666	1	0.210
Within Groups	170.237	57	
TOTAL	180.785	64	

# $p < .01$

	Mean	Variance
REACTING	4.84	143.9662
NO REACTING	- 4.69	174.8149
CLASS 1	0.76	181.1593
CLASS 2	- 0.89	183.7838
BOYS	- 0.09	173.0359
GIRLS	0.08	192.1664

TABLE 5.37

ANALYSIS OF VARIANCE: DIFFERENCES IN CHAMOIS POSTTEST RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	1.338	1	0.727
Between Classes	0.684	1	0.371
Between Sexes	0.458	1	0.249
Between Treatments by Classes	0.343	1	0.186
Between Treatments by Sexes	1.647	1	0.895
Between Classes by Sexes	7.957	1	4.323*
Between Treatments by Classes by Sexes	5.676	1	3.083
Within Groups	1.841	57	
TOTAL	1.922	64	

* $p < .05$

	Mean	Variance
REACTING	0.17	2.5391 #
NO REACTING	-0.16	1.3634 #
CLASS 1	0.10	2.1610
CLASS 2	-0.11	1.7227
BOYS	0.12	2.1117
GIRLS	-0.11	1.8148

These variances are significantly different ($p < .05$) and hence one of the assumptions underlying analysis of variance is violated.

TABLE 5.38

ANALYSIS OF VARIANCE: DIFFERENCES IN GENERALIZATION POSTTEST RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	55.887	1	1.552
Between Classes	29.470	1	0.819
Between Sexes	43.341	1	1.204
Between Treatments by Classes	16.682	1	0.463
Between Treatments by Sexes	5.649	1	0.157
Between Classes by Sexes	23.574	1	0.655
Between Treatments by Classes by Sexes	2.920	1	0.081
Within Groups	36.002	57	
TOTAL	34.838	64	

	Mean	Variance
REACTING	0.90	32.4383
NO REACTING	-0.87	36.5898
CLASS 1	0.68	30.9580
CLASS 2	-0.79	39.2908
BOYS	0.84	33.4274
GIRLS	-0.76	35.8444

TABLE 5.39

ANALYSIS OF VARIANCE: DIFFERENCES IN TOTAL POSTTEST RESIDUAL ACHIEVEMENT FOR THE REACTING AND NO REACTING TREATMENTS IN EXPERIMENT FOUR

Source of Variance	Mean Square	Degrees of Freedom	F Ratio
Between Treatments	2301.100	1	8.889 #
Between Classes	149.776	1	0.579
Between Sexes	36.767	1	0.142
Between Treatments by Classes	36.734	1	0.142
Between Treatments by Sexes	76.694	1	0.296
Between Classes by Sexes	277.509	1	1.072
Between Treatments by Classes by Sexes	101.280	1	0.391
Within Groups	258.869	57	
TOTAL	277.116	64	

# $p < .01$

	Mean	Variance
REACTING	5.90	225.7378
NO REACTING	-5.73	265.6392
CLASS 1	1.54	262.7717
CLASS 2	-1.79	295.9419
BOYS	0.87	271.7517
GIRLS	-0.79	287.8398

CHAPTER SIX

DISCUSSION AND CONCLUSIONS

In this chapter the results presented in the previous chapter will be discussed, the implications of these results for classroom learning will be noted, and some possible avenues for future research will be suggested.

Pupil responding:

The results presented in chapter five indicate that pupil participation, in the form of overt pupil responses to teacher solicitations, has very little effect on achievement under the conditions of the present study.

Experiment one indicated that there were no significant differences in mean residual achievement for classes taught under three conditions of overt pupil responding. Pupils who were required to make overt responses to the lesson content in an unpredictable sequence (condition x) did not have a significantly higher mean residual achievement score than (i) pupils who could predict when they would be required to make overt responses (condition y) and (ii) pupils who were not required to respond overtly at all, but were free to respond or not as they wished (condition z).

The hypotheses tested rule out the possibility that the various treatments had effects on achievement which were not evident when mean residual achievement scores were compared.

First, the patterns of responses to the posttest items were the same for the random responding treatment and the systematic responding treatment. That is, not only did the two treatment groups have mean residual achievement scores which were not significantly different, but they also did equally well on both the posttest items relevant to the responses they made during the lessons and the posttest items not relevant to the responses they made during the lessons. It is clear that being able to predict when they would be asked to respond to the lesson questions did not lower the achievement of the systematic responding pupils on those items not relevant to the questions they were asked to respond to during the lessons. Neither did it raise their achievement on the items relevant to the questions they were asked to respond to during the lessons.

Second, the most frequent responding pupils in the self-selected responding treatment did not score significantly higher on the posttest than the least frequent responding pupils. That is, the random responding and self-selected responding treatment groups had mean residual achievement scores which were not significantly different, and, in addition, the self-selected responding pupils who responded frequently did not have a significantly higher mean residual achievement score than the self-selected responding pupils who responded infrequently. This result, despite the fact that there were marked differences in the number of responses made, clearly establishes that the frequency with which pupils chose to respond to the lesson questions had little effect on achievement.

Experiment two, a stronger test of the responding variable, substantiated the findings of experiment one. Pupils who were prevented from making any overt responses to the lesson content did not have a significantly lower mean residual achievement score than the pupils who were required to make overt responses in a random sequence.

Experiment three will be discussed in detail later in the chapter, but at this point it may be stated that it also suggests that the responding variable is weak. Any increase in achievement brought about by the requirement of continuous overt responding in the programmed learning treatment, if any existed, was so small that it was outweighed by the other variables present in this experiment.

The assumptions on which the hypotheses were based may be briefly reiterated as follows. It was assumed that the experimental treatments would have an effect on pupil attending behaviour and a consequent effect on achievement. At the outset of the study it seemed reasonable to assume that pupils who were required to respond overtly to the lesson content in an unpredictable sequence would feel constrained to attend closely to the lessons in anticipation of being asked to respond overtly and would therefore achieve highly.

It seemed equally reasonable to assume that pupils who could predict when they were to be asked to respond overtly, or who were not required to respond overtly, would not feel constrained to make covert responses to the lesson content to the same extent and would therefore have lowered achievement. The results of the study fail to bear out these assumptions and it is therefore necessary to seek explanations for the results.

First, the possibility that the results were obtained because the pupils did not perceive the treatment differences may be safely ruled out. The mean question estimate scores for the random responding, systematic responding, and self-selected responding treatments in experiment one were not significantly different which is to be expected since the mean number of questions asked was virtually the same for each treatment (see p.98). However, the question estimate variances for the three treatment groups were 1.8602, 0.4636 and 2.5774 respectively which is the order one would expect. The self-selected responding treatment, in which there were differences in the frequency with which pupils responded, has the highest variance while the systematic responding treatment, in which pupil responding was equally distributed and predictable, has the smallest variance. While the random responding treatment question estimate variance is not significantly different from the self-selected responding treatment question estimate variance, the systematic responding treatment question estimate variance is significantly different from the question estimate variances for the other two treatments. The systematic responding and random responding question estimate variances are different beyond the .01 level of confidence (F equals 4.01) and the systematic responding and self-selected responding question estimate variances are also significant at the same level of confidence (F equals 5.56).

Table 6.1 shows the t test summary obtained when the mean question estimate scores for the most frequent responding and least frequent responding groups in the self-selected responding treatment in experiment one were compared. The highly significant difference between the two groups shows that the pupils knew how frequently they had been asked to respond relative to the other pupils.

Table 6.2 shows the t test summary obtained when the mean question estimate scores for the responding and no responding treatments in experiment two were compared. The highly significant difference between the two treatments shows that the pupils in this experiment also knew how frequently they had been asked to respond relative to the other pupils.

Second, it is possible that the particular conditions of the present study were such that attending behaviour was unaffected by the requirements of overt responding. This could have come about if (i) a 'Hawthorne Effect' had existed and pupils had paid attention because of novel conditions, such as the presence of a new teacher, a tape-recorder, and so on, (ii) the interest level of the lessons had been such that the pupils had attended or not irrespective of any requirements to respond overtly or (iii) the pupils had been motivated to attend to the lessons because they knew that they were to be posttested.

TABLE 6.1

A COMPARISON OF THE QUESTION ESTIMATE SCORES FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE

Group	Number	Mean	S.D.	t
Most Frequent Responding	34	2.79	1.27	
				6.23#
Least Frequent Responding	34	4.71	1.27	

significant beyond the .001 level

TABLE 6.2

A COMPARISON OF THE QUESTION ESTIMATE SCORES FOR THE RESPONDING AND NO RESPONDING TREATMENTS IN EXPERIMENT TWO

Group	Number	Mean	S.D.	t
Responding	31	2.26	1.24	
				20.23#
No Responding	31	6.94	0.36	

significant beyond the .001 level

While this second possibility cannot be ruled out, and it would be unreasonable to suggest that these factors had no effect, the writer is of the opinion that it is not a very parsimonious explanation.

Pupils in the schools used in the study are regularly taught by student teachers on section and so a new teacher is not particularly novel to them. In addition intermediate school pupils are used to being taught by a number of the regular staff members and not by only one teacher. The teachers introduced the writer simply as 'Mr. Hughes, who will be taking some lessons with you this week' (see Appendix E) and it was not suggested that anything out of the ordinary would take place. It seems unlikely, therefore, that the presence of the writer, ipso facto, would have had a marked effect on the pupils. The pupils appeared to pay remarkably little attention to the presence of the taperecorder, although it is not possible to gauge its exact effect. Also, the presence of the coloured pictures and other materials would have been just as likely to distract the pupils' attention as to act as a stimulus to attending behaviour.

In chapter three it was pointed out that an effort was made to prepare a lesson series which would not be too interesting or too dull for the pupils, and so obscure the effects of the responding variable. While it cannot be proved, the writer is of the opinion that the materials vary widely in interest value. On a number of occasions individual pupils asked if they were going to have another lesson when the writer arrived to set up the materials. On being informed that they were some showed clear pleasure. When the matter was pursued further, however, and the pupils were asked why they were pleased, they mostly claimed that it was because they would not have to do maths or some other subject they claimed not to like. Only rarely did pupils say it was because they liked the lessons.

While the pupils were asked not to talk to pupils in other classes about the lessons, it was realized that some pupils would inevitably mention what was happening to friends in other classes. To check that the pupils were generally not aware that the posttest was being given the pupils in the third class given the lessons at school D were asked to indicate if they knew that they were to be given the posttest after the posttest had been completed. Of the total class, including both experimental and non-experimental pupils, only three pupils indicated that they knew of the posttest. Since the third class taken was more likely to hear of the posttest than the second class taken it may be assumed that even fewer of the pupils in the second class would have been aware of the posttest. It thus seems that the possibility that the pupils may have been highly motivated, irrespective of the treatment used, because they knew they were to be posttested may be safely ruled out.

Third, it is possible that Form II pupils have learnt to control their own attending behaviour to the extent that the requirement of overt responding, at least in the short term, does not appreciably enhance learning. The writer is of the opinion that this is the most likely explanation of the results obtained.

It is clear that unless pupils have learnt to control their own attending behaviour, without the need for frequent overt participation, the teaching process must be grossly inefficient in the typical class lesson. The pupils in the normal classroom with around 35 pupils, can receive, on average, about three per cent of the teacher's solicitations. If they do not attend without being asked to respond overtly little will be learnt. Teachers must appreciate this point and they presumably encourage their pupils to attend to the material being taught whether they expect to be asked to respond overtly or not. The results of the study suggest that teachers have, by Form II, successfully taught their pupils to attend to classroom lessons, at least in the short term, without the requirement of overt responding.

Would the responding variable have had an effect on achievement 'over the long haul'? In experiment one the treatment F ratios for posttest one and posttest two were almost equal, showing that exposure to the treatments for one lesson made no difference to their effects. However, in experiment two the treatment F ratio for posttest two was larger than the treatment F ratio for posttest one, suggesting that exposure to the treatments for one period may have increased their effects. It seems, therefore, that continued use of the extreme responding treatment, as used in experiment two, could begin to have a significant effect on achievement if it were continued long enough. However, this treatment is markedly different from the way in which teachers distribute their questions in a normal classroom. On the other hand, there is no evidence to suggest that the more mild treatments, as used in experiment one, would necessarily give rise to achievement differences even if they were carried on for a long time.

It thus appears that, at the Form II level, the class lesson, in which pupils are required to respond overtly to only a fraction of the teacher's solicitations, may be much more efficient than some writers would have us believe. It follows that teachers need not feel that the class lesson is ineffective simply because it is not possible to have all pupils responding overtly at once. Teachers should also bear in mind that some pupils prefer to make overt responses less frequently than others, without any consequent reduction in their achievement. The fact that a particular pupil does not proffer frequent responses to the teacher's solicitations does not appear to be a necessary indication that he is not attending to the material being presented.

It would be instructive if future studies could investigate the responding variable with subjects younger than those used in the present study. It seems reasonable to expect that younger pupils, with their shorter attention span, and limited experience in school learning situations, might benefit from conditions requiring them to make overt responses.

Church[1] (personal communication), studied the effects of pupil

[1]This study is being undertaken as part of the requirements of the Ph. D. degree at the University of Canterbury.

participation on pupil achievement in a science topic at the Standard 4 level. Results indicated that an experimental group given half the number of questions addressed to a control group did not score significantly less than the control group on a posttest of achievement. However, when a second experimental group was given only one sixth the number of questions given the control group their achievement was significantly impaired ($p < .05$). Church found that the participation variable was the weakest of the variables he investigated.

This suggests a possible pattern in which participation effects are inversely related to age. It seems unrealistic to expect teaching variables to operate consistently across all age groups and ability levels and such a relationship would be quite reasonable. Further closely controlled studies of pupil responding with different age groups are thus recommended to clarify the effects of pupil responding at the different age levels.

The results presented in chapter five indicate that the pupils were able to predict how frequently they would respond overtly to the lesson questions under conditions in which they were not required to respond. This is clearly indicated by the desired question frequency scores which were significantly higher for the least frequent responding group in comparison with the most frequent responding group in the self-selected responding treatment.

However, the pretest variables measured in the study do not indicate the pressage[1] characteristics of the pupils who chose to respond frequently in comparison with the pupils who chose to respond infrequently. It seems that the distinguishing characteristics of the two groups must be pressage characteristics because the pupils were able to predict how frequently they would respond before the lessons were given.

Further research needs to be done to establish what these pressage characteristics are. Because none of the cognitive or attitudinal pretests given in the pretest battery differentiate between the two groups personality traits could be investigated.

<u>Teacher Reacting:</u>

The results presented in chapter five indicate that, under the conditions of the present study, positive teacher reactions facilitate pupil achievement in comparison with minimal teacher reactions. Experiment four indicated that pupils who received positive teacher reactions to their overt responses, where appropriate, had significantly higher mean residual achievement scores on three of the posttests than the pupils who received minimal teacher reactions. The other three posttests were in the same direction and one of them approached significance at the .05 level.

[1] The term pressage characteristic refers to a characteristic which existed before the teaching started. The terms was first used by Mitzel (1960).

The results presented in chapter five also indicate that the increase in achievement of the reacting group over the no reacting group is the result of the generalized effect of positive teacher reactions and not the reinforcement of particular pupil responses.

First, the treatment F ratio for posttest two (10.797) is much larger than the treatment F ratio for posttest one (3.659). This suggests that exposure to the treatments for one lesson increased their effects in subsequent lessons. If positive reacting acted to reinforce specific responses, and so increased achievement on the posttest items relevant to those responses, it could be expected that the F ratios for posttests one and two would be very similar.

Second, the posttest answer patterns analysis indicated that there was no difference between the responding total and the no responding total for the reacting group. That is, the pupils in the reacting group did no better on the posttest items relevant to the lesson responses they were given positive reactions for than on the posttest items not relevant to the lesson responses they were given positive reactions for. The posttest answer pattern analysis indicated that the only effect of positive reacting was to generally raise the performance of the reacting group in comparison with the no reacting group.

The results of this section of the study are in line with the results of the studies cited in the review of research. However, the studies cited in the review have suffered from methodological problems, making it difficult to state clear relationships between positive teacher reacting and pupil achievement.

Some studies have confounded variables. For example, a number of studies have confounded positive and negative teacher reactions. A high level of negative reacting must coexist with a low level of positive reacting other things being equal, so that where studies have used ratios of positive to negative teacher reactions it is never clear whether the important variable is the presence of positive reactions, the absence of negative ones, or some combination of the two. In the present study results may be unambiguously interpreted. Positive teacher reactions give rise to increased achievement in comparison with minimal teacher reactions.

Some studies have lacked control of variables. For example, observational studies are unable to demonstrate causal variables, thus making it impossible to tell whether the positive reactions have caused high achievement, the high achievement has caused positive reactions, or whether some unknown variable has caused both the positive reactions and the high achievement. In the present study, in which there was rigorous control over variables, the causal variable is clearly established. Positive teacher reactions cause high achievement.

Some studies have been divorced from the classroom. For example, laboratory studies have used artifical materials and treatments making it impossible to generalize to the classroom setting. In the present study such problems have been eliminated as far as is possible, and tentative generalization to other school subjects, class levels, and ability groups is reasonable, in the meantime, while the results of other studies dealing with different subjects, different class levels, and different ability groups are awaited.

These additional studies must be undertaken before the place of responding and reacting in the learning process can be fully established, and educators are in a position to train teachers to be more efficient. In order to maximize the internal validity of the present study a number of variables were carefully controlled. To the extent that the control of these variables has been successful results from the study may be only tentatively generalized. For example, only average ability pupils were used in the present study. Do the results hold up with bright pupils and with dull pupils? The pupils used in the study were all Form II pupils. Do the results hold up with older pupils and with younger pupils? The only product variable studied in the present study was achievement. Do the treatments have effects on attitudes and other product variables?

While the results of such studies are awaited it may be tentatively concluded that teachers should maximize the use of appropriate positive teacher reactions rather than giving minimal reactions which they commonly do. For example, none of the 16 most common types of teacher feedback found by Zahorik (1968, 1969a, 1969b) contained an element of elaborate praise which is Zahorik's equivalent of praise as defined in the present study.

Further studies need to investigate the effects of negative teacher reactions in comparison with minimal reactions. Such studies will not be easy. The writer found it difficult to avoid reacting positively to good answers from the pupils in the no reacting group, and maximizing negative reactions would be very difficult. However, once the position of negative reactions in comparison with minimal reactions has been established it will be possible to begin studying the best combination of the two kinds of reaction which is what the research must ultimately do. If these variables exhibit curvilinear relationships with achievement, as has been suggested by a number of writers, then the optimal level of each kind of reaction needs to be established.

Programmed instruction:

The programmed text was originally planned to enable pupils not included in the experimental classes in experiment one to cover the content of the lessons, thus keeping them productively occupied while the experimental pupils were being given the lessons and enabling them to sit the posttests with the experimental pupils. However, it was clear that if a programmed text were prepared it could be used as a strong test of the responding variable in which the pupils responding to each solicitation in the programmed text were compared with the pupils responding to only a proportion of the total number of solicitations in the lessons. To do this it would have been necessary to control extraneous variables such as rate of working and so on.

By the time the data were collected experiment two had been completed as a strong test of the responding variable and it was decided to have the pupils work through the material in the programmed text at their own rate. Thus, this section of the study was a comparison of programmed learning and conventional instruction and not just a test of the responding variable, although the frequency of overt responding is one of only four variables not equated in the two treatments.

It was originally planned to compare the treatments (a) with content covered held constant and (b) with time spent working on the content held constant. As has been pointed out the time spent working on the material was not held constant and this comparison has not been made. The three comparisons made in chapter five hold content covered constant and so the two treatments differ in the following respects.

1. The programme pupils wrote their answers while the lesson pupils spoke their answers. From experiments one and two it may be safely concluded that this difference would have had a negligible effect on achievement.

2. The time spent working on the material was different for the programme group and the lesson group. While it is not possible to calculate how much time the programme group and the lesson group spent working on the content relevant to each of the three posttests used to compare the treatments, it is possible to say that the mean time spent working on the material by the programme pupils would have been shorter than the mean time spent on the material by the lesson group. The mean time spent by the programme group on the total programme was 97.33 minutes in comparison with 114.00 minutes spent by the lesson group on the total lessons. The 13 pupils who failed to finish the programme could thus have spent an average of 43.60 extra

minutes working on the programme before the mean time spent on the material was equal for the two treatments. It is quite obvious that this amount of time would not have been required. Thus the time factor favours the programme treatment.

3. The programme group read the material while the lesson group listened to the material. This difference presumably affected the responding level of the pupils although it is not possible to establish in which direction. For example, if the programme pupils read each word carefully they were making a covert response to each word and covert responding was maximized. On the other hand if they skimmed the material covert responding may not have been high. The same is true of the lesson group. If the pupils listened intently their covert responding level would have been higher than it they had not listened carefully.

4. The programme pupils made more overt responses to the lesson content than the lesson group. The mean number of overt responses made by the programme group was 174. 32 compared with 20. 39 for the lesson group.

The results presented in chapter five indicate, at first sight, that the programme treatment is inferior to the lesson treatment. However, when the classes are considered separately, it is clear that the treatments have had different effects in the two classes. In the first class the programme treatment is clearly inferior to the lesson treatment but in the second class this is not the case.

The pupils in the first class spent an average of 94.12 minutes working on the programme as a whole with only three pupils failing to finish in the allotted time. In the second class, however, ten of the 17 pupils failed to finish and the mean time spent on the material was 100.53 minutes. The picture which emerges from these figures is one of two different programme groups. The programme pupils from the first class completed the material very quickly in comparison with the pupils from the second class. This picture fits the results obtained. The group which hurried through the material did relatively poorly while the group which worked more slowly did better. At the same time, however, the lesson group from class one did better than the lesson group from class two giving rise to the significant interactions between classes and treatments noted in chapter five.

It is very difficult to find a reason for the interaction between classes and treatments. If the effect was caused by differences between the groups on one of the pretest measures then it is to be expected that the lesson group from class one would how a high score on that pretest relative to the lesson group from class two, while the programme group from class one would show a low score relative to the programme group from class two, or vice versa. Such a relationship does not exist for any of the pretest measures (see Appendix H). With this possibility eliminated it is only possible to guess the cause of the interaction and because the writer is unable to find any parsimonious explanation such conjecture will not be included in this discussion.

The conclusion then concerning the comparison between programmed instruction and conventional instruction is that the lesson method is superior to the programme method under the conditions of this study only for some groups the distinguishing characteristics of which are unknown. At the same time it must be borne in mind that the programme took less time than the lessons. Thus the absolute difference between the treatments must be weighed against the saving in time.

Some writers have claimed that comparing a programmed text with a class lesson is not very useful (for example, Kay et al., 1968). However, the reasons given to support such a claim are naive. Kay et al. claim that after such a comparison has been made the programme can be inspected but the activities of the classroom teacher cannot be analyzed. While it is true that, in the past, the methods used to make comparisons between programmed instruction and a class lesson have been such that it is not possible to quantify the behaviour of the teacher this is not the case in the present study. The lessons can be analyzed after the teaching is over.

The writer is aware of the limitations of the present study. In an effort to meet the time limit applied to M.A. degrees the data collection had to be curtailed. It is quite clear that further work needs to be done along similar lines to the present study to answer questions such as the following. First, is the interaction effect between classes by treatments found in the present study a general effect and if so what is the causal variable or what are the causal variables? Second, if there is not a general interaction between treatments by classes which set of data presented in the present study is indicative of the general findings, that for class one or that for class two? Third, how much time do pupils save by learning through programmed instruction rather than through a conventional lesson?

In the present study the lessons were as good as the writer could produce with many hours of preparation, trials and modifications, expensive materials, and so on. It seems clear that unless these lessons are markedly superior to the programmed version the practical advantages of the programme are marked. The programme is easily duplicated, the lessons are not.

Miscellaneous:

Sex differences: In chapter five clear sex differences were noted in experiment one. The analysis of variance summaries show that the boys did significantly better than the girls on five of the six posttest measures while the sixth posttest score shows a nonsignificant difference in favour of boys. When the self-selected responding data alone are considered the boys did significantly better than the girls on three of the posttest measures and there are nonsignificant differences in favour of boys on the other three posttest scores.

However, the other three experiments fail to support this finding. Of the 15 analysis of variance summaries for experiments two, three, and four nine show differences in favour of boys while six show differences in favour of girls and none of the differences is significant. It thus seems that the sex differences noted in experiment one are specific to the conditions under which that experiment was conducted and that sex differences are not general.

Clearly, then, an explanation of the differences between the boys and girls in experiment one cannot be found in the topic taught because this is the same for all experiments. If the differences are a function of the responding variable used in experiment one then they should also have been found in experiment two and they were not. Four of the five pretest measures used in the regression analyses in experiment one were also used in at least two of the other experiments, while the six pretest measures which were not used in experiment one were also not used in at least one other experiment (see Table 5.1). The only pretest measure unique to the regression analyses for experiment one is age. However, since age was excluded from the regression analyses in experiments two, three, and four because it had a low correlation with the posttest scores, and since there was very little difference between the sexes on this variable, including it in the regression analyses would have made a negligable difference to the results (see Appendix F and Appendix H).

The reason for the sex differences in experiment one remains unknown.

<u>Methodology</u>: At this point it is worth discussing the general methodological question of whether to compare whole classes given different treatments, as in experiment one, or whether to compare different treatment groups within classes, as in the other three studies. The second alternative is generally recommended, but problems associated with this methodology need to be borne in mind.

When whole classes are compared the research design must become much more complicated. The latin squares design used in experiment one is more complicated than the randomized group design used in the other three experiments. Even with a design like the latin squares design it is difficult to control extraneous variables. When treatment groups within classes are compared some extraneous variables are almost automatically controlled and the data collection is easier.

In addition, the statistical unit in treatment-within-class comparisons is the individual pupil, because pupils may be allocated to treatments at random, while in whole class comparisons the correct statistical unit is the class.

This point has not been ignored in the present study. The individiual pupil is the correct unit of analysis in experiments two, three, and four, while in experiment one the correct unit is really the class, although the individual pupil has been used thus increasing the risk of a type I error. However, because the treatment effects in experiment one are not significant with individual pupil degrees of freedom changing the unit to the class would be of little significance.

Two points should be noted in favour of using whole classes. First, it is not always possible to take two treatments simultaneously within a class, as was the case with experiment one. Unless it is possible to teach groups within classes separately in such cases, as in experiment three, it is necessary to use the whole class methodology.

Second, it is possible that there may be interactions between treatments when they are given to groups within classes. A methodological study designed to test the hypothesis that such interactions exist is strongly recommended because there must always be doubts about the validity of findings utilizing treatment groups within classes until this is done. For example, it would be instructive if groups receiving minimal teacher reactions to their responses were compared when the minimal reactions were given alongside different treatments. Do pupils receiving minimal teacher reactions in classes where the other pupils receive positive teacher reactions perform differently on a posttest from pupils receiving minimal teacher reactions alongside pupils given negative teacher reactions? The possibility that such interactions exist cannot be ignored. The whole class methodology is crucial where treatment groups within classes cannot be taught separately and such interactions exist.

REFERENCES

Amidon, E. and Flanders, N.A. (1961). The effects of direct and indirect teacher influence on dependent-prone students learning geometry. Journal of Educational Psychology, 52, 286-91.

Anderson, J.A. and Henderson, J.B. (1961). Himalayan Thar in New Zealand: Aspects of Life History and Assessment of Management Problems. Wellington: New Zealand Deer-stalkers Association (Inc).

Andreas, B.G. (1968). Psychological Science and the Educational Enterprise. New York: John Wiley and Sons, Inc.

Anstey, E. (1966). Psychological Tests. London: Thomas Nelson and Sons Ltd.

Anthony, B.C.M. (1967). The Identification and Measurement of Classroom Environmental Process Variables Related to Academic Achievement. Unpublished Doctoral Dissertation. Chicago: University of Chicago. Reported in Rosenshine (1970b).

Australian Council for Educational Research (1958). A.C.E.R. Intermediate Test D. Melbourne: Australian Council for Educational Research.

Ausubel, D.P. (1968). A Subsumption Theory of Meaningful Verbal Learning and Retention: In Kuhlen, R.G. ed. Studies in Educational Psychology. Massachusetts: Blaisdell Publishing Company. 167-74.

Bellack, A.A. et al. (1966). The Language of the Classroom. New York: Teachers College Press, Columbia University.

Bennett, G.K. et al. (1965). Academic Promise Tests. New York: The Psychological Corporation.

Birkin, T.A. (in press). 'Toward a Model of Instructional Processes'. In Westbury, I. and Bellack, A.A. eds. Research into Classroom Processes. New York: Teachers College Press. Reported in Flanders(1970) and Rosenshine (1970b).

Brown, G.I. (1960). Which pupil to which classroom climate? Elementary School Journal, 60, 265-73.

Campbell, J.R. (1968a). Cognitive and Affective Process Development and its Relation to a Teacher's Interaction Ratio. Unpublished Doctoral Dissertation. New York: New York University. Reported in Campbell and Barnes (1969).

Campbell, J.R. and Barnes, C.W. (1969). Interaction analysis - a breakthrough? Phi Delta Kappan, 50, 587-90.

Campbell, W.J. (1968b). Studies of teaching. New Zealand Journal of Educational Studies, 3. 97-124.

Cook, R.E. (1967). The Effects of Teacher Methodology upon Certain Achievements of Students in Secondary School Biology. Unpublished Doctoral Dissertation. Iowa City: University of Iowa. Reported in Evans (1970) and Rosenshine (1970b).

Darling, F.F. (1937). A Herd of Red Deer. London: Oxford University Press.

Dollins, J.G. et al. (1960). With words of praise. Elementary School Journal, 60, 446-50.

Donne, T.E. (1924). The Game Animals of New Zealand: An Account of Their Introduction, Acclimatization, and Development. London: John Murray.

Ebel, R.L. (1965). Measuring Educational Achievement. New Jersey: Prentice-Hall, Inc.

Ebel, R.L. (1969). 'Some Limitations of Basic Research in Education'. In Anderson, R.C. et al. Current Research on Instruction. New Jersey: Prentice-Hall, Inc. 15-21.

Ellenberger, W. et al. (1956). An Atlas of Animal Anatomy for Artists New York: Dover Publications, Inc.

Elley, W.B. and Reid, N.A. (1969). Progressive Achievement Tests: Reading Comprehension and Reading Vocabulary. Wellington: New Zealand Council for Educational Research.

Evans, T.P. (1970). Flanders System of Interaction Analysis and Science Teacher Effectiveness. A paper presented to the Forty-third Annual Meeting of the National Association for Research on Science Teaching.

Flanders, N.A. (1960). Teacher Influence, Pupil Attitudes, and Achievement. Cooperative Research Project No. 397, United States Office of Education. Reported in Flanders (1970).

Flanders, N.A. (1964). 'Some Relationships Among Teacher Influence, Pupil Attitudes, and Achievement'. In Biddle, B.J. and Ellena, W.J. eds. Contemporary Research on Teacher Effectiveness. New York: Holt, Rinehard and Winston 196-231.

Flanders, N.A. (1967). 'Teacher Behaviour and In-service Programs'. In Amidon, E.J. and Hough, J.B. eds. Interaction Analysis: Theory, Research and Application. Massachusetts: Addison-Wesley, 256-61.

Flanders, N.A. (1970). Analyzing Teaching Behaviour. Massachusetts: Addison-Wesley.

Flanders, N.A. and Simon, Anita (1969). 'Teacher Effectiveness'. In Ebel, R.L. ed. Encyclopedia of Educational Research, 4th edition, London: Macmillan, 1423-1437.

Furst, Norma F. (1967). The Multiple Languages of the Classroom: A Further Analysis and a Synthesis of Meanings Communicated in High School Teaching. A paper presented at the Annual Meeting of the American Educational Research Association, 1967.

Gage, N.L. (1963). 'Paradigms for Research on Teaching'. In Gage, N.L. ed. Handbook of Research on Teaching. Chicago: Rand McNally and Co. 94-141.

Gage, N.L. (1968a). An analytical approach to research on instructional methods. Phi Delta Kappan, 49, 601-06.

Gage, N.L. (1968b). Can science contribute to the art of teaching. Phi Delta Kappan, 49, 399-403.

Good, T.L. (1969). Student Achievement Level and Differential Opportunity for Classroom Participation. Texas: University of Texas (mimeo).

Good, T.L. (1970). Which pupils do teachers call on? Elementary School Journal, 70, 190-98.

Hamachek, D. (1969). Characteristics of good teachers and implications for teacher education. Phi Delta Kappan, 50, 341-45.

Harris, L. H. (1967). Hunting Red Deer. Wellington: New Zealand Forest Service.

Heil, L. M. and Washburne, C. (1961). Characteristics of teachers related to children's progress. Journal of Teacher Education, 12, 401-6.

Hilgard, E. R. (1964). 'A Perspective on the Relationship Between Learning Theory and Educational Practices', in Hilgard E. R. ed. Theories of Learning and Instruction. Chicago The National Society for the Study of Education, 402-15.

Hoetker, W. J. (1967). Analyses of the Subject Matter Related Verbal Behaviour in Nine Junior High School English Classes. Unpublished Doctoral Dissertation. Washington: Washington University. Reported in Hoetker, J. and Ahlbrand, W. P. (1969). The persistence of the recitation. American Educational Research Journal, 6, 145-67.

Hurlock, Elizabeth B. (1925). An evaluation of certain incentives used in school work. Journal of Educational Psychology, 16, 145-59.

Kay, H. et al. (1968). Teaching Machines and Programmed Instruction. Middlesex: Penguin Books Ltd.

Keeling, B. (in press). Verbal Aptitude Tests. Christchurch: University of Canterbury.

Kleinman, Gladys S. (1966). Assessing teaching effectiveness: the state of the art. Science Education, 50, 234-8.

Lantz, D. L. and Medley, D. M. (1967). Classroom Application of Teacher Behaviour Research. A paper presented at the Annual Meeting of the American Educational Research Association, 1967.

La Shier, W.S. and Westmeyer, P. (1967). The use of interaction analysis in BSCS laboratory block classrooms. Journal of Teacher Education, 18, 439-46.

Lawrence, P. J. (1965). The Anatomy of Teaching. A paper presented to the Australian and New Zealand Association for the Advancement of Science, 1965.

Maccoby, N. et al. (1961). 'Further Studies of Student Participation Procedures in Film Instruction'. In Lumsdaine, A. A. ed. Student Response in Programmed Instruction. Washington: National Academy for Science: National Research Council, 295-325.

Medley, D. M. and Mitzel, H. E. (1959). Some behavioural correlates of teacher effectiveness. Journal of Educational Psychology, 50, 239-46.

Michael, D.N. and Maccoby, N. (1961). 'Factors Influencing the Effects of Student Participation on Verbal Learning from Films'. In Lumsdaine, A.A. ed. Student Response in Programmed Instruction. Washington: National Academy for Science: National Research Council, 271-293.

Mitzel, H. E. (1960). 'Teacher Effectiveness'. In Harris, C. W. ed. Encyclopedia of Educational Research (3rd ed) New York: Macmillan, 1481-1486.

Morrison, Betty M. (1966). The Reactions of Internal and External Children to Patterns of Teaching Behaviour. Unpublished Doctoral Dissertation. Michigan: University of Michigan Reported in Flanders (1970) and Flanders and Simon (1969).

Nelson, Lois N. (1964). The effect of classroom interaction on pupil linguistic performance. Dissertation Abstracts, 25, 1789.

New Zealand Department of Education (1954). Understanding the World. Wellington: New Zealand Department of Education.

New Zealand Forest Service (1968). Distribution of Game Mammals in New Zealand. Wellington: New Zealand Forest Service.

Nuthall, G.A. (1968). Types of research on teaching. New Zealand Journal of Educational Studies, 3, 125-47.

Penny, R.E. (1969). Presentational Behaviours Related to Success in Teaching. Unpublished Doctoral Dissertation. Stanford: Stanford University. Reported in Rosenshine (1970b).

Perkins, H.V. (1965). Classroom behaviour and underachievement. American Educational Research Journal, 2, 1-12.

Powell, E.R. (1968). Teacher Behaviour and Pupil Achievement. A paper presented at the Annual Meeting of the American Educational Research Association, 1968.

Rippey, R.M. (1966). A contrast between the teacher and materials. School Review, 74, 283-91.

Roberts, G. (1968). Game Animals in New Zealand. Wellington: A.H. and A.W. Reid.

Rosenbaum, M.E. (1962). Effect of direct and vicarious verbalization on retention. Child Development, 33, 103-10.

Rosenshine, B. (1969). Teaching behaviours related to pupil achievement. Classroom Interaction Newsletter, 5, 4-17.

Rosenshine, B. (1970a). Evaluation of classroom instruction. Review of Educational Research, 40, 279-300.

Rosenshine, B. (1970b). Teaching Behaviours and Student Achievement. Stockholm: International Association for the Evaluation of Educational Achievement (mimeo).

Rosenshine, B. and Furst, Norma (in press) 'Research on Teacher Performance Criteria'. In Smith, B.O. ed. Research on Teacher Education: A symposium. New Jersey: Prentice-Hall, Inc. 37-72.

Sandars, E. (1951). A Beast Book for the Pocket. Oxford: Oxford University Press.

Schantz, Betty, M.B. (1964). An experimental study comparing the effects of verbal recall by children in direct and indirect teaching methods as a tool of measurement. Dissertation Abstracts, 25, 1054.

Schulman, L.S. (1970). Reconstruction of educational research. Review of Educational Research, 40, 371-96.

Schirner, S.W. (1967). A Comparison of Student Outcomes in Various Earth Science Courses Taught by Seventeen Iowa Teachers. Unpublished Doctoral Dissertation. Iowa: University of Iowa. Reported in Evans (1970).

Sharp, G.S. (1966). A Study of Certain Teacher Characteristics and Behaviour as Factors Affecting Pupil Achievement in High School Biology. Unpublished Doctoral Dissertation. Columbia: University of South Carolina. Reported in Rosenshine (1970b).

Silberman, H.F. (1957). Effects of praise and reproof on reading growth in a non-laboratory classroom setting. Journal of Educational Psychology, 48, 199-206.

Simon, Anita and Boyer, E.G. eds. (1968). Mirrors for Behaviour: An Anthology of Classroom Observation Instruments. Philadelphia: Research for Better Schools.

Simon, Anita and Boyer, E.G. eds. (1970). Mirrors for Behaviour II: An Anthology of Classroom Observation Instruments. Philadelphia: Research for Better Schools.

Snider, R.M. (1966). A Project to Study the Nature of Physics Teaching Using the Flanders Method of Interaction Analysis. Unpublished Doctoral Dissertation. New York: Cornell University. Reported in Evans (1970), Flanders (1970) and Flanders and Simon (1969).

Soar, R.S. (1966). Teacher-Pupil Interaction and Pupil Growth. A paper presented at the Annual Meeting of the American Educational Research Association, 1966.

Soar, R.S. (1967). Pupil Growth Over Two Years in Relation to Differences in Classroom Process. A paper presented at the Annual Meeting of the American Educational Research Association, 1967.

Soar, R.S. (1968). Optimum teacher-pupil interaction for pupil growth. Educational Leadership, 26, 275-280.

Spaulding, R.L. (1965). Achievement, Creativity, and Self-Concept Correlates of Teacher-Pupil Transactions in Elementary Schools. Urbana: University of Illinois. Reported in Rosenshine (1970b).

Stolurow, L.M. (1965). 'Model the Master Teacher or Master the Teaching Model'. In Krumboltz, J.D. ed. Learning and the Educational Process. Chicago: Rand McNally and Co. 223-247.

Travers, R.M.W. et al. (1964). Learning as a consequence of the learner's task involvement under different conditions of feedback. Journal of Educational Psychology, 55, 167-73.

Turner, R. (1967). Pupil influence on teacher behaviour. Classroom Interaction Newsletter, 3, 5-8.

Van Wagenen, R.K. and Travers, R.M.W. (1963). Learning under conditions of direct and vicarious reinforcement. Journal of Educational Psychology, 54, 356-62.

Withall, J. (1949). The development of a technique for the measurement of social-emotional climate in classrooms. Journal of Experimental Education, 17, 347-361.

Wittrock, M. (1967). Focus on educational psychology. Educational Psychologist, 4, 17-20.

Wodzicki, K.A. (1950). Introduced Mammals of New Zealand: An Ecological and Economic Survey. Wellington: New Zealand Department of Scientific and Industrial Research.

Wright, C.J. (1968). An Analysis of Verbal Teaching Behaviour and its Relationship to Pupil Intelligence, Prior Knowledge, and Achievement in Standard Two Nature Study Lessons. Unpublished Master's Thesis, Christchurch: University of Canterbury.

Wright, C.J. and Nuthall, G.A. (1970). The relationships between teacher behaviours and pupil achievement in three experimental elementary science lessons. American Educational Research Journal, 7, 477-491

Yager, R.E. (1966). Teacher effects upon the outcomes of science instruction. Journal of Research in Science Teaching, 4, 236-42.

Zahorik, J.A. (1968). Classroom feedback behaviour of teachers. Journal of Educational Research, 62, 147-50.

Zahorik, J.A. (1969a). Teacher verbal feedback. Classroom Interaction Newsletter, 4, 34-41.

Zahorik, J.A. (1969b). Teacher Verbal Feedback and Content Development. A paper presented at the Annual Meeting of the American Educational Research Association, 1969.

APPENDIX A

THE FINAL LESSON PLANS AND PHOTOGRAPHS ILLUSTRATING THE MATERIALS USED IN THE LESSONS

DEFINITIONS OF TERMS USED IN THE LESSON NOTES

TEACHER STATES. This indicates that the teacher is to tell the pupils the information which follows. The term has been used only at the beginning of each lesson since all other teacher statements in the lessons follow on from teacher evaluations and so have been placed under the heading teacher evaluates.

TEACHER SOLICITS. This indicates that a pupil is to be asked to respond to the solicitation which follows. Generally solicitations were in the form of questions, but, in some cases, they required the pupil to respond to a command

TEACHER REPEATS. This indicates that the teacher is to repeat the pupil's response to the previous solicitation or redirection. Usually the pupil's response was repeated verbatim, although where a long response was given it was repeated in summary form. When a pupil was unable to give a response to a solicitation or redirection this was acknowledged with a statement such as, 'You're not quite sure?'

TEACHER REDIRECTS. This indicates that the teacher is to redirect the previous solicitation to another pupil. The actual wording of the redirection was governed by the previous pupil's response to the initial solicitation and the need to change the wording to avoid a stilted presentation. The following examples, which were the most frequently employed, illustrate the wordings used.
Is that right(correct), Bill?
Is he(John) right(correct), Bill?
Do you agree with that(John), Bill?
What do you think, Bill?
Could you help him(John) out please, Bill?
Could you tell us the answer please, Bill?
The last two forms were used only where the previous pupil asked to respond had been unable to offer an answer.

TEACHER EVALUATES. This indicates that the teacher is to evaluate the responses to the previous redirection and/or solicitation. Except in experiment four the evaluation was limited to simple knowledge of results using one of the following forms:

You were both right.
Bill was right.
You were both almost right.
Bill was almost right.
You were both wrong.
Statements of praise or criticism were carefully avoided. In experiment four the evaluation was made as previously described on p. 80-2.

TEACHER THANKS. This indicates that the teacher is to thank the pupil for his response. The thanking was done in a perfunctory manner and could not have been considered as praise. The only exception was in experiment four where it was intended that some pupils should be praised and then the thanking was effusive going far beyond the single thankyou given in the other experiments.

The lessons were divided into incidents by the blue lines and all materials used in the lessons were underlined in red. This served to facilitate the presentation of the lessons by enabling the writer to find the place when it was necessary to check on the wording of the lessons and by indicating clearly when new materials were required.

Teacher States. Well, today we're going to have the first of three lessons about two animals found in the South Island. These animals are the red deer and the tahr. You'll remember that I gave you a short test about the red deer and the tahr last time I was here to see what you knew about them.

Now, because I don't know your names I've got some name cards here which will help me to know who I'm talking to. These cards have your christian name on them, although where two people in the class have the same christian name the surname has also been put on the card. When you get your card fold it like this (demonstrate) and stand it on your desk, without talking. At the same time clear your desk of anything else that might be on it because you won't need anything other than the name cards for this lesson. When you've finished sit up straight so that I can tell you're ready to go on. (Get four children, two boys and two girls, to give out the name cards.)

As you can see I've got a tape recorder with me so that I can record everything we cover, but if this recording is to be any use to me it needs to be a good one. Now there are two ways in which you can help make this recording a good one. Firstly, when you answer a question speak up clearly, so that the tape can record you clearly, and secondly, make sure that you don't shuffle around and scrape your chairs, whisper to the person next door to you and so on, because if you do those little microphones up there (point) will pick it all up and I won't be able to hear what the person who's speaking is saying when I play the tape back.

Now we've got a lot of work to cover today, and in the other lessons, and I think that any questions you may have will probably be answered later on in this lesson, or in the other lessons, so we won't have any questions from you today, or in the other lessons. However, if you've got anything you want to know about, which I don't cover in the lessons, you can write it down on a piece of paper and after the lessons are finished I'll take some time out to answer your questions. So remember no questions from you today, or in the other lessons.

Don't talk to other people in other rooms about what we're doing in these lessons, because I'll be taking the lessons with some other classes in the school and if you talk to friends in these classes about the lessons you may spoil it for them.

(For experiment one, random responding: experiment three, lesson treatment: experiment four: say)

There will be no need for you to put your hands up when I ask a question, because I'll be asking you whether you've got your hand up or not. I've got a little tin here with your names in and when I want to ask someone a question I'll just take one of the names out of the tin and ask that person. You will all have an equal number of turns and you won't know when your next turn is coming.

(For experiment one, systematic responding: say)

There will be no need for you to put your hands up when I ask a question, because I'll be asking you whether you've got your hand up or not. I'll start at the back of the room, on the left hand side, and move across to the front right hand side of the room. You'll all have an equal number of turns and you'll know when your next turn is coming.

(For experiment one self-selected responding: say)

Put your hand up if you want to give me the answer to a question. I won't be asking anyone who hasn't got his or her hand up, so if you don't put your hand up you won't be asked anything.

(For experiment two: say)

There will be no need for you to put your hands up when I ask a question because I'll be asking you whether you've got your hand up or not. I've got a little tin here with some of your names in and when I want to ask a question I'll just take one of the names out of the tin and ask that person. Now I haven't got all your names in the tin and so some of you won't be asked any questions while some others will be asked a lot.

Teacher States.	You've already been told the names of the animals you'll be learning about and one of them is the red deer.
CARD AH 1	
	There are actually eight members of the deer family, or eight deer species, found in New Zealand and their names are on this card here. They are the rusa deer, the sambar deer, the sika deer, the fallow deer, the whitetail deer, which is sometimes called the Virginia deer, the wapiti, which is sometimes called the American elk, the moose, some of you probably didn't know that but we've got moose here, and the red deer. Of these the last five, the ones in green, are found in the South Island. So you can see it's not much use talking about 'deer' - you need to say which deer you mean.
Teacher Solicits.	WHICH DEER ARE WE GOING TO LEARN ABOUT?
Teacher Repeats.	
Teacher Evaluates.	The red deer.
Teacher Solicits.	WHAT'S THE NAME OF THE OTHER ANIMAL WE'LL BE LEARNING ABOUT?
Teacher Repeats.	
Teacher Evaluates.	The tahr.
CARD AQ 1	
	Now you will find that the tahr is a very interesting animal. One of the interesting things about it is that you may spell its name in three different ways. You may also pronounce it two different ways.
Teacher Solicits.	SPELL TAHR AS IT'S WRITTEN AT THE TOP OF THE CARD.
Teacher Repeats.	
Teacher Evaluates.	T-a-h-r. This is how we will spell it in these lessons.

Teacher Solicits.	SPELL TAHR AS IT'S WRITTEN IN THE MIDDLE OF THE CARD.
Teacher Repeats.	
Teacher Evaluates.	T-h-a-r
Teacher Solicits.	SPELL TAHR AS IT'S WRITTEN AT THE BOTTOM OF THE CARD.
Teacher Repeats.	
Teacher Evaluates.	T-h-a-a-r. Because we'll be spelling tahr t-a-h-r and not t-h-a-r or t-h-a-a-r a cross has been put through the bottom two spellings. This doesn't mean to say it's wrong to spell tahr like this, just that we'll be spelling it the other way.
CARD AQ 1R	We'll pronounce the word 'tar' as at the top of the card, but it may also be pronounced 'thar' as at the bottom of the card. Because we will pronounce it 'tar' and not 'thar' a cross has been put through 'thar' at the bottom of the card. The red deer and the tahr are both exotic, feral animals.
CARD AQ 2	
Teacher Solicits.	WHAT DOES EXOTIC MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD AQ 2R	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	Exotic means introduced from abroad, as you can see on the back of the card. Any animal which is not a native animal, and lives here, is an exotic animal. Any mammal in New Zealand (except the native bat which is the only native mammal we have here, if we don't count the sea mammals like the seal and the whale) and most of the birds found around our cities are exotic, because they were introduced from abroad.

CARD AQ 3

Teacher Solicits.	WHAT DOES FERAL MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

CARD AQ 3R

Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	Feral means wild or undomesticated, as you can see on the back of this card. There are a number of feral mammals in New Zealand, for example; the wild pig, the opossum, the hedgehog, the rabbit, the hare, and so on, and almost all the birds, except fowls and budgies and birds like that, are also feral or wild.

CARDS AF 1, AF 2, AF 3

(While putting up ask the following questions.)

Teacher Solicits.	WHAT IS THE WORD WHICH MEANS INTRODUCED FROM ABROAD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Exotic means introduced from abroad.

Teacher Solicits.	WHAT'S A WORD WHICH MEANS WILD OR UNDOMESTICATED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Feral means wild or undomesticated.

Teacher Solicits.	WHAT ARE THE ANIMALS IN THESE PICTURES HERE RED DEER OR TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	They're red deer.
	Well in a few minutes we'll look more closely at these red deer, but we know that the red deer was introduced to the South Island, because we know that it's an exotic animal, so we'd better find out which part of the world the red deer is a native of, and which part of the world it was introduced to the South Island from.

CARD AH 2

Teacher Solicits.	WHAT DO WE CALL THE PART OF THE WORLD SHOWN IN THIS MAP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The map is a map of Europe, and the red deer is a native of Europe.
Teacher Solicits.	WHAT IS THE NAME OF THE COUNTRY HERE (POINT TO ENGLAND) ?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The country is England, and the red deer in the South Island were introduced from England.

In 1851 one male and one female red deer were liberated near Nelson, after being brought here by ship from England. However, the female was shot not long afterwards and so they did not breed. And then in 1861, two female and one male red deer

	were brought out from England and again liberated near Nelson and this time they bred and established themselves, and so the first successful liberation was in 1861.
	Well we've mentioned the male red deer and the female red deer, so we'd better find out the names we give to the male, female, and young red deer, and some of the characteristics which they have. Look at our pictures for a moment.
Teacher Solicits.	WHICH OF THESE ANIMALS IS THE MALE RED DEER - THE ONE ON THE LEFT, THE ONE IN THE MIDDLE OR THE ONE ON THE RIGHT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The animal on the left is the male red deer.
Teacher Solicits.	HOW CAN YOU TELL IT'S A MALE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	You can tell that the animal on the left is the male red deer because it's got antlers on its head. The female red deer doesn't have antlers, as you can see in the middle picture.
CARD AQ 4	
	Here's the word - antlers.
Teacher Solicits.	WHAT DO WE CALL A MALE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A male red deer is called a stag.

CARD AQ 5

	Here's the word - stag.
Teacher Solicits.	WHAT DO WE CALL A FEMALE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A female red deer is called a hind.

CARD AQ 6

	Here's the word - hind. The animal on the right in the pictures is a young red deer.
Teacher Solicits.	WHAT DO WE CALL A YOUNG RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A young red deer is called a fawn.

CARD AQ 7

	Here's the word - fawn.
Teacher Solicits.	WHAT DO YOU NOTICE ABOUT THE FAWN'S COAT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The fawn's coat is spotted until it's about three months old and then it loses its spots.

Now the stag is roughly the same shape and size as a horse. He weighs about 300 pounds, which gives you some idea of how big he is. The hind is smaller and lighter and would weigh about 200 pounds, or about two-thirds of the stag's weight. The

	difference in size can be a help in telling a stag from a hind around October. Each October the stag loses his antlers and begins to grow a new set, and while these new antlers are growing the stag is without antlers just like the hind. However, his size gives us a clue that he's a stag and not a hind. The stag also has a short mane around his neck, which is hard to see in our pictures because of the way he's standing, and this also helps to tell him from a hind.
Teacher Solicits.	ABOUT HOW BIG IS THE STAG'S TAIL?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer, both stags and hinds, have a short stumpy tail about six inches long.
Teacher Solicits.	WHAT DO YOU NOTICE ABOUT THE COLOUR OF THE STAG'S RUMP AROUND THE TAIL?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer, both stags and hinds have a light coloured rump patch.

CARDS AF 4, AF 5, AF 6.

(While putting up ask the following questions)

Teacher Solicits.	WHICH COUNTRY WERE THE RED DEER IN THE SOUTH ISLAND INTRODUCED FROM?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer in the South Island were introduced from England.

Teacher Solicits.	WHICH PART OF THE WORLD IS THE RED DEER A NATIVE OF?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer is a native of Europe.
Teacher Solicits.	WHAT ARE THE ANIMALS IN THESE PICTURES WHICH I'VE JUST PUT UP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	They're tahr. These pictures show the tahr, so if you haven't seen a tahr, or a picture of a tahr before, you'll now have some idea of what they are like. The tahr is exotic so we'd better see where it comes from.

CARD AH 3

Teacher Solicits.	WHAT IS THE NAME OF THE COUNTRY IN THIS MAP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The map is a map of India.
Teacher Solicits.	WHAT IS THE VERY HIGH RANGE OF MOUNTAINS COLOURED IN IN ORANGE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The mountains are the Himalayan Mountains,and the tahr is a native of the Himalayan Mountains in Northern India. Shortly before this century some tahr were taken to England from the Himalayan Mountains, and they were kept in a park for wild animals there. In 1904 three male

	and three female tahr were shipped to New Zealand from this park in England. On the way one of the males jumped overboard and drowned, but the others all arrived safely and were liberated near Mount Cook, where they became established. So the first successful liberation of the tahr in the South Island was in 1904, and surprisingly enough the animals actually came from England, although they were originally taken there from the Himalayan Mountains in Northern India.
Teacher Solicits.	WHICH OF THE TAHR PICTURES SHOWS THE MALE TAHR - THE ONE ON THE LEFT, THE ONE ON THE RIGHT OR THE ONE IN THE MIDDLE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr on the right is the male tahr and he has the same name as a very large animal with horns found on our farms.
Teacher Solicits.	WHAT DO WE CALL THE MALE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The male tahr is called a bull.
CARD AQ 8	
	There it is - bull.
Teacher Solicits.	HOW CAN YOU TELL A STAG FROM A HIND MOST EASILY EXCEPT AROUND OCTOBER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Except around October we can tell a stag from a hind most easily by his antlers. Now the bull tahr hasn't got antlers.

Teacher Solicits.	WHAT'S HE GOT INSTEAD OF ANTLERS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Instead of having antlers like the stag the bull tahr has horns.
Teacher Solicits.	DOES THE FEMALE TAHR HAVE HORNS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Both the bull tahr and the female tahr have horns, so we can't tell a bull from a female by looking to see which has horns and which hasn't. However, the bull tahr has something around his neck, which the female tahr hasn't got around her neck, and we can use this to distinguish one from the other.
Teacher Solicits.	WHAT IS IT THAT THE BULL TAHR'S GOT AROUND HIS NECK?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bull tahr's got a mane around his neck while the female hasn't.
CARD AQ 9	
	This mane has a special name which is written on this card here.
Teacher Solicits.	WHAT DO WE CALL THE BULL TAHR'S MANE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bull tahr's mane is called a ruff.

	Now the female tahr and the young tahr have the same names as the female goat and the young goat.
Teacher Solicits.	WHAT DO WE CALL A FEMALE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The female tahr is called a nanny.
CARD AQ 10	
	Here's the word - nanny.
Teacher Solicitis.	WHAT DO WE CALL THE YOUNG TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The young tahr is called a kid.
CARD AQ 11	
	Here's the word - kid.
	The bull tahr is not as big as the stag. In shape and size he's a bit like a large goat with long hair, and he weighs about 200 pounds which is as much as the hind weighs. The nanny tahr is smaller and lighter than the bull. She weighs less than half his weight - about 80 pounds, and as you can see in the picture she looks very much like a goat. It's no wonder that the tahr looks like a goat because it's a member of the goat family, and it's sometimes called the Himalayan Mountain Goat.
Teacher Solicits.	WHY DO YOU THINK IT IS CALLED THAT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr's sometimes called the Himalayan Mountain Goat because it's a member of the goat family and it's a native of the Himalayan Mountains.

Now the tahr doesn't lose its horns each year, but they keep growing throughout life. Each year a new piece is added and that makes a ring on the horn. By counting these rings you can see how old the tahr is.

CARD AQ 12

Teacher Solicits.	HOW OLD IS THIS TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	This tahr is eleven years old. You can't tell how old a stag is from his antlers because the size of his antlers depends on a number of things, such as the feed he's getting, and they may be smaller this year than they were last year.

CARD AQ 13

Teacher Solicits.	WHAT DOES HABITAT MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

CARD AQ 13R

Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	Habitat means the area in which an animal lives.

Teacher Solicits.	WHAT DOES FERAL MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Feral means wild or undomesticated. Now if the red deer and the tahr are feral or undomesticated they won't live on farms, so let's find out what their habitats in the South Island are.

REMOVE CARDS AF 3, AF 4.

CARDS AF 7, AF 8, AF 9.

(While putting up ask the following questions)

Teacher Solicits.	ABOUT HOW MANY POUNDS DOES THE BULL TAHR WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bull tahr weighs about 200 pounds.
Teacher Solicits.	ABOUT HOW MANY POUNDS DOES THE NANNY TAHR WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The nanny tahr weighs about 80 pounds.
Teacher Solicits.	IN WHICH YEAR WAS THE TAHR FIRST INTRODUCED TO THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr was first introduced to the South Island in 1904.
	Now the three maps show, on the left, the tahr's habitat in the South Island, on the right, the red deer's habitat in the South Island, and the map in the middle shows the height of the land in the South Island.

Teacher Solicits.	WHAT DO WE CALL A MAP WHICH SHOWS THE HEIGHT OF THE LAND IN A COUNTRY?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A map which shows the height of the land in a country is called a relief map. Relief map is written at the top of the middle map. Look at the relief map for a moment.
Teacher Solicits.	WHAT COLOUR IS THE LAND ABOVE 6,000 FEET ON THE RELIEF MAP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The land above 6,000 feet has been coloured blue.
Teacher Solicits.	WHAT COLOUR IS THE LAND BELOW 1,200 FEET ON THE RELIEF MAP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The land below 1,200 feet has been coloured green.
Teacher Solicits.	WHAT COLOUR IS THE LAND ABOVE 1,200 FEET BUT BELOW 6,000 FEET ON THE RELIEF MAP?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The land between 1,200 feet and 6,000 feet is white.

	Now let's have a look at the map of the red deer's habitat which is the one on the right.
Teacher Solicits.	IS THE RED DEER FOUND ON THE LAND BELOW 1,200 FEET GENERALLY SPEAKING?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer isn't usually found on the land below 1,200 feet. Now there's one other area on the map where the red deer isn't found.
Teacher Solicits.	WHAT IS THIS LAND LIKE IN TERMS OF ITS HEIGHT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer isn't found on the high mountains above 6,000 feet. So generally speaking the red deer, in the South Island, is found between 1,200 and 6,000 feet. Look at the map of the tahr's habitat which is the map on the left.
Teacher Solicits.	WHAT HEIGHT IS THE LAND ON WHICH THE TAHR IS FOUND GENERALLY SPEAKING?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Generally speaking we can say that the tahr is found in the high areas of the South Island above about 5,000 feet.

	Now we learnt before that the red deer and the tahr are exotic or introduced animals.
<u>REMOVE CARD AF 8</u>	
<u>CARD AF 10</u>	
Teacher Solicits.	READ PRINCIPLE ONE FOR US.
Teacher Thanks.	
Teacher Redirects.	
Teacher Thanks.	Man always has reasons for introducing animals to countries in which they are not naturally found. Let's see why the red deer and the tahr were introduced to the South Island.
Teacher Solicits.	HANDS UP THOSE OF YOU WHOSE FATHER OR OLDER BROTHER HAS A RIFLE AT HOME.
Teacher Evaluates.	
Teacher Solicits.	GIVE ONE REASON FOR THE INTRODUCTION OF THE RED DEER AND THE TAHR TO THE SOUTH ISLAND.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer and the tahr were introduced to the South Island for shooting, and shooting is a sport, so they were introduced for sport. Sport was the only reason for the introduction of the tahr, but the red deer was also introduced for two other reasons.

Teacher Solicits.	WHAT IS THE MEAT FROM THE RED DEER CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer meat is called venison.
CARD AQ 14	
	Here's the word - venison.
Teacher Solicits.	GIVE A SECOND REASON FOR THE INTRODUCTION OF THE RED DEER TO THE SOUTH ISLAND.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer was introduced to the South Island for meat or venison, as well as for sport.
SKINS	
	These skins will help you to get the third reason.
Teacher Solicits.	GIVE THE THIRD REASON FOR THE INTRODUCTION OF THE RED DEER TO THE SOUTH ISLAND.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer were introduced for their skins which are used to make all kinds of leather goods. Today both the red deer and the tahr are used for all three purposes. We hunt them for sport, we export the meat and skins from both animals, and we also use their meat and skins here ourselves.

Teacher Solicits.	NAME AS MANY OF THE DEER SPECIES FOUND IN NEW ZEALAND AS YOU CAN.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The eight deer species found in the country are the red deer, the fallow deer, the rusa deer, the sika deer, the sambar deer, the whitetail or Virginia deer, the wapiti or American elk, and the moose.
Teacher Solicits.	HOW MANY OF THESE SPECIES ARE FOUND IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	There are five deer species in the South Island.
Teacher Solicits.	WHAT DO WE CALL THE TAHR'S MANE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr's mane is called a ruff.
Teacher Solicits.	HOW MANY WAYS MAY YOU PRONOUNCE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Tahr may be pronounced two ways.

Teacher Solicits.	ABOUT HOW MUCH DOES THE STAG WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The stag weighs about 300 pounds.
Teacher Solicits.	ABOUT HOW MANY POUNDS DOES THE HIND WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The hind weighs about 200 pounds.
Teacher Solicits.	ABOUT HOW MANY POUNDS DOES THE NANNY TAHR WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The nanny tahr weighs about 80 pounds.
Teacher Solicits.	ABOUT HOW MANY POUNDS DOES THE BULL TAHR WEIGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bull tahr weighs about 200 pounds.
Teacher Solicits.	DURING WHICH MONTH DOES THE STAG LOSE HIS ANTLERS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The stag loses his antlers in October.

Teacher Solicits.	IN WHICH YEAR WAS THE RED DEER FIRST INTRODUCED TO THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer was first introduced to the South Island in 1851.
Teacher Solicits.	HOW MANY MALE RED DEER WERE LIBERATED IN THE FIRST LIBERATION OF RED DEER IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	One male and one female red deer were liberated in the first liberation in the South Island.
Teacher Solicits.	IN WHICH YEAR WAS THE FIRST SUCCESSFUL LIBERATION OF RED DEER IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The first successful liberation of red deer in the South Island was in 1861.
Teacher Solicits.	HOW MANY FEMALE RED DEER WERE LIBERATED IN THE FIRST SUCCESSFUL LIBERATION OF RED DEER IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Two female and one male red deer were liberated in the first successful liberation of red deer in the South Island.

Teacher Solicits.	HOW MANY FEMALE TAHR WERE LIBERATED IN THE SOUTH ISLAND IN THE FIRST LIBERATION IN 1904?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Three female and two male tahr were liberated in the first liberation of tahr in the South Island.
Teacher Solicits.	THE RED DEER IS SELDOM FOUND BELOW ABOUT HOW MANY FEET?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer is seldom found below about 1,200 feet or above 6,000 feet.
	Well that's all we'll have time for today. Keep your name cards in your desk where you can find them easily for the next lesson. Just wait quietly until Mr. etc. tells you what to go on with.

CARDS BF 1, BF 2, BF 3, BF 4, BF 5, BF 6, BF 7.

Teacher States.	Today we're going to have the second lesson about the red deer and the tahr. Take out your name cards and put them on your desk.
	Remember to speak up clearly so that the tape can record you clearly. When I played the tape back after the first lesson some of you were a little bit hard to hear, so see if you can speak up clearly today. Also, be sure not to make any extra noise by shuffling around or whispering to the person next to you.
Teacher Solicits.	NAME AS MANY OF THE DEER SPECIES FOUND IN NEW ZEALAND AS YOU CAN.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The sika deer, the sambar deer, the rusa deer, the fallow deer, the whitetail or Virginia deer, the wapiti or American elk, the moose, and the red deer.
Teacher Solicits.	WHY DID THE FIRST LIBERATION OF RED DEER IN THE SOUTH ISLAND FAIL?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The first liberation of red deer in the South Island failed because the hind was shot.
	We've already found out what the red deer's habitat in the South Island is like and what the tahr's habitat in the South Island is like, so we'd better find out what the environments would be like in these habitats.

CARD BQ 1

Teacher Solicits.	WHAT DOES ENVIRONMENT MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

CARD BQ 1R

Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	Environment means the conditions in which an animal lives.
Teacher Solicits.	WOULD IT BE VERY COLD IN THE TAHR'S ENVIRONMENT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr lives in a very cold environment, as you can tell from all the snow in the background of our pictures, and of course we have already learnt that the tahr lives high up in the mountains where it's cold.
Teacher Solicits.	WOULD THE RED DEER'S ENVIRONMENT BE AS COLD AS THE TAHR'S ENVIRONMENT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr's environment is colder that the red deer's, but the red deer still lives in a fairly cold environment, as you can see from the snow up on the tops of the mountains in our pictures.
Teacher Solicits.	READ PRINCIPLE TWO ON THIS CARD (POINT) FOR US.
Teacher Thanks.	
Teacher Redirects.	
Teacher Thanks.	Principle two states that animals have bodies which suit them to their environments and help them to survive in those environments.
Teacher Solicits.	WHAT SORT OF SKIN OR COAT WOULD A RED DEER OR A TAHR NEED IF IT WERE TO BE SUITED TO THE COLD CONDITIONS IN WHICH IT LIVES?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

Teacher Evaluates.	If principle two is true we would expect the red deer and the tahr to have warm skins or coats.
SKINS	Well, I've got a red deer skin and a tahr skin here (hold up). If you look closely at these two skins you'll see that they are both fairly warm, which supports principle two.
Teacher Solicits.	WHICH ANIMAL WOULD HAVE THE WARMER COAT, THE RED DEER OR THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	We would expect the tahr to have a warmer coat than the red deer.
Teacher Solicits.	WHY WOULD WE EXPECT THE TAHR TO HAVE A WARMER COAT THAN THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	We would expect the tahr to have a warmer coat than the red deer because it lives in a colder environment.
Teacher Solicits.	WHICH OF THESE TWO SKINS IS THE TAHR SKIN - THE ONE ON THE LEFT OR THE ONE ON THE RIGHT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The skin on the left is the tahr skin. The skin on the left has the longer hair, and it also has very fine wool next to the skin. I'll bring it round so that you can see it. (Take the skin around and point to the wool and say 'There it is in there'.)

Teacher Solicits.	IS THE TEMPERATURE THE SAME ALL THE YEAR ROUND OR DOES IT CHANGE WITH THE SEASONS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The temperature varies with the seasons. Principle two tells us that animals have bodies which suit them to their environments and help them to survive in those environments.
Teacher Solicits.	DO YOU THINK THE RED DEER AND THE TAHR WILL HAVE COATS WHICH ARE OF THE SAME WARMTH ALL YEAR ROUND OR WOULD YOU EXPECT THEM TO VARY WITH THE SEASONS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	We would expect the coats to vary with the seasons.
Teacher Solicits.	DURING WHICH SEASON WOULD YOU EXPECT THE TAHR TO HAVE THE WARMEST COAT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	We would expect the tahr to have its thickest coat in winter when the weather is coldest, and this is what we find.

	Another example of principle two is that the red deer and the tahr are both ruminants.
CARD BQ 2	
	Here's the word - ruminant. The cow is a ruminant and we say she chews something.
Teacher Solicits.	WHAT IS IT THAT THE COW CHEWS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The cow chews the cud.
Teacher Solicits.	WHAT IS A RUMINANT THEN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD BQ 2R	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	A ruminant is an animal which chews the cud.
CARD BQ 3	
Teacher Solicits.	WHAT IS THIS CUD WHICH A RUMINANT CHEWS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD BQ 3R	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	The cud is a ball of regurgitated food.

CARD BQ 4

Teacher Solicits.	WHAT DOES THIS WORD REGURGITATE MEAN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

CARD BQ 4R

Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	Regurgitate means to bring food from the stomach to the mouth. Actually, it's not quite as simple as this because a ruminant has more than one part to its stomach.

REMOVE CARD BF 7

I've got a big card here to show you this.

CARD BF 8

This diagram shows what a ruminant's stomach is actually like.

Teacher Solicits.	HOW MANY PARTS ARE THERE ALTOGETHER IN A RUMINANT'S STOMACH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	There are four parts to a ruminant's stomach. When a ruminant collects its food it swallows it without chewing it, and it passes into the largest part of the stomach where it's stored. The large black arrow shows what happens.

Teacher Solicits.	WHAT IS THE NAME OF THE PART OF THE STOMACH IN WHICH A RUMINANT STORES ITS FOOD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The unchewed food passes into the paunch when the ruminant swallows it and it is here that it is stored. When the paunch is full the animal goes to a safe place to digest the stored food. The food in the paunch passes into the second part of the stomach, a little at a time, and here it is made into cud. The small black arrow shows what happens.
Teacher Solicits.	WHAT IS THE SECOND PART OF THE STOMACH CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The second part of a ruminant's stomach is called the honeycomb, and it's here that the stored food is made into cud. The cud is then regurgitated and, as the orange arrow shows, it passes back up into the mouth.
Teacher Solicits.	IS THE FOOD CHEWED OR NOT AT THIS STAGE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The cud is a ball of unchewed food.
	When the cud gets to the mouth the animal chews it up thoroughly and swallows it for the second time, and it goes down into the third part of the stomach. The blue arrow shows what happens.

Teacher Solicits.	WHAT IS THE THIRD PART OF A RUMINANT'S STOMACH CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The third part of a ruminant's stomach is called the manyplies. From the manyplies the food passes into the fourth part of the stomach, and down through the rest of the system and is digested.
Teacher Solicits.	WHAT IS THE FOURTH PART OF THE STOMACH CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The fourth part of the stomach is called the belly.
	Now ruminants are plant eating animals.
CARD BQ 5	
Teacher Solicits.	WHAT DO WE CALL A PLANT EATING ANIMAL?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD BQ 5R	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	A plant eating animal is called a herbivor. Herbivors eat a large volume of food in a day, when compared with meat eating animals of equal size, because plants are a less concentrated food than meat. The exact amount red deer and tahr eat in a day is not known, but the cow eats about 150 pounds of grass each day which is a lot of food.

Teacher Solicits.	IF A RUMINANT HAD TO CHEW EVERY MOUTHFUL OF THIS LARGE VOLUME OF FOOD AS IT COLLECTED IT, WOULD IT TAKE A LONG TIME TO GATHER IT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	If ruminants had to chew every mouthful of their food before they swallowed it they would take a long time to gather it. Because they don't have to chew every mouthful as they collect it, they are able to gather it in a fairly short time.
Teacher Solicits.	WHAT WAS THE REASON FOR THE INTRODUCTION OF BOTH THE RED DEER AND THE TAHR TO THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer and the tahr were both introduced to the South Island because they can be hunted for sport. Back in the countries they came from they were not only hunted by men, but also by other animals.
CARD BQ 6	There's a special word for an animal which hunts or preys upon other animals.
Teacher Solicits.	WHAT IS THIS WORD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD BQ 6R	
Teacher Solicits.	READ THE CARD.

Teacher Evaluates.	An animal which hunts or preys upon other animals is a predator. While we don't usually call man a predator, we will in these lessons, because man hunts the red deer and the tahr.

REMOVE CARD BF 8

CARD BF 7

Teacher Solicits.	READ PRINCIPLE TWO.
Teacher Thanks.	
Teacher Redirects.	
Teacher Thanks.	Animals have bodies which suit them to their environments and help them to survive in those environments. Now we have all the facts to apply our principle to. The red deer and the tahr have predators in their environments which they must escape from if they're to survive. They are both herbivors, which means that they need to collect a lot of food to give them the energy they need, and they are both ruminants, which means that they can collect their food quickly because they don't have to chew it as they collect it.

Teacher Solicits.	EXPLAIN HOW BEING RUMINANTS MIGHT HELP THE RED DEER AND THE TAHR TO KEEP OUT OF THEIR PREDATOR'S WAY AND SO HELP THEM TO SURVIVE.
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

Teacher Evaluates.	This is in fact what happens. The red deer and the tahr come out early in the morning and in the evening and collect their food and store it in the paunch. Then they go away to a safe place and hide, regurgitate the food, chew it and digest it. During the time they're hiding they're out of the way of their predators and therefore they are more likely to survive. Of course you can see how this illustrates principle two very nicely. Now let's have a look at another example of principle two.
Teacher Solicits.	WHAT ARE THE THREE SENSES WHICH AN ANIMAL CAN USE TO DETECT ITS PREDATORS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	An animal can use smell, hearing, and sight to detect its predators.
	Principle two states that animals have bodies which suit them to their environments and help them to survive in those environments.
Teacher Solicits.	BEARING IN MIND PRINCIPLE TWO DO YOU THINK THE RED DEER AND THE TAHR WOULD HAVE GOOD SENSES?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Both the red deer and the tahr live in environments in which there are predators they need to detect, and so we would expect them to have good senses, which they both have. Now while it's true that the red deer and the tahr have very good senses, it's also true that each animal uses one sense more than the others in detecting its predators.

Teacher Solicits.	DO YOU THINK THE RED DEER AND THE TAHR WOULD USE THE SAME SENSE AS THEIR MOST IMPORTANT SENSE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer and tahr rely on different senses as their most important sense.
Teacher Solicits.	WHY SHOULD THIS BE SO?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer and tahr live in different environments, and they rely most on the sense which works best in their particular environment. Let's see which sense the red deer relies on most. Look at our pictures of the red deer.
Teacher Solicits.	IS THERE MUCH BUSH IN THE RED DEER'S ENVIRONMENT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	There's a lot of bush in the red deer's environment.
Teacher Solicits.	WOULD THE SENSE OF SIGHT BE VERY USEFUL IN DETECTING PREDATORS IN THE BUSH IN WHICH THE RED DEER LIVES?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

Teacher Evaluates.	Because the bush provides cover behind which a predator could hide, the sense of sight is not as effective in bushy country as it is in open country, where the view is not obstructed. We would not expect the red deer to rely most on its sense of sight, and this is exactly what we find.
Teacher Solicits.	WHICH WOULD BE MORE IMPORTANT IN DETECTING APPROACHING PREDATORS, THE ABILITY TO SEE COLOUR, OR THE ABILITY TO SEE MOVEMENT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The ability to see movement is more important in detecting predators than is the ability to see colour. If you think of the T.V., which is in black and white, you'll realize that we can get along without colour vision quite well. The red deer is colour blind but it's very good at seeing movement. Generally speaking the red deer's sense of sight is about as good as our own. Look at our pictures of the red deer again.
Teacher Solicits.	ARE THERE ANY RIVERS AND STREAMS IN THE RED DEER'S ENVIRONMENT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	There are rivers and streams in the red deer's environment which make a lot of noise because they are fast flowing. It's also fairly easy to walk silently in the bush because of the moss on the ground and because the trees absorb the noise.

Teacher Solicits.	WOULD YOU EXPECT THE RED DEER TO RELY ON ITS SENSE OF HEARING AS ITS MOST IMPORTANT SENSE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	We would not expect the red deer to rely on its sense of hearing, as its most important sense, because of the rivers and streams, moss, and trees, and this is what we find.
Teacher Solicits.	WHICH SENSE DOES THE RED DEER RELY ON AS ITS MOST IMPORTANT SENSE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The sense of smell is the red deer's most important sense. While an animal can move fairly silently through the bush without being seen it cannot cover up its scent. The red deer's sense of smell is very well developed and some people have suggested that it's 100 times as good as our own.
Teacher Solicits.	WHAT IS THE TAHR'S ENVIRONMENT LIKE, OPEN OR BUSH COVERED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr lives in an open environment.

Teacher Solicits.	WHICH SENSE WOULD BE THE MOST USEFUL TO THE TAHR IN AN ENVIRONMENT LIKE THIS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The sense of sight is the most useful in an open environment, and this is the sense which the tahr relies on mostly. The tahr has a very well developed sense of sight, and, while they are not as well developed as its sense of sight, the tahr's sense of smell and sense of hearing are good too.
	What we've learnt about the senses of the red deer and the tahr illustrates principle two very well - animals have bodies which suit them to their environments and help them to survive in those environments.
	A fourth example of principle two is that the red deer and the tahr are both ungulates.
CARD BQ 7	
	Here's the word - ungulate.
REMOVE CARD BF 7	
CARD BF 9	
	This drawing of a man's leg, a tahr's leg, and a red deer's leg will help you to work out what an ungulate is. The important part of the leg has been circled in orange.
Teacher Solicits.	WHAT DO YOU CALL THE PART OF THE MAN'S LEG WHICH HAS BEEN CIRCLED IN ORANGE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The man's foot has been circled.

Teacher Solicits.	WHAT DO YOU CALL THE PART OF THE RED DEER'S LEG WHICH HAS BEEN CIRCLED IN ORANGE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer's hoof has been circled in orange. Both the red deer and the tahr are ungulates while man is not.
Teacher Solicits.	WHAT IS AN UNGULATE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD BQ 7R	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	An ungulate is a hoofed animal. Principle two tells us that being ungulates should help the red deer and the tahr to survive, so let's see how it does. We'll deal with each animal separately because each is helped in a slightly different way.
CARDS BH 1, BH 2.	
	This is a drawing of a man's leg showing the bones, and a red deer's leg also showing the bones. The two lines running across the drawings divide the legs up into three parts.
Teacher Solicits.	WHICH PART OF THE MAN'S LEG DOES THE TOP LINE RUN THROUGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The top line runs through the man's knee.

Teacher Solicits.	WHICH PART OF THE MAN'S LEG DOES THE BOTTOM LINE RUN THROUGH?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bottom line runs through the man's ankle.
Teacher Solicits.	WHAT IS THE PART OF THE RED DEER'S LEG THAT THE TOP LINE RUNS THROUGH EQUIVALENT TO ON THE MAN'S LEG?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The top line runs through the equivalent of the man's knee.
Teacher Solicits.	WHAT IS THE PART OF THE RED DEER'S LEG THAT THE BOTTOM LINE RUNS THROUGH EQUIVALENT TO ON THE MAN'S LEG?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The bottom line runs through the equivalent of the man's ankle. You can see that the lines divide the legs up into equivalent parts.
Teacher Solicits.	WHAT IS THE PART OF THE RED DEER'S LEG BELOW THE BOTTOM LINE, EQUIVALENT TO ON THE MAN'S LEG?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	It's equivalent to the man's foot. Man stands flat on his foot while the red deer stands on the tips of its toes. By tipping on to the tips of its toes the red deer has a longer leg than it would otherwise have. You'll probably have noticed that sprinters at the Olympic Games have fairly long legs.

Teacher Solicits.	HOW IS BEING AN UNGULATE GOING TO AFFECT THE RED DEER'S RUNNING ABILITY?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Being an ungulate helps the red deer run faster by increasing the length of its leg.
Teacher Solicits.	WHAT WOULD HAPPEN TO YOUR TOES IF YOU TRIED TO STAND ON THE TIPS OF THEM IN BARE FEET?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	If you try to stand on the tips of your toes in bare feet your toes bend. The red deer's hoof, like all other ungulates' hooves, is made of the same material as your toe nails. This hard material provides a band around the toes which stops them from bending. This helps the red deer to run fast by providing support for the toes. Earlier in these lessons we said that the red deer is a bit like a horse in shape. Horses can run fast and they are ungulates too. The red deer then, is built for speed because of its long leg and protecting hoof.

REMOVE CARDS BH 1, BH 2.

Teacher Solicits.	WHICH ANIMAL HAS THE LONGER LEG, THE RED DEER OR THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer has a longer leg than the tahr.

Teacher Solicits.	IS THE TAHR BUILT AS MUCH FOR SPEED AS THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr is not built as much for speed as the red deer is, but it's helped by being an ungulate just as the red deer is
Teacher Solicits.	WHAT SORT OF A CLIMBER WOULD THE TAHR HAVE TO BE IF IT WERE TO SURVIVE IN THE ENVIRONMENT YOU CAN SEE IN OUR PICTURES OF THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Because it lives in a very steep environment the tahr must be a good climber. If it were not a good climber it would fall and be killed.
Teacher Solicits.	WHICH ANIMAL HAS THE MORE POWERFUL LEG, THE RED DEER OR THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr has a more powerful leg than the red deer.
Teacher Solicits.	WHICH LEG WOULD BE BETTER SUITED TO CLIMBING UP STEEP CLIFFS AND JUMPING FROM ROCK TO ROCK, A SHORTER MORE POWERFUL ONE OR A LONGER THINNER ONE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

Teacher Evaluates.	A leg the shape of the tahr's is better suited to climbing than one like the red deer's. You can see that, while the tahr's leg is shorter than the red deer's, the fact that the tahr is an ungulate gives it a longer leg than it would otherwise have. The tahr has something even more important than the shape of its leg which helps it to climb well, and that's its very special hoof.
CARD BQ 8	
	This drawing shows a tahr's hoof looking at it from the bottom. The drawing is of one leg.
Teacher Solicits.	WHAT ARE THE TIPS OF THE HOOF LIKE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr has a very pointed hoof which is much more pointed than the red deer's. The black part around the edge is called a horny rim which is a raised piece around the outside of the hoof. The orange part is a soft pad which is inside the horny rim.
Teacher Solicits.	HOW MANY TOES HAS THE TAHR GOT ON EACH FOOT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr has two toes on each foot like the red deer. Because of this the red deer and the tahr are both two toed ungulates. The horse is a one toed ungulate and so is a little different from the red deer and the tahr. The tahr's toes can move independently because they are split up the middle. The tahr uses the point of its hoof and its horny rim to get a grip in the small nitches in the rock. Because it can move its toes independently the tahr can get a better grip than it could if its toes could only move together. The soft pad helps it to get a grip on the flatter rocks.

	The tahr is suited to climbing because of its powerful leg and its special hoof. There are some other things which help the tahr to climb well. For example, its very good eyesight, which we've already mentioned, and its very good sense of balance, but we won't worry any more about these.
Teacher Solicits.	IN WHICH PART OF A RUMINANT'S STOMACH IS THE CUD MADE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The cud is made in the honeycomb.
Teacher Solicits.	AFTER THE CUD HAS BEEN CHEWED WHICH PART OF THE STOMACH DOES IT PASS INTO?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The cud passes into the manyplies after it has been chewed.
Teacher Solicits.	INTO WHICH PART OF A RUMINANT'S STOMACH DOES THE FOOD PASS LAST?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The food passes into the belly last and from there into the rest of the system and is digested.
	Well that's all we'll have time for today. Keep your name cards in your desk where you can find them easily for the next lesson. Just wait quietly until Mr. etc. tells you what to go on with.

CARDS CF 1, CF 2, CF 3, CF 4, CF 5, CF 6, CF 7.

Teacher States.	Today we're going to have the last lesson about the red deer and the tahr. Take out your name cards and put them on your desk. Remember to speak up clearly so that the tape can record you clearly and to make as little extra noise as possible.
Teacher Solicits.	WHAT IS A HOOFED ANIMAL CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A hoofed animal is called an ungulate.
Teacher Solicits.	WHAT IS AN ANIMAL WHICH CHEWS THE CUD CALLED?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	An animal which chews the cud is called a ruminant.
Teacher Solicits.	ABOUT HOW MANY POUNDS OF FOOD DOES A COW EAT IN A DAY?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	A cow eats about 150 pounds of food each day.
Teacher Solicits.	IT HAS BEEN SAID THAT THE RED DEER'S SENSE OF SMELL IS HOW MANY TIMES BETTER THAN OUR OWN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	It has been suggested that the red deer's sense of smell is 100 times better than our own. Now, we know that the temperatures in the environments in which the red deer and the tahr live, vary with the seasons and that the temperatures are coldest in winter.

Teacher Solicits.	READ PRINCIPLE THREE (POINT).
Teacher Thanks.	
Teacher Redirects.	
Teacher Thanks.	Animals behave in ways suited to their bodies and their environments which helps them to survive.
Teacher Solicits.	WHICH SEASON WOULD BE THE WORST FOR THE KIDS AND FAWNS TO BE BORN IN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Winter is the worst season for the kids and fawns to be born in.
Teacher Solicits.	WHY IS WINTER THE WORST SEASON FOR THE KIDS AND FAWNS TO BE BORN IN?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Winter is the worst season for the kids and fawns to be born in because it's the coldest season. New born animals are not very strong, and if they were born in the winter many of them would die of the cold, so it's better if they are born in the warmer half of the year. The warmer half of the year would be from mid October to mid April roughly speaking.

Teacher Solicits.	WOULD IT BE BETTER FOR THE KIDS AND FAWNS TO BE BORN NEARER THE BEGINNING OR THE END OF THE WARMER HALF OF THE YEAR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	It is better for the kids and fawns to be born near the beginning of the warmer half of the year.

Teacher Solicits.	WHY IS IT BETTER FOR THE KIDS AND FAWNS TO BE BORN AT THIS TIME?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	If the kids and fawns are born near the beginning of the warmer half of the year it gives them time to grow strong before the winter comes. So it would be better if they were born from mid October to mid January, rather than from mid January to mid April. Now if the kids and fawns are to be born in these months the red deer and the tahr must mate earlier than this, because they have a gestation period of several months.

CARD CQ 1

Teacher Solicits.	WHAT IS THE GESTATION PERIOD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

CARD CQ 1R

Teacher Solicits.	READ THE CARD.

Teacher Evaluates.	The gestation period is the time from mating to the birth of the young. The gestation period of the red deer is about eight months, so , if the fawns are to be born from mid October to mid January, the red deer must mate eight months earlier than this. Principle three tells us this should be so. Let's see what we actually find.
Teacher Solicits.	HOW LONG IS THE RED DEER'S GESTATION PERIOD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer's gestation period is about eight months. In New Zealand red deer mate from the middle of March through to the middle of May, with most of the mating taking place in April. The fawns are born eight months later, from the middle of November through to the middle of January, with most of them being born in December. This fits principle three very well. The gestation period of the tahr is about seven months, so, if the kids are to be born in the early part of the summer, the tahr must mate seven months earlier than this. Principle three tells us this should be so.
Teacher Solicits.	HOW LONG IS THE TAHR'S GESTATION PERIOD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	

Teacher Evaluates.	The tahr's gestation period is about seven months. What we actually find is that the tahr mates a month after the red deer, mating being from mid April until mid June, with most mating taking place in May. The kids are therefore born at the same time as the fawns. This is, of course, what principle three told us should be so. Both the kids and fawns are born in the late spring and early summer, which gives them warm summer months to grow in, so that they are strong before the winter comes, which helps them to survive. Normally red deer and tahr have only one fawn or kid each year, but occasionally twins are born.
Teacher Solicits.	WHICH COUNTRY WERE THE RED DEER IN THE SOUTH ISLAND INTRODUCED FROM?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer in the South Island were introduced from England.
Teacher Solicits.	WHEN IT IS SUMMER HERE WHAT SEASON IS IT IN ENGLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	When it's summer here it's winter in England because England is on the opposite side of the world from New Zealand

	Red deer fawns are mostly born in December in New Zealand.
Teacher Solicits.	WOULD THE FAWNS MOSTLY BE BORN DURING DECEMBER IN ENGLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer fawns are mostly born in June in England.
Teacher Solicits.	WHY ARE RED DEER FAWNS MOSTLY BORN IN JUNE IN ENGLAND AND NOT IN DECEMBER AS IN NEW ZEALAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The fawns are mostly born in England during June because this is late spring and early summer in England.
Teacher Solicits.	IF THE RED DEER INTRODUCED TO THE SOUTH ISLAND FROM ENGLAND HAD CONTINUED TO MATE DURING THE MONTHS THEY NORMALLY MATED IN, DURING WHICH SEASON WOULD THE FAWNS HAVE BEEN BORN IN HERE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The fawns would have been born in winter.

Teacher Solicits.	WHAT WOULD HAVE HAPPENED TO A LOT OF THEM?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	If the fawns had been born in the winter many of them would have died of the cold.
	Red deer in England mate from mid September to mid November, and the fawns are born from mid May until mid July, which is six months later than in New Zealand. Most of the mating takes place in October and most of the fawns are born in June.
Teacher Solicits.	WOULD THE TAHR MATE DURING THE SAME SEASON IN NORTHERN INDIA AND IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr, like the red deer, mates during the same season anywhere in the world.
Teacher Solicits.	WOULD THE TAHR MATE DURING THE SAME MONTHS IN NORTHERN INDIA AND THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Mating takes place during different months because the seasons occur during different months in the two countries. All this illustrates principle three, which states that animals behave in ways suited to their bodies and their environments which helps them to survive.

	Let's look at another example of principle three. We learnt earlier in the lessons that the red deer and the tahr are ruminants, which means that they can collect a large volume of food quickly so that they're not exposed to their predators for too long. Now while the red deer and the tahr can collect their food at any time they like, they collect it only at two particular times, and, by collecting it at these times, they behave in a way which makes full use of their bodies, and helps them to survive.
Teacher Solicits. Teacher Repeats. Teacher Redirects. Teacher Repeats.	WHEN DO THE RED DEER AND THE TAHR ACTUALLY COLLECT THEIR FOOD?
Teacher Evaluates.	Red deer and tahr collect their food early in the morning and during the evening, which is when their predators are not so likely to be around, and when they are not so likely to be caught and killed. By collecting their food at these times the red deer and the tahr give us another example of principle three.
	Let's look at another example. We learnt earlier in the lessons that the red deer relies most on its sense of smell to detect its predators. There is one problem with the sense of smell and that's that the scent must be carried on the wind to the red deer.
REMOVE CARD CF 7 CARD CH 1	You can see this in this drawing.
Teacher Solicits. Teacher Repeats. Teacher Redirects. Teacher Repeats.	WHICH OF THESE TWO RED DEER IS GOING TO BE ABLE TO PICK UP THE SCENT OF ITS PREDATOR MORE EASILY-THE TOP ONE OR THE BOTTOM ONE?

Teacher Evaluates.	The one at the top of the drawing will be more likely to detect its predator.
Teacher Solicits.	DO YOU THINK THE SAME PROBLEM APPLIES TO THE SENSE OF HEARING AS WELL?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	To some extent the same problem applies to the sense of hearing as well. It's much easier to hear someone when the wind is coming past them, towards you. The red deer often uses two senses together to give it the best possible, all round protection.
Teacher Solicits.	WHICH TWO SENSES WILL IT USE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The two senses are the sense of smell and the sense of sight.
REMOVE CARD CH 1	
CARD CH 2	You can see that the red deer in this picture is lying with its back to the wind, so that an animal coming up behind it can be detected by its scent being carried on the wind, or, possibly, by a noise being carried on the wind. At the same time any animal coming up in front of the red deer will be likely to be seen. By lying in this way the red deer is making maximum use of its body and behaving sensibly, which illustrates principle three.

Teacher Solicits.	WHAT IS PRINCIPLE THREE?
Teacher Thanks.	
Teacher Redirects.	
Teacher Thanks.	Animals behave in ways suited to their bodies and their environments which helps them to survive.
	Before we leave the senses of the red deer and the tahr we can see one more example of principle three. Red deer and tahr live in groups, as you can see in the middle pictures of the red deer and the tahr, and often large numbers of them can be seen together.
Teacher Solicits	WHAT DO WE CALL A GROUP OF RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD CQ 2	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	A group of red deer is called a herd.
Teacher Solicits.	WHAT DO WE CALL A GROUP OF TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD CQ 3	
Teacher Solicits.	READ THE CARD.
Teacher Evaluates.	A group of tahr is called a mob.

	In the army during a war, when the soldiers are trying to detect their enemies, they don't all keep watch all the time, but they post sentries and take it in turn to keep watch.
Teacher Solicits.	DO YOU THINK THAT RED DEER AND TAHR POST SENTRIES, BEARING IN MIND PRINCIPLE THREE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Both red deer and tahr post sentries. Red deer sentries warn others in the herd of approaching danger by making a noise called a bark. Tahr sentries warn the mob by giving quite a distinct whistle, and by stamping their feet.
	We have one more example of principle three. We learnt that the red deer, because of its hoof and leg, is built for speed.
Teacher Solicits.	HOW WOULD YOU EXPECT THE RED DEER TO BEHAVE WHEN IT DETECTS A PREDATOR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	When the red deer detects a predator it runs away at high speed, making use of its body which helps it to run fast. It doesn't strike out with its legs, or anything else, because this is too dangerous.

Teacher Solicits.	WHAT ARE THE TAHR'S LEG AND HOOF ESPECIALLY SUITED TO?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The tahr's leg and hoof are suited to climbing.
Teacher Solicits.	WHAT WOULD THE TAHR DO WHEN IT DETECTED A PREDATOR COMING?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	When the tahr sees a predator coming it runs to a high cliff where the enemy can't reach it and there it is safe. The way red deer and tahr behave when they detect predators is suited to their bodies, and illustrates principle three.

REMOVE CARD CH 2

CARD CF 7

Teacher Solicits.	READ PRINCIPLE FOUR FOR US (POINT).
Teacher Thanks.	
Teacher Solicits.	
Teacher Thanks.	Introducing animals to countries in which they are not naturally found often causes problems, because this upsets the balance of nature.

Teacher Solicits.	WHAT IS THE BALANCE OF NATURE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The plants and animals naturally found in a country live together in a balanced way. Each animal or plant has its place and each can survive. When new and different animals are introduced this balance may be upset, and some of the plants and animals may die out.
Teacher Solicits.	WHAT SORT OF FOOD DO RED DEER AND TAHR EAT?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Red deer and tahr eat plants. Now the plants in New Zealand were in balance when there was only one native mammal, the native bat. Many of these plants cannot survive being eaten and die. Now plants have a very important function in keeping the soil from being blown away by the wind and washed away by the rain. There's a word we use when the soil is washed away by the rain and blown away by the wind.
Teacher Solicits.	WHAT IS THIS WORD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
CARD CQ 4	
Teacher Solicits.	READ THE CARD.

Teacher Evaluates.	Erosion. Both the red deer and the tahr cause erosion by eating and treading on plants and killing them. Another problem is that both animals often eat pasture and crops which farmers have grown for domestic animals.
Teacher Solicits.	WHICH ANIMAL WOULD CAUSE THE BIGGER PROBLEM HERE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer is the bigger problem.
Teacher Solicits.	WHY IS THE RED DEER THE BIGGER PROBLEM?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer's habitat is closer to farms than is the tahr's.
	However, the tahr is a problem on some high country farms. While the problem of the red deer and the tahr eating domestic pasture is not a balance of nature problem it is a serious problem in some areas, because of the large number of animals involved. Without natural enemies, other than man, in New Zealand the red deer and the tahr have multiplied rapidly. It has been estimated that there were as many as 5 million red deer in New Zealand a few years ago.
Teacher Solicits.	DURING WHICH MONTHS DOES THE RED DEER MATE IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	In the South Island the red deer mates from mid March to mid May, with most of the mating taking place in April.

Teacher Solicits.	DURING WHICH MONTHS DOES THE TAHR MATE IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	In the South Island the tahr mates from mid April to mid June, with most of the mating taking place in May.

Teacher Solicits.	DURING WHICH MONTHS ARE THE KIDS AND FAWNS BORN IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	In the South Island the kids and fawns are born from mid November to mid January, with most of them being born in December.

REMOVE CARDS CF 1, CF 2, CF 3, CF 4, CF 5, CF 6, CF 7.

(While doing so ask the following question.)

Teacher Solicits.	DURING WHICH MONTH ARE RED DEER MOSTLY BORN IN ENGLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	In England red deer are mostly born in June, which is six months later than in New Zealand

CARDS CF 8, CF 9

Well, let's see if we can apply our principles to a new animal. This animal is the chamois. The cards (point) show the chamois' habitat in the South Island and give some information about the chamois. Read the information about the chamois through to yourself twice, and use it to answer the following questions.

(Wait long enough for the information to be read twice)

Teacher Solicits.	DOES THE CHAMOIS HAVE A SMALLER HABITAT IN THE SOUTH ISLAND THAN THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois has a smaller habitat in the South Island than the red deer.
Teacher Solicits.	GENERALLY SPEAKING, IS THE CHAMOIS' HABITAT IN THE SOUTH ISLAND HIGHER OR LOWER THAN THE TAHR'S?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Generally speaking, the chamois' habitat in the South Island is lower than the tahr's.
Teacher Solicits.	GENERALLY SPEAKING, IS THE CHAMOIS' HABITAT IN THE SOUTH ISLAND COLDER THAN THE RED DEER'S?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	Generally speaking, the chamois' habitat in the South Island is colder than the red deer's.

Teacher Solicits.	DOES THE CHAMOIS HAVE A THICKER COAT THAN THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois has a thinner coat than the tahr.
Teacher Solicits.	DOES THE CHAMOIS HAVE ITS THICKEST COAT AT THE SAME TIME AS THE TAHR HAS ITS THICKEST COAT IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois has its thickest coat in the winter like the tahr.
Teacher Solicits.	DOES THE CHAMOIS LIVE IN A MORE OPEN ENVIRONMENT THAN THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois' environment is more open than the red deer's.
Teacher Solicits.	WOULD THE CHAMOIS HAVE A BETTER SENSE OF SMELL THAN THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois has a poorer sense of smell than the red deer.

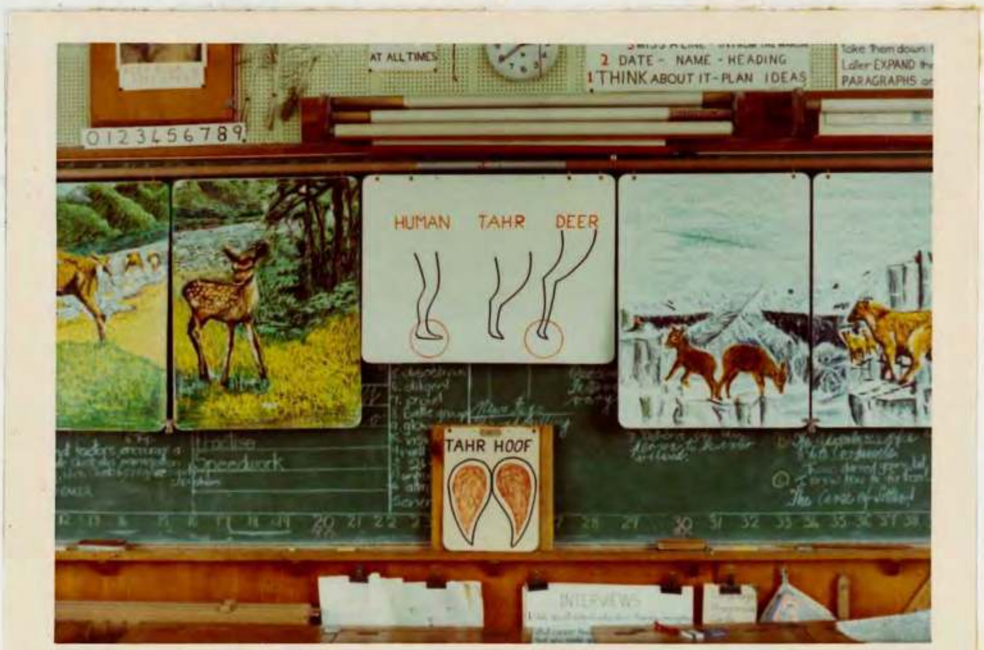
Teacher Solicits.	DOES THE CHAMOIS LIVE IN A STEEPER ENVIRONMENT THAN THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois lives in a less steep environment than the tahr.
Teacher Solicits.	IS THE CHAMOIS A BETTER CLIMBER THAN THE TAHR?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois is a poorer climber than the tahr.
Teacher Solicits.	IS THE CHAMOIS LIKELY TO BE AN UNGULATE?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois is an ungulate.
Teacher Solicits.	DOES THE CHAMOIS HAVE A MORE POWERFUL LEG THAN THE RED DEER?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois has a more powerful leg than the red deer.

Teacher Solicits.	WOULD THE CHAMOIS' HOOF BE BETTER SUITED TO CLIMBING THAN THE RED DEER'S?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois' hoof is better suited to climbing than the red deer's.
Teacher Solicits.	WHEN WOULD THE CHAMOIS COLLECT ITS FOOD?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois collects its food early in the morning and during the evening.
Teacher Solicits.	WOULD THE CHAMOIS HAVE ITS YOUNG LATER IN THE YEAR THAN THE TAHR IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois and the tahr have their young at the same time in the South Island.
Teacher Solicits.	WOULD THE CHAMOIS AND THE RED DEER MATE AT THE SAME TIME IN THEIR NATIVE LANDS?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The red deer mates before the chamois.

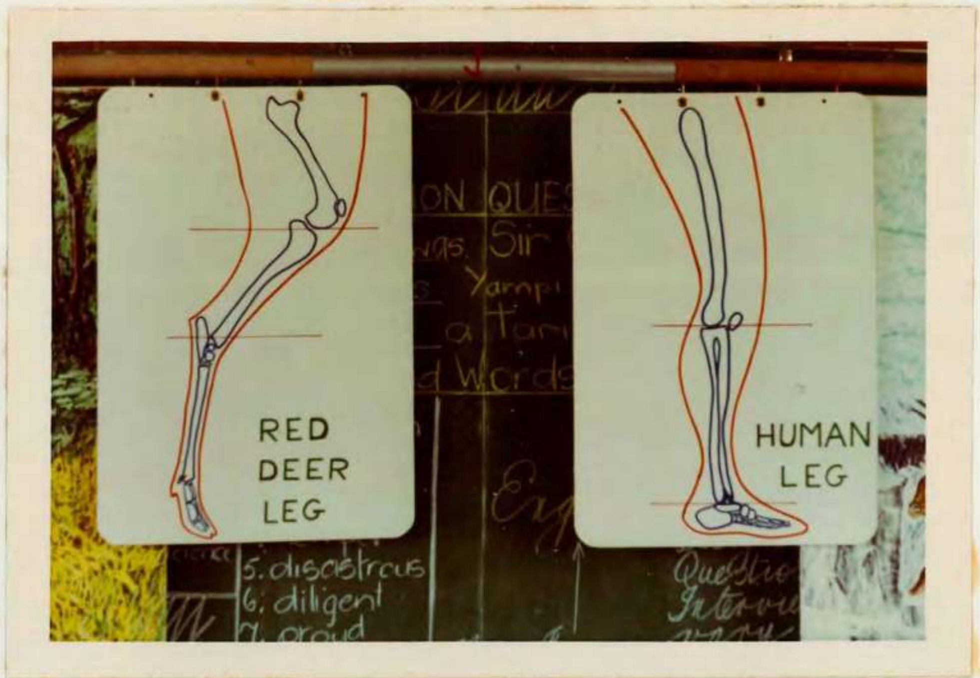
Teacher Solicits.	WOULD THE CHAMOIS AND THE TAHR MATE AT THE SAME TIME IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois and the tahr mate at the same time in the South Island.
Teacher Solicits.	DO YOU THINK THE CHAMOIS WOULD CAUSE EROSION IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois causes erosion in the South Island.
Teacher Solicits.	WOULD THE CHAMOIS BE A BIGGER OR A SMALLER PROBLEM THAN THE RED DEER THROUGH EATING DOMESTIC PASTURE IN THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois is a smaller problem than the red deer.
Teacher Solicits.	WHAT IS THE MOST LIKELY EXPLANATION FOR THE INTRODUCTION OF THE CHAMOIS TO THE SOUTH ISLAND?
Teacher Repeats.	
Teacher Redirects.	
Teacher Repeats.	
Teacher Evaluates.	The chamois was introduced for sport.

Above, the lesson materials as they appear on page 206.

Below, the lesson materials as they appear on page 234.



The lesson materials as they appear on page 223 of the lesson plans.



The lesson materials as they appear on page 230.

The F (full) cards were 23 inches x 31 inches,
the H (half) cards were $15\frac{1}{2}$ inches x 23 inches and
the Q (quarter) cards were $11\frac{1}{2}$ inches x $15\frac{1}{2}$ inches.

APPENDIX B

THE POSTTESTS AND SCORING STANDARDS

CONTENTS

NATURE STUDY TEST - PART ONE

Name: ______________________________

INSTRUCTIONS

In this test you are to fill in the spaces with the ONE word, number, or date which best completes the statement or answers the question. Look at Example One below.

EXAMPLE ONE

A male sheep is called a RAM (w), a female sheep is called a EWE (w), and a young sheep is called a LAMB (w).

A male sheep is called a ram so 'ram' has been put in the first space, a female sheep is called a ewe so 'ewe' has been put in the second space and a young sheep is called a lamb so 'lamb' has been put in the last space. Look at Example Two below.

EXAMPLE TWO

From which animal does mutton come? SHEEP (w)

Mutton comes from sheep so 'sheep' has been put in the space provided to answer the question.

To help you know whether a word, number, or date is required a letter has been put in brackets at the end of each space. (w) means a word is required, (n) means a number is required and (d) means a date is required.

If you want to change an answer rub out the one you want to change. You must have only ONE word, number, or date in each space. To help you with some of the questions in this test there is a list of words inside this booklet. Take this sheet out and read it to yourself as I read it to you.

Begin with question one on the next page and work down, doing each question in turn. Do not puzzle over any questions you do not know the answers to, because you will not have time for this. When you have finished page one turn over and begin on the second page. ONCE YOU HAVE TURNED A PAGE YOU MUST NOT TURN BACK TO ANY PREVIOUS PAGE, SO CHECK YOUR WORK BEFORE YOU TURN OVER. Work through the test until you reach the last page and then stop work. Remember you must not turn back to any of the pages you have completed.

Are there any questions? Work as quickly as you can.

TURN TO PAGE ONE AND BEGIN WORK.

PAGE ONE

1. How many parts does the tahr have to its stomach? _______ (n).
2. New Zealand's only native land mammal is the native ________(w).
3. A hoofed animal is called an ____________ (w).
4. To bring food from the stomach to the mouth is to ____________ (w) it.
5. An animal which kills other animals is called a ___________ (w).
6. An animal which eats plants is called a ___________ (w).
7. An animal which chews the cud is called a ____________ (w).
8. The time from mating to the birth of the young is the ____________ (w) period.
9. A group of tahr is called a ________ (w) while a group of red deer is called a _______ (w).
10. A word which means 'introduced from abroad' is __________ (w).
11. The area in which an animal lives is called its ____________ (w).
12. A word which means 'wild or undomesticated' is ___________ (w).
13. The conditions in which an animal lives are called its ____________ (w).
14. The tahr's mane is called a __________ (w).
15. The meat from red deer is called ____________ (w).
16. There are ___________ (n) deer species in New Zealand, ___________ (n) of which are found in the South Island.
17. A male red deer is called a _________(w), a female red deer is called a __________ (w) and a young red deer is called a ___________ (w).
18. A male tahr is called a _______ (w), a female tahr is called a ________ (w) and a young tahr is called a _________ (w).
19. A male red deer weighs about ______ (n) pounds while a female red deer weighs about _______ (n) pounds.
20. A male tahr weighs about _______ (n) pounds while a female tahr weighs about _______ (n) pounds.

CHECK YOUR WORK BEFORE YOU TURN OVER. REMEMBER YOU MUST NOT TURN BACK TO THIS PAGE.

PAGE TWO

21. The four parts of a red deer's stomach are the ________(w), the _________(w), the _________(w) and the ________(w).
22. The small ball of food which the tahr regurgitates is called the ________(w).
23. Tahr are born in the late _________(w) and early _______(w) seasons in Northern India because it is _________(w) then are there are several months before ________(w).
24. In the South Island red deer mate from mid ________(w) to mid ________(w) with most of the mating taking place in the month of ________(w).
25. In the South Island tahr mate from mid ________(w) to mid ________(w) with most mating taking place in the month of ________(w).
26. In the South Island red deer are born from mid ________(w) to mid ________(w) with most of them being born in the month of ________(w).
27. The red deer's gestation period is about ________(n) months and the tahr's gestation period is about ________(n) months.
28. In shape the red deer is rather like a ________(w) while the tahr is rather like a ________(w).
29. The red deer has a tail about ________(n) inches long and a light coloured ________(w) patch.
30. The tahr is a member of the ________(w) family.
31. The name 'tahr' may also be spelt ________(w) and ________(w).
32. The name 'tahr' may be pronounced in how many ways? ______(n).
33. The red deer is a native of many countries in _________(w) and it was first introduced to the South Island from one of these countries called _________(w) in the year ______(d).

CHECK YOUR ANSWERS BEFORE YOU TURN OVER. REMEMBER YOU MUST NOT TURN BACK TO THIS OR ANY OTHER PAGE.

PAGE THREE

34. When the red deer collects its food it swallows it and it passes into the largest part of the stomach called the ________(w) where it is ________(w). From here it passes into the second part of the stomach called the ________(w) where it is made into ________(w) which is then ________(w) and chewed. The food is then swallowed for a second time and passes into the third part of the stomach called the ________(w) and from there it goes into the last part of the stomach called the ________(w) and from there it goes through the rest of the system and is digested.

35. The horse is a _______(n) toed ungulate.

36. The red deer relies most on its sense of ________(w) to detect its enemies and this sense has been said to be ________(n) times better than our own.

37. About how many pounds of food does a cow eat in a day _______(n).

38. The tahr relies most on its sense of ________(w) to detect its enemies because it lives in an ________(w) environment.

39. The tahr's ________(w) is made of the same material as our finger nails.

40. Red deer usually have _________(n), but may have ________(n), young each year.

41. Red deer make a sound called a ________(w) to warn other red deer of approaching danger while tahr make a sound called a _________(w) to warn other tahr.

42. In England red deer mostly mate during the month of _______(w) and are mostly born during the month of ________(w).

43. The first liberation of red deer in the South Island failed because the ________(w) was ________(w).

44. The first SUCCESSFUL liberation of red deer in the South Island was in the year ______(d) when ______(n) male and _____(n) female red deer were liberated.

CHECK YOUR WORK BEFORE YOU TURN OVER. REMEMBER YOU MUST NOT TURN BACK TO THIS OR ANY OTHER PAGE.

PAGE FOUR

45. The tahr's ________ (w) leg and special ________ (w) help it to be a good climber.

46. The tahr's coat is made of long ________ (w) and short ________ (w).

47. The tahr's coat is ________ (w) than the red deer's because it lives in a ________ (w) environment.

48. Red deer can collect a large volume of food ________ (w) because they don't have to ________ (w) it as they collect it.

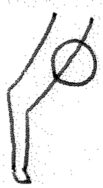
49. The tahr's hoof has a soft ________ (w) around which there is a horny ________ (w) and its toes move ________ (w).

50. The red deer is good at seeing ________ (w) but it cannot see ________ (w)

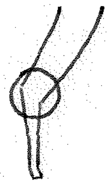
51. The red deer's sense of ________ (w) and sense of ________ (w) are about as good as our own.

Below are four drawings of a red deer's leg, each of which has a piece circled. Name the part of a man's leg which the circled part of the red deer's leg is equivalent to.

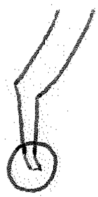
52. The circled part of this red deer's leg is equivalent to a man's → ________ (w)



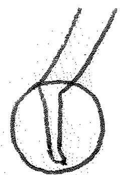
53. The circled part of this red deer's leg is equivalent to a man's → ________ (w).



54. The circled part of this red deer's leg is equivalent to a man's → ________ (w)



55. The circled part of this red deer's leg is equivalent to a man's → ________ (w).



CHECK YOUR WORK BEFORE YOU TURN OVER. REMEMBER YOU MUST <u>NOT</u> TURN BACK TO THIS OR ANY OTHER PAGE.

PAGE FIVE

56. The red deer often uses its sense of ________(w) and its sense of ________(w) together to help it detect its enemies.

57. The red deer and the tahr cause problems in the South Island because they cause ________(w) by __________(w) plants and by ________(w) on them and so killing them.

58. In the South Island the red deer is ________(w) of a problem than the tahr through eating domestic pasture because it has a different ________(w).

59. Three things which help to tell a male red deer from a female red deer are his ________(w), his ________(w) and his short ________(w).

60. The young red deer's coat is ________(w) until it is about ________(n) months old.

61. The number of red deer introduced to the South Island in the first liberation was ________(n) male and ________(n) female and they were liberated near the city of _________(w).

62. Red deer were introduced to the South Island for ________(w), for their ________(w) and for their ________(w).

63. The tahr is a native of the ________(w) Mountains in Northern ________(w) and the country they were introduced to the South Island from was ________(w).

64. The tahr was introduced to the South Island for what reason? ________(w).

65. You can tell how old a tahr is by the ________(w) on its ________(w).

66. The tahr was introduced to the South Island in the year _____(d) when _______(n) male and _____(n) female tahr were liberated in the Southern Alps.

67. Generally speaking the red deer in the South Island are found between ______(n) feet and ______(n) feet.

CHECK YOUR ANSWERS BEFORE YOU TURN OVER. REMEMBER YOU MUST NOT TURN BACK TO THIS OR ANY OTHER PAGE.

PAGE SIX

68. In which month do red deer lose their antlers?__________ (w).

69. The eight deer species found in New Zealand are the red deer, the __________ (w) deer, the __________ (w) deer, the __________ (w) deer, the __________ (w) deer, the __________ (w) or __________ (w) deer, the __________ (w) or __________ (w) elk, and the __________ (w).

70. The male chamois is called a __________ (w), the female chamois is called a __________ (w) and the young chamois is called a __________ (w).

71. __________ (n) chamois were liberated near Mount __________ (w) in the year __________ (d).

72. A male chamois weighs about ______ (n) pounds and a female chamois weighs about ______ (n) pounds.

73. The chamois is a native of Central __________ (w) and its gestation period is about __________ (n) months.

STOP HERE. YOU MAY CHECK THIS PAGE BUT REMEMBER THAT YOU MAY NOT TURN BACK TO ANY OTHER PART OF THE TEST.

Below is a list of words you will find helpful in answering the questions in this test. Many of the words you will need are NOT in this list, and some of the words in the list are NOT needed. These words will be particularly useful in helping you to spell words you are not sure of. The words have been put in alphabetical order to help you to find the ones you want.

Embryo	Masticate
Environment	Omniverous
Equestrian	Panacea
Erosion	Paunch
Exodus	Precursor
Exotic	Predator
Fallow	Provost
Fecund	Recalcitrate
Feral	Regurgitate
Feria	Rudiment
Gasification	Ruminant
Gestation	Rumba
Habitat	Sambar
Halliard	Sippet
Herbivor	Umbrage
Hereditary	Unguent
Homunculus	Ungulate
Honeycomb	Venison
Hummel	Verdure
Manyplies	Virginia

POSTTEST ANSWERS

	1.	4
*	2.	BAT
	3.	UNGULATE
	4.	REGURGITATE
	5.	PREDATOR
	6.	HERBIVOR
	7.	RUMINANT
	8.	GESTATION
	9a	MOB
	9b	HERD
*	10.	EXOTIC
*	11.	HABITAT
*	12.	FERAL
	13.	ENVIRONMENT
*	14.	RUFF
*	15.	VENISON
*	16a	8
*	16b	5
*	17a	STAG
*	17b	HIND
*	17c	FAWN
*	18a	BULL
*	18b	NANNY
*	18c	KID
*	19a	300
*	19b	200
*	20a	200
*	20b	80
#	21a	PAUNCH
	21b	HONEYCOMB
	21c	MANYPLIES
	21d	BELLY
	22	CUD
	23a	SPRING
	23b	SUMMER
	23c	WARM, WARMER, HOT, HOTTER
	23d	WINTER
	24a	MARCH, May, April
	24b	MAY, March, April
	24c	APRIL, March, May
	25a	APRIL, June, May
	25b	JUNE, April, May
	25c	MAY, April, June
	26a	NOVEMBER, January, December
	26b	JANUARY, November, December
	26c	DECEMBER, November, January
	27a	8
	27b	7

*	28a	HORSE
*	28b	GOAT
*	29a	6
*	29b	RUMP
*	30	GOAT
*#	31a	THAR
*	31b	THAAR
*	32	2
*	33a	EUROPE
*	33b	ENGLAND, Great Britain
*	33c	1851
	34a	PAUNCH
	34b	STORED, held, kept
	34c	HONEYCOMB
	34d	CUD, balls
	34e	REGURGITATED
	34f	MANYPLIES
	34g	BELLY
	35	ONE, single
	36a	SMELL, nose
	36b	100
	37	150
	38a	SIGHT, eyes vision
	38b	OPEN, empty, barren, bare, clear, coverless
	39	HOOF
	40a	1
	40b	2
	41a	BARK
	41b	WHISTLE
	42a	OCTOBER
	42b	JUNE
*	43a	HIND, female
*	43b	SHOT, killed
*	44a	1861
*	44b	1
*	44c	2
	45a	POWERFUL, strong, muscular
	45b	HOOF, feet, toes
	46a	HAIR, fur
	46b	WOOL
	47a	WARMER, LONGER, THICKER
	47b	COLDER, COOLER
	48a	QUICKLY, FAST
	48b	CHEW
	49a	PAD, sole, cushion
	49b	RIM, ridge, edge, shell, crust
	49c	INDEPENDENTLY, separately, individually, alternately
	50a	MOVEMENT
	50b	COLOUR

#	51a	SIGHT, see, eyes
	51b	HEARING, sound
	52	KNEE
	53	ANKLE
	54	TOES
	55	FOOT
#	56a	SMELL
	56b	SIGHT, see, eyes
	57a	EROSION
	57b	EATING, TRAMPLING
	57c	FEEDING, TREADING, STEPPING, WALKING, STANDING. Note: If Eating was given in 57b, Feeding was not acceptable in 57c - if Trampling was given in 57b the only acceptable response for 57c was Feeding.
	58a	MORE, WORSE, BIGGER, GREATER
	58b	HABITAT
*#	59a	ANTLERS, horns
*	59b	SIZE, height, weight, bigness
*	59c	MANE, ruff, Note: While generally interchangeable size(etc.) was not acceptable in place of mane.
*	60a	SPOTTED, dotted
*	60b	3
*	61a	1
*	61b	1
*	61c	NELSON
*	62a	SPORT, game, hunting, shooting
*	62b	SKINS, coats, pelts, hides, furs, leather
*	62c	MEAT, VENISON, food, flesh
*	63a	HIMALAYAN
*	63b	INDIA
*	63c	ENGLAND, Great Britain
*	64	SPORT, game, hunting, shooting
*	65a	RINGS, circles, lines, marks, segments, sections, groves
*	65b	HORNS, antlers. Note: 65a Horns with 65b Head was scored one-half
*	66a	1904
*	66b	2
*	66c	3
*#	67a	1,200
*	67b	6,000
*	68	OCTOBER
*#	69a	SAMBAR
*	69b	SIKA
*	69c	RUSA
*	69d	FALLOW
*	69e	WHITETAIL

*	69f	VIRGINIA
*	69g	WAPITI
*	69h	AMERICAN, South American
*	69i	MOOSE
	70a	BUCK
	70b	DOE
	70c	KID
	71a	8
	71b	COOK
	71c	1907
	72a	80
	72b	50
	73a	EUROPE
	73b	7

Note: One bonus point was given when 69e and 69f were both in the correct place, the same with 69g and 69h

DO NOT MAKE ANY MARKS ON THIS TEST BOOKLET

PUT YOUR ANSWERS ON THE SEPARATE ANSWER SHEET

NATURE STUDY TEST

PART TWO

This part of the test contains a number of statements, each of which is either 'true' or 'false'. On the separate answer sheet, beside each number, are three letters, T, F, and X. Read each statement and decide if you think it is true or false. If you think a statement is true put a circle around T on the separate answer sheet, and if you think it is false put a circle around F on the separate answer sheet. When you cannot decide if a statement is true or not put a circle around X. DO NOT GUESS. Look at Example One below.

EXAMPLE ONE:

The rabbit is a mammal.

The rabbit is a mammal because it is warm blooded, suckles its young, and so on. The statement 'the rabbit is a mammal' is therefore true and so T has been circled on the separate answer sheet. Look at Example Two below.

EXAMPLE TWO:

The whale is a fish.

The whale is a sea mammal and not a fish. The statement 'the whale is a fish' is therefore false and so F has been circled on the separate answer sheet.

If you had not known the answers to these questions you would have put a circle around X, you would NOT have guessed.

If you want to change an answer rub out the one you want to change. You must have only one answer for each question.

To help you answer some of the questions about the chamois, a relief map and a chart have been put at the front of the room. *

Are there any questions? Work as quickly as you can.

TURN TO PAGE ONE AND BEGIN WORK

* The map and chart shown on pages 357-8 were provided on F cards (23 inches x 31 inches).

*+ 1. The male red deer has a mane.

*+ 2. New Zealand exports meat and skins from the red deer and the tahr.

* 3. The tahr was liberated near Mount Tasman.

+ 4. Tahr stamp their feet to warn others in the mob of approaching danger.

* 5. All the tahr sent to the South Island for the first liberation arrived safely

+ 6. Red deer and tahr are born in the same months in the South Island.

*+ 7. The female tahr has horns but the female red deer does not have antlers.

+ 8. Red deer collect their food in the early morning and the evening.

+ 9. The tahr's hoof is more pointed than the red deer's.

* 10. Another name for the tahr is the Indian Mountain Sheep.

+ 11. Red deer and tahr both have fairly warm coats.

* 12. The male tahr sheds his horns.

* 13. The size of a male red deer's antlers depends on his age.

* 14. A relief map shows where you find particular animals living.

+ 15. The tahr's eyesight and sense of balance help it to climb well.

* 16. The tahr is found in the Southern Alps north of Greymouth.

+ 17. The red deer's coat is made only of hair.

* 18. The red deer is found in the highest areas of the South Island.

+ 19. Animals which are ungulates have longer legs than they would have if they were not ungulates.

* 20. The tahr is seldom found above 5,000 feet in the South Island.

+ 21. The tahr has better eyesight than the red deer.

22. The red deer's coat is the same thickness all year round.

23. The red deer's main method of protecting itself is to strike out with its front legs.

24. The tahr escapes its enemies by running away at speed.

25. The tahr mates during the same months in the South Island and Northern India.

+ 26. It has been estimated that there were five million red deer in New Zealand a few years ago.

+ 27. Animals which are ungulates can run faster than they would be able to if they were not ungulates.

GO ON TO THE NEXT PAGE

PAGE TWO

\+ 28. The tahr has a shorter but more powerful leg than the red deer.

29. Red deer warn others in the herd of approaching danger by whistling.

\+ 30. The red deer is a two toed ungulate.

\+ 31. The tahr's hoof helps to protect its toes.

32. Red deer eat pasture intended for domestic animals but tahr do not.

*+ 33. The female red deer is about two-thirds as big as the male red deer.

34. Red deer in the South Island cause problems because they spread disease among domestic cattle.

35. Apart from its sense of sight the tahr has poor senses.

*+ 36. The male tahr is about two and a half times as big as the female tahr.

* 37. The female tahr has a short mane called a ruff.

38. The chamois has a bigger habitat in the South Island than the red deer.

39. Generally speaking the chamois lives lower down than the red deer.

40. Generally speaking the chamois' environment is warmer than the red deer's.

\+ 41. The chamois has a thicker coat than the red deer.

42. The chamois is a bigger problem than the red deer through eating domestic pasture.

\+ 43. Generally speaking the chamois lives in a more open environment than the red deer.

44. The chamois has a better sense of smell than the red deer.

45. In the South Island the chamois mates before the red deer.

46. The chamois and the red deer mate during the same months in their native lands.

\+ 47. The chamois lives in a steeper environment than the red deer.

\+ 48. The chamois is a better climber than the red deer.

\+ 49. The chamois causes erosion in the South Island.

\+ 50. The chamois' hoof is better suited to climbing than the red deer's.

51. The chamois has a longer leg than the red deer.

\+ 52. The chamois' coat is thickest in winter.

\+ 53. The chamois has a bigger habitat in the South Island than the tahr.

54. The chamois lives in a steeper environment than the tahr.

GO ON TO THE NEXT PAGE

PAGE THREE

+ 55. The chamois was introduced to the South Island for sport.

56. The chamois lives in a more open environment than the tahr.

+ 57. The chamois is an ungulate.

+ 58. Generally speaking the chamois lives lower down than the tahr.

59. The chamois is a better climber than the tahr.

60. The chamois' hoof is better suited to climbing than the tahr's.

61. The chamois collects its food in the late morning and early afternoon.

+ 62. The chamois has a thinner leg than the tahr.

+ 63. In the South Island the chamois mates in the same months as the tahr.

64. The chamois has better eyesight than the tahr.

+ 65. The chamois would have its young in the same months as the tahr in the South Island.

66. Generally speaking the chamois lives in a colder environment than the tahr.

+ 67. The chamois has a thinner coat than the tahr.

68. The chamois and the tahr mate in different seasons in their native lands.

STOP HERE

THE POSTTEST QUESTIONING SCALE

A	B	C	D	E	F	G

A PERSON WHO IS VERY OFTEN ASKED QUESTIONS IN CLASS	A PERSON WHO IS ASKED AN AVERAGE NUMBER OF QUESTIONS IN CLASS	A PERSON WHO IS HARDLY EVER ASKED QUESTIONS IN CLASS

Instructions:

You have all seen this chart before. You'll remember how it works, but to refresh your memories we'll run briefly through it again. A person who is very often asked questions in class fits in the A category, a person who is hardly ever asked questions in class fits in the G category, while a person who is asked an average number of questions in class fits in the D category, and so on. Decide which category best describes how many questions you were asked during the lessons I took with you, and, when you have decided, put the letter of that category after the large 1 at the top of your answer sheet - here (point). Remember you are to put the letter of the category which best describes how many questions I asked you during the lessons I took with you last week.

APPENDIX C

THE PRETESTS AND RELEVANT STATISTICS

CONTENTS

DO NOT MAKE ANY MARKS IN THIS BOOKLET	PUT YOUR ANSWERS ON THE SEPARATE ANSWER SHEET

Below are a number of statements, and underneath each of these statements are five categories like this:

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

On the separate answer sheet are the same five categories, underneath each of which is a small bracket like this:

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE
( )	( )	( )	( )	( )

Decide how you feel about each statement, and, on the separate answer sheet, put a tick in the brackets below the category which best tells how you feel about the statement. For example, if you strongly disagree with a statement put a tick in the brackets under STRONGLY DISAGREE on the separate answer sheet; if you agree with a statement but not strongly put a tick under AGREE. Only if you cannot decide whether you agree or disagree put a tick in the brackets under UNDECIDED. Make sure you answer as honestly as possible and feel free to say you strongly agree or strongly disagree, if this is how you feel. Remember, all your answers go on the separate answer sheet.

1. I think people who spend a lot of their spare time watching birds and other animals could be doing more interesting things.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

2. I would rather watch programmes about wild life or wild animals on the television than any other programmes.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

3. I would rather work as a vet where I could deal with animals than as a nurse or a doctor.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

4. I would rather visit an airport control tower or a fashion parade than visit a zoo.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

5. Books about animals are often boring and I would rather read about famous people or famous places.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

6. If I visited a museum I would like to spend most of my time looking at the birds and animals rather than looking at the other things they have there.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

7. I would rather do a project about social studies than one about nature study.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

8. Learning about animals is not very important and I would rather learn about other things.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

9. When I go to the Show on Show Day I like to spend most of my time watching the animals rather than at the side shows.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

10. I think nature study is an interesting subject and I would rather learn about it than many other subjects.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

11. On a school visit I would rather go to a factory than go to a farm.

STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE

STOP HERE. DO NOT TURN THE PAGE

THE REVISED PRETEST ATTITUDE SCALE ITEM INTERCORRELATIONS

Item	1	2	3	4	5	6	7	8	9	10	11	12	Total
1		.17	.13	.21	.19	.00	.22	.28	.11	.16	-.02	.20	.39
2			.33	.26	.07	.16	.34	.37	.44	.38	.22	.21	.62
3				.12	.20	.04	.08	.36	.24	.33	.11	.20	.50
4					.25	.28	.29	.24	.31	.13	-.01	.49	.56
5						.19	.31	.42	.07	.23	.00	.35	.52
6							.14	.12	.29	.11	-.01	.07	.39
7								.35	.31	.54	.04	.27	.60
8									.20	.35	-.02	.34	.63
9										.36	.14	.28	.60
10											.37	.14	.65
11												-.04	.29
12													.56

* Item 11 was eliminated, the other 11 items making the final scale N = 78

USE
THE SEPARATE
ANSWER SHEET

DO NOT MAKE
ANY MARKS ON
THIS BOOKLET

NATURE STUDY TEST

On the following pages you will find a number of questions, and underneath each of these questions are five possible answers labelled A, B, C, D, and E. If you think A is the right answer circle A on the separate answer sheet; if you think B is the correct answer put a circle around B; if you think C put a circle around C; and if you think D put a circle around D on the separate answer sheet. If you do not know the answer put a circle around E on the answer sheet. DO NOT GUESS. If you are not reasonably sure you know which is the right answer circle E. An example is given below.

Example One

1. An animal which suckles its young is called a

   A. Marsupial

   B. Reptile

   C. Mammal

   D. Mollusc

   E. I don't know

A marsupial is an animal which carries its young in a pouch so A is not correct; a reptile does not suckle its young so B is not correct; D is incorrect because a mollusc is a shellfish and so that leaves C which is the correct answer. Look at the separate answer sheet. You can see that C has been circled in the example on the answer sheet. Remember, if you did not know what an animal which suckled its young was called you would have put E, you would NOT have guessed. Are there any questions? Carry on, beginning with number one on the next page and marking your answers on the separate answer sheet.

1. The meat from a red deer is called

   A. Veal
 * B. Venison
   C. Mutton
   D. Hogget
   E. I don't know

2. A male red deer is called a

   A. Steer
 * B. Stag
   C. Steed
   D. None of these
   E. I don't know

3. An animal which preys upon other animals is called a

 * A. Predator
   B. Predella
   C. Herbivor
   D. Protozoan
   E. I don't know

4. The red deer's tail is like a

   A. Cow's
   B. Pig's
   C. Fox's
 * D. Different from all these
   E. I don't know

5. Red deer live mostly

   A. Near the coast
   B. On the plains
 * C. In the bush
   D. On open mountains
   E. I don't know

6. If you wanted a really thick tahr skin you would go hunting in

   A. Spring
   B. Summer
   C. Autumn
 * D. Winter
   E. I don't know

7. The red deer's senses are

   A. Very poor
   B. Poor
   C. Good
 * D. Very good
   E. I don't know

8. The introduction of the red deer into the South Island caused problems because the red deer

   A. Spreads disease among cattle
   B. Can attack people during the mating season
 * C. Causes erosion by destroying plants
   D. All of these
   E. I don't know

9. An animal's environment is

A. The kind of food it eats

B. The country it originally came from

* C. The conditions in which it lives

D. The way in which it behaves

E. I don't know

10. Cud means

A. Part of a ruminant's stomach

* B. A ball of regurgitated food

C. A plant eaten by red deer

D. The kind of teeth found in some mammals

E. I don't know

11. Which of the following statements about the red deer is true?

* A. The male but not the female has antlers

B. The female but not the male has antlers

C. Both the male and the female have antlers

D. Neither the male nor the female have antlers

E. I don't know

12. The young red deer's coat is

A. Piebald

B. Fawn

C. Striped

* D. Spotted

E. I don't know

13. An animal which eats plants is

A. Viviparous
B. Omniverous
C. Carniverous
* D. Herbiverous
E. I don't know

14. When attacked by an enemy the red deer

* A. Runs away at high speed
B. Climbs a high cliff
C. Charges with it s antlers lowered
D. Strikes out with its front legs
E. I don't know

15. A group of red deer is called a

A. Mob
* B. Herd
C. Flock
D. Pack
E. I don't know

16. Red deer give birth to how many young?

A. One
* B. Usually one but sometimes two
C. Usually two but sometimes one
D. Two
E. I don't know

17. Which of the following statements about the male red deer is true?

    A. He never has antlers at any time
    B. He has antlers which grow throughout life
    * C. He grows a new set of antlers each year
    D. He grows new antlers when his old ones are broken
    E. I don't know

18. An animal's habitat is

    A. The country it originally came from
    B. The type of coat it has
    * C. The area in which it is found
    D. The way in which it behaves
    E. I don't know

19. How many toes does the red deer have on each foot?

    * A. Two
    B. Three
    C. Four
    D. Five
    E. I don't know

20. The red deer's foot is most like a

    A. Cat's
    * B. Sheep's
    C. Pony's
    D. Horse's
    E. I don't know

21. Tahr live

    A. Near the coast
    B. On the plains
    C. In the bush
    * D. In the mountains
    E. I don't know

22. A female red deer is called a

    * A. Hind
    B. Hart
    C. Hummel
    D. Heifer
    E. I don't know

23. Red deer collect their food

    * A. Early in the morning and in the evening
    B. During the late morning and early afternoon
    C. During the night
    D. When they get hungry
    E. I don't know

24. To bring food from the stomach into the mouth is to

    A. Masticate
    B. Disgorge
    C. Vomit
    * D. Regurgitate
    E. I don't know

25. The tahr's coat when compared with the red deer's is

   A. About the same length
   B. Shorter in winter but longer in summer
 * C. Longer at any time
   D. Shorter at any time
   E. I don't know

26. In New Zealand the red deer's coat is

   A. The same thickness all year round
 * B. Thicker in June than in January
   C. Thicker in January than in June
   D. Thicker sometimes depending on the weather
   E. I don't know

27. An animal which chews the cud is called a

   A. Herbivor
   B. Rodent
 * C. Ruminant
   D. Vertebrate
   E. I don't know

28. An exotic animal is

   A. A native animal
   B. An extinct animal
 * C. An introduced animal
   D. An unusual animal
   E. I don't know

29. Red deer were brought to New Zealand from

*A. England
B. China
C. America
D. Africa
E. I don't know

30. The tahr is

*A. Short and stocky with horns
B. Short and stocky without horns
C. Tall and thin with horns
D. Tall and thin without horns
E. I don't know

THE REVISED PRETEST OF ACHIEVEMENT ITEM STATISTICS

Final Form Number	Difficulty* Index	Discrimination# Index
1	82	58
2	79	81
3	78	71
4	76	62
5	75	80
6	73	89
7	73	81
8	70	1.00
9	67	55
10	64	72
11	62	78
12	62	63
13	60	52
14	55	83
15	55	81
16	55	59
17	50	85
18	46	60
19	45	87
20	42	81
21	39	70
22	38	85
23	34	69
24	34	60
25	34	51
26	33	57
27	26	59
28	26	47
29	26	42
30	17	1.00
Eliminated	57	32
"	53	29
"	22	41
"	17	44
"	11	65
"	11	20

N = 212

* The figure indicates the per cent passing the item

Anstey's 'D', Anstey (1966)

THE PRETEST QUESTIONING SCALE

A	B	C	D	E	F	G
A PERSON WHO IS VERY OFTEN ASKED QUESTIONS IN CLASS			A PERSON WHO IS ASKED AN AVERAGE NUMBER OF QUESTIONS IN CLASS			A PERSON WHO IS HARDLY EVER ASKED QUESTIONS IN CLASS

Instructions:

This chart has been divided up into seven parts which have been labelled A, B, C, D, E, F, and G. A person who is very often asked questions in class would fit in the A category, a person who is hardly ever asked questions in class would fit in the G category, while a person who is asked an average number of questions in class would fit in the D category. The other categories lie inbetween the ones I have described to you. For example, a person who is asked questions in class a little bit more than hardly ever, but not much more, would fit in the F category, and a person who is asked questions in class a little bit less than very often would fit in the B category. Now you will all realize that each person in the class could be placed in one of these seven categories, depending on how many questions he or she is normally asked in class.

1. Decide which category best describes how many questions you are normally asked in class, and put the letter of that category after the large 1 at the top of your answer sheet - here (point). Remember you are to put the letter which best describes how many questions you are normally asked in class.

2. Now decide how often you would like to be asked questions in class, if you could be given the choice, and put the letter of the category which best describes how often you would like to be asked after the large 2 on the top of your answer sheet - here (point). Remember you are to put the letter which best describes how many questions you would like to be asked in class if you could choose.

295.

Do not make any marks in this booklet

Mark your answers on the separate answer sheet

VOCABULARY

Directions

We want to find out how many words you know. On the left-hand side of each page, next to the question number, you will see a word printed in capital letters. To the right are five other words printed in small letters and lettered A, B, C, D and E. You are to choose ONE of the words A, B, C, D or E which means the SAME (or most nearly the same) as the word in capital letters. You should then circle the letter which indicates your choice on the separate answer sheet.

Look at Example X, which shows how this is done.

Example X

BATTLE A. Afraid B. Machine C. Fight D. History E. Destroy

"Fight" means the same as "Battle" so the letter C has been circled on the answer sheet.

Now try Example Y yourself. Choose the right answer from the five words in small letters and then circle the letter indicating your choice on the answer sheet, opposite Example Y.

Example Y

ABROAD A. Beyond B. Author C. Deal D. Outline E. Overseas

The one word that means most nearly the same as "Abroad" is "Overseas", so you should have circled the letter E on the answer sheet.

There are fifty questions like these on the three following pages and you have 15 minutes to do them all. Work as quickly and accurately as you can. If you finish before time is called, check your answers. If you are not sure of an answer, select the choice which is your best guess. Have you any questions?

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

1	SHREWD	A. Clever	B. Mean	C. Deliberate	D. Unpleasant	E. Dishonest
2	CHASE	A. Purify	B. Voyage	C. Travel	D. Pursue	E. Select
3	CUSTOMARY	A. Usual	B. Ancient	C. Humane	D. Moderate	E. Mild
4	VAGUE	A. Uncertain	B. Empty	C. Difficult	D. Feeble	E. Timid
5	PRECISE	A. Smooth	B. Tidy	C. Exact	D. Approximate	E. Clear
6	ELEGANT	A. Flowing	B. Healthy	C. Perfumed	D. Brilliant	E. Graceful
7	CONCEAL	A. Advise	B. Hide	C. Repair	D. Trap	E. Secure
8	YEARNING	A. Flaming	B. Feeling	C. Longing	D. Knowing	E. Moulding
9	VIGOROUS	A. Frivolous	B. Talkative	C. Energetic	D. Speedy	E. Rough
10	MODIFY	A. Alter	B. Bruise	C. Control	D. Construct	E. Hazard
11	RESPECT	A. Measure	B. Study	C. Esteem	D. Condemn	E. Review
12	CEASE	A. Forbid	B. Abandon	C. Grab	D. Stop	E. Omit
13	RELUCTANT	A. Weary	B. Dependent	C. Backward	D. Futile	E. Hesitant
14	PROSPECT	A. Review	B. Outlook	C. Wealth	D. Catalogue	E. Success
15	ASCENT	A. Decree	B. Plume	C. Prime	D. Agree	E. Rise
16	INTERPRET	A. Allege	B. Translate	C. Ignore	D. Change	E. Show
17	HAMPER	A. Hinder	B. Cheat	C. Capture	D. Lift	E. Confront
18	RAMBLE	A. Grumble	B. Climb	C. Whisper	D. Pursue	E. Wander
19	CONVENIENT	A. Flowing	B. Gathered	C. Holy	D. Timely	E. Speedy
20	ABSURD	A. Naughty	B. Ridiculous	C. Stupid	D. Dishonest	E. Humorous

GO ON TO THE NEXT PAGE

21	DYE	A. Decay	B. Cloud	C. Gasp	D. Darken	E. Stain
22	COUNSEL	A. Change	B. Advise	C. Remove	D. Purchase	E. Charge
23	INSOLENT	A. Hostile	B. Impudent	C. Afraid	D. Difficult	E. Lonely
24	CONVEY	A. Carry	B. Group	C. Fetch	D. Flock	E. Load
25	BOUNDLESS	A. Adjacent	B. Combustible	C. Unlimited	D. Unknown	E. Magnificent
26	GRANDEUR	A. Explosive	B. Beauty	C. Magnificent	D. Brutality	E. Manoeuvre
27	PROCURE	A. Give	B. Obtain	C. Fasten	D. Store	E. Plant
28	DISTINCT	A. Coloured	B. Sensible	C. Plain	D. Clean	E. Gallant
29	FONDLY	A. Quietly	B. Solemnly	C. Closely	D. Tenderly	E. Gently
30	ATTENTIVE	A. Cautious	B. Intelligent	C. Mindful	D. Kind	E. Honest
31	DISMAL	A. Tragic	B. Embarrassed	C. Empty	D. Weary	E. Dreary
32	DOWNCAST	A. Cloudy	B. Fearful	C. Deep	D. Sad	E. Perplexed
33	QUELL	A. Punish	B. Banish	C. Destroy	D. Subdue	E. Surprise
34	CHASM	A. Abyss	B. Twitch	C. Despair	D. Horror	E. Mistake
35	LITERATE	A. Untidy	B. Educated	C. Faulty	D. Decayed	E. Wasted
36	INFINITE	A. Short	B. Internal	C. Distasteful	D. Eternal	E. Final
37	UPROAR	A. Crash	B. Insult	C. Phase	D. Tumult	E. Disaster
38	HOSTILE	A. Sarcastic	B. Fearful	C. Antagonistic	D. Crowded	E. Enormous
39	APPEASE	A. Pacify	B. Order	C. Incur	D. Silence	E. Loathe
40	CONSOLE	A. Argue	B. Reduce	C. Please	D. Comfort	E. Order

GO ON TO THE NEXT PAGE

41. SINCERE	A. Proper	B. Genuine	C. Courteous	D. Exact	E. Hopeful
42. PROFUSE	A. Abundant	B. Rapid	C. Insulting	D. Enormous	E. Gaudy
43. COUNTERMAND	A. Superscribe	B. Revoke	C. Repair	D. Confound	E. Lacerate
44. LEGIBLE	A. Eatable	B. Permissible	C. Legal	D. Agreeable	E. Readable
45. NOTABLE	A. Honest	B. Unfit	C. Clear	D. Inefficient	E. Eminent
46. PROMINENT	A. Intelligent	B. Helpful	C. Bounteous	D. Conspicuous	E. Courageous
47. KNIGHTLY	A. Saintly	B. Chivalrous	C. Serene	D. Bold	E. Heroic
48. ABSOLUTE	A. Close	B. Direct	C. Complete	D. Vital	E. Timid
49. BEQUEST	A. Separation	B. Property	C. Prayer	D. Legacy	E. Requirement
50. ETHEREAL	A. Doubtful	B. Misty	C. Soluble	D. Humid	E. Heavenly

STOP HERE - GO BACK AND CHECK YOUR ANSWERS

MAKE SURE YOUR ANSWERS ARE CLEARLY MARKED ON THE ANSWER SHEET

APPENDIX D

THE PROGRAMMED TEXT AND INSTRUCTIONS FOR ADMINISTERING IT IN EXPERIMENT THREE

This book is about two animals found in the South Island. These animals are the red deer and the tahr. You will remember that you had a short test about the red deer and the tahr a short time ago to see what you knew about them.

HOW TO USE THIS BOOK

Firstly, put your name on the separate answer booklet in the space provided. All the answers to the questions in this book go in the separate answer booklet.

DO NOT MAKE ANY MARKS ON THIS BOOK

Secondly, take out the coloured photographs and the sheets of maps and other drawings and place them on your desk where you can get them easily.

Thirdly, take out the orange card and place it on the page so that it covers the writing. Slide this card down the page until you come to the first red line running across the page.

Fourthly, keeping the work below the red line covered, read the work you have just uncovered carefully and answer the question which appears just above the red line. All the questions are in capital letters and have a Q before them. Your answer goes in the separate answer booklet beside the appropriate number.

Fifthly, move the card down to the next red line. The answer to the question you have just answered is given below the first red line and has an A in front of it. Mark your answer in the answer booklet with a tick if it is right and a cross if it is wrong. Your answer does not have to be exactly the same as the answer given. If it means the same mark it right.

Sixthly, read on down the page until you come to the next question which you will answer in the same way.

You move right through the book in this way. Use the coloured photographs, maps and drawings when you are told to use them in the book. A short example is given on the next page. Turn over and slide your orange card down to the first red line.

EXAMPLE

The kangaroo, which carries its young in a pouch, is a native of Australia.

Q. 1 WHAT IS AN ANIMAL WHICH CARRIES ITS YOUNG IN A POUCH CALLED?

A. 1 A marsupial. The young kangaroo, which is called a joey, crawls into its mother's pouch as soon as it is born. The joey is very small and weak when it is first born and without a pouch to live in it would die.

Q. 2 WHAT DO WE CALL A YOUNG KANGAROO?

A. 2 A joey.

Q. 3 WHAT WOULD HAPPEN TO THE JOEY IF IT DID NOT HAVE A POUCH TO LIVE IN WHEN IT WAS FIRST BORN?

A. 3 It would die.

Are there any questions?

Carry on, beginning on the next page, and marking all your answers in the separate answer booklet.

You have already been told the names of the animals you will be learning about and one of them is the red deer. There are actually eight members of the deer family, or eight deer species found in New Zealand and their names are in the following list.

The rusa deer
The sambar deer
The sika deer
The fallow deer
The whitetail deer which is sometimes called the Virginia deer
The wapiti which is sometimes called the American elk
The moose (you probably did not know that but we have got moose here) and
The red deer.

Of these, the last five, the ones with green beside them, are found in the South Island. So you can see it is not much use talking about 'deer' - you need to say which deer you mean.

Q. 1 WHICH DEER ARE YOU GOING TO LEARN ABOUT?

A. 1 The red deer.

Q. 2 WHAT IS THE NAME OF THE OTHER ANIMAL YOU WILL BE LEARNING ABOUT?

A. 2 The tahr. Now you will find that the tahr is a very interesting animal. One of the interesting things about it is that you may spell its name in three different ways. You may also pronounce it two different ways.

LIST ONE

Tahr

~~Thar~~

~~Thaar~~

Q. 3 SPELL 'TAHR' AS IT IS WRITTEN AT THE TOP OF LIST ONE.

A. 3 Tahr. This is how we will spell it in this book.

Q. 4 SPELL 'TAHR' AS IT IS WRITTEN IN THE MIDDLE OF LIST ONE.

A. 4 Thar.

Q. 5 SPELL 'TAHR' AS IT IS WRITTEN AT THE BOTTOM OF LIST ONE.

A. 5 Thaar. Because we will be spelling 'tahr' t-a-h-r, and not t-h-a-r or t-h-a-a-r, a cross has been put through the bottom two spellings. This does not mean to say that it is wrong to spell 'tahr' like this, just that we will be spelling it the other way.

LIST TWO

Tar

~~Thar~~

We will pronounce the word 'tar' as at the top of list two but it may also be pronounced 'thar' ('th' as in <u>th</u>in and 'ar' as in f<u>ar</u>) as at the bottom of list two. Because we will pronounce it 'tar' and not 'thar' a cross has been put through 'thar' at the bottom of the list.

The red deer and the tahr are both exotic, feral animals.

Q. 6 WHAT DOES EXOTIC MEAN?

A. 6 Exotic means introduced from abroad. Any animal which is not a native animal and lives here is an exotic animal. Any mammal in New Zealand (except the native bat which is the only native mammal we have here if we do not count the sea mammals like the seal and the whale) and most of the birds found around our cities are exotic, because they were introduced from abroad.

Q. 7 WHAT DOES FERAL MEAN?

A. 7 Feral means wild or undomesticated. There are a number of feral mammals in New Zealand, for example the wild pig, the opossum, the hedgehog, the rabbit, the hare and so on and almost all the birds, except fowls and budgies and birds like that, are also feral or wild.

Q. 8 WHAT IS THE WORD WHICH MEANS INTRODUCED FROM ABROAD?

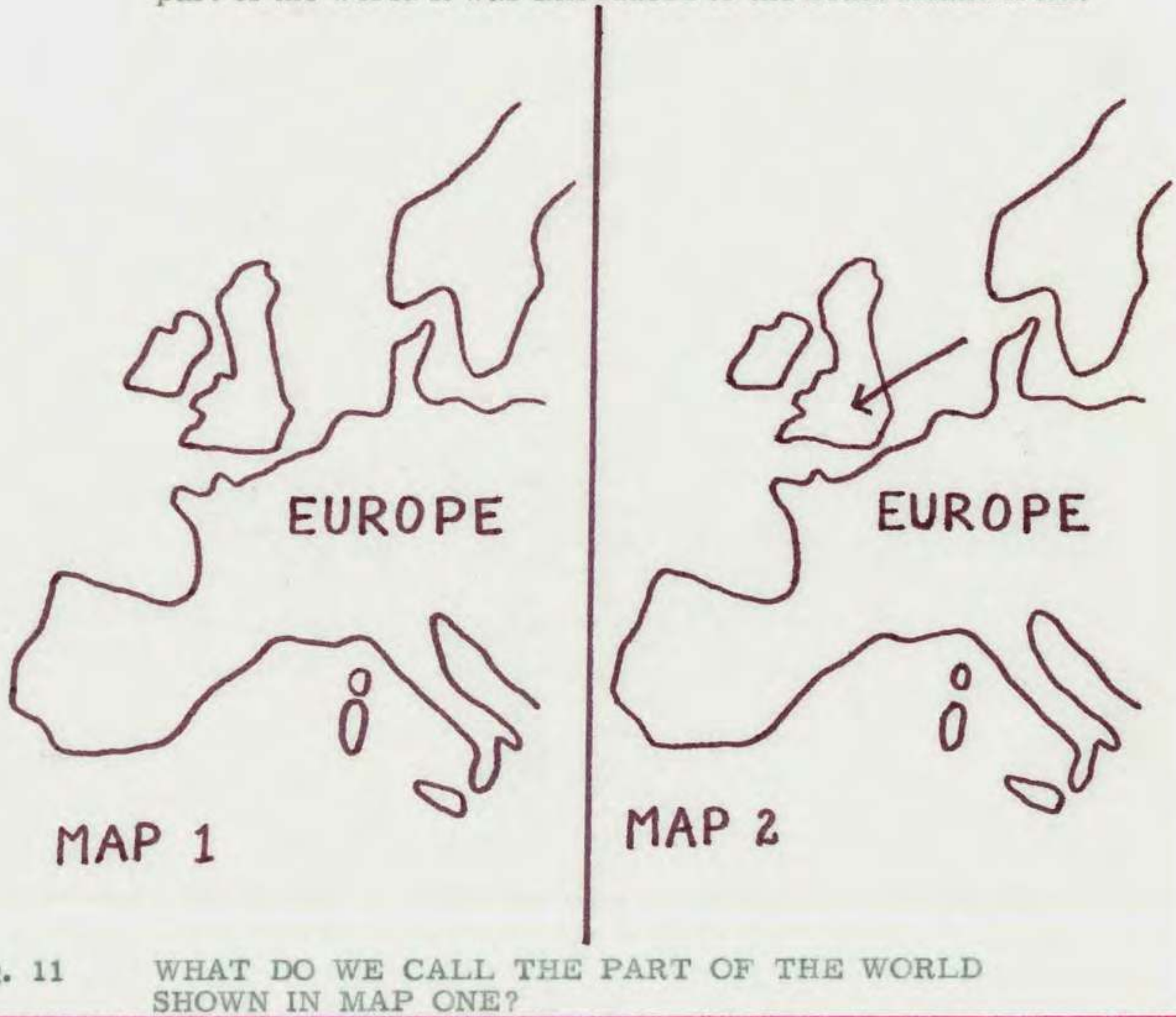
A. 8 Exotic means introduced from abroad.

Q. 9 WHAT IS A WORD WHICH MEANS WILD OR UNDOMESTICATED?

A. 9 Feral means wild or undomesticated.

Q. 10 WHAT ARE THE ANIMALS IN PHOTOGRAPH SET ONE - RED DEER OR TAHR?

A. 10 They are red deer. In a few minutes we will look more closely at these red deer, but we know that the red deer was introduced to the South Island, because we know that it is an exotic animal, so we had better find out which part of the world the red deer is a native of, and which part of the world it was introduced to the South Island from.



Q. 11 WHAT DO WE CALL THE PART OF THE WORLD SHOWN IN MAP ONE?

A. 11 The map is a map of Europe and the red deer is a native of Europe.

Q. 12 WHAT IS THE NAME OF THE COUNTRY WITH THE ARROW POINTING TO IT IN MAP TWO?

A. 12 The country is England and the red deer in the South Island were introduced from England. In 1851 one male and one female red deer were liberated near Nelson after being brought here by ship from England. However, the female was shot not long afterwards and so they did not breed. And then in 1861, two female and one male red deer were brought out from England and again liberated near Nelson, and this time they bred and established themselves, and so the first successful liberation was in 1861. We have mentioned the male red deer and the female red deer so we had better find out the names we give to the male, female, and young red deer and some of the characteristics which they have.

Q. 13 WHICH OF THE ANIMALS IN PHOTOGRAPH SET ONE IS THE MALE RED DEER - THE ONE ON THE LEFT, THE ONE IN THE MIDDLE, OR THE ONE ON THE RIGHT?

A. 13 The animal on the left is the male red deer.

Q. 14 HOW CAN YOU TELL IT IS A MALE RED DEER?

A. 14 You can tell that the animal on the left is the male red deer because he has antlers on his head. The female red deer does not have antlers as you can see in the middle picture.

Q. 15 WHAT DO WE CALL A MALE RED DEER?

A. 15 A male red deer is called a stag.

Q. 16 WHAT DO WE CALL A FEMALE RED DEER?

A. 16 A female red deer is called a hind. The animal on the right in photograph set one is a young red deer.

Q. 17 WHAT DO WE CALL A YOUNG RED DEER?

A. 17 A young red deer is called a fawn.

Q. 18 WHAT DO YOU NOTICE ABOUT THE FAWN'S COAT?

A. 18 The fawn's coat is spotted until it is about three months old and then it loses it spots. The stag is roughly the same shape and size as a horse. He weighs about 300 pounds which gives you some idea of how big he is. The hind is smaller and lighter and would weigh about 200 pounds, or about two-thirds of the stag's weight. The difference in size can be a help in telling a stag from a hind around October. Each October the stag loses his antlers and begins to grow a new set and while these new antlers are growing the stag is without antlers just like the hind. However, his size gives us a clue that he is a stag and not a hind. The stag also has a short mane around his neck which is hard to see in photograph set one because of the way he is standing, and this also helps to tell him from a hind.

Q. 19 HOW BIG IS THE STAG'S TAIL?

A. 19 Red deer, both stags and hinds, have a short stumpy tail about six inches long.

Q. 20 WHAT DO YOU NOTICE ABOUT THE COLOUR OF THE STAG'S RUMP AROUND THE TAIL?

A. 20 Red deer, both stags and hinds, have a light coloured rump patch.

Q. 21 WHICH COUNTRY WERE THE RED DEER IN THE SOUTH ISLAND INTRODUCED FROM?

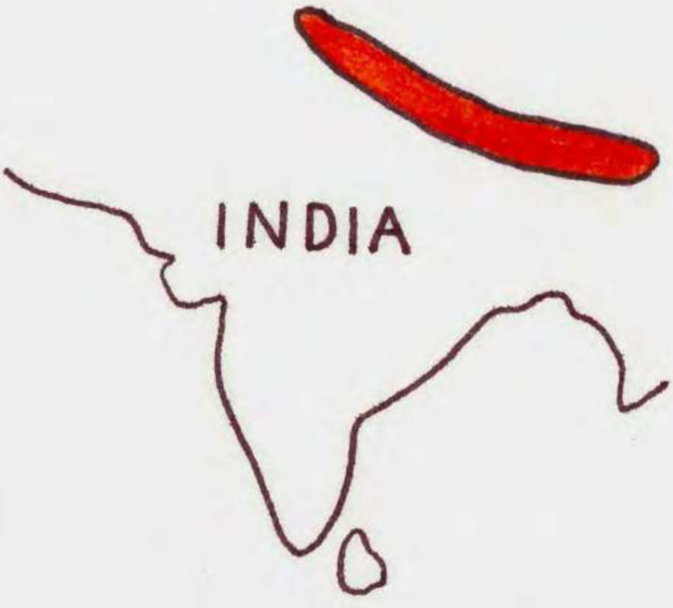
A. 21 The red deer in the South Island were introduced from England.

Q. 22 WHICH PART OF THE WORLD IS THE RED DEER A NATIVE OF?

A. 22 The red deer is a native of Europe.

Q. 23 WHAT ARE THE ANIMALS IN PHOTOGRAPH SET TWO?

A. 23 They are tahr. Photograph set two shows the tahr so if you have not seen a tahr, or a picture of a tahr, before you will now have some idea of what they are like. The tahr is exotic so we had better see where it comes from.



Q. 24 WHAT IS THE NAME OF THE COUNTRY IN THIS MAP?

A. 24 The map is a map of India.

Q. 25 WHAT IS THE VERY HIGH RANGE OF MOUNTAINS COLOURED IN IN ORANGE?

A. 25 The mountains are the Himalayan Mountains and the tahr is a native of the Himalayan Mountains in Northern India. Shortly before this century some tahr were taken to England from the Himalayan Mountains and they were kept in a park for wild animals there. In 1904 three male and three female tahr were shipped to New Zealand from this park in England. On the way, one of the males jumped overboard and drowned, but the others all arrived safely and were liberated near Mount Cook, where they became established. So the first successful liberation of the tahr in the South Island was in 1904, and, surprizingly enough, the animals actually came from England although they were originally taken there from the Himalayan Mountains in Northern India.

Q. 26 WHICH OF THE ANIMALS IN PHOTOGRAPH SET TWO IS THE MALE TAHR - THE ONE ON THE LEFT, THE ONE ON THE RIGHT, OR THE ONE IN THE MIDDLE?

A. 26 The tahr on the right is the male tahr and he has the same name as a very large animal with horns found on our farms.

Q. 27 WHAT DO WE CALL THE MALE TAHR?

A. 27 The male tahr is called a bull.

Q. 28 HOW CAN YOU TELL A STAG FROM A HIND MOST EASILY EXCEPT AROUND OCTOBER?

A. 28 Except around October, we can tell a stag from a hind most easily by his antlers. The bull tahr has not got antlers.

Q. 29 WHAT HAS HE GOT INSTEAD OF ANTLERS?

A. 29 Instead of having antlers like the stag, the bull tahr has horns.

Q. 30 DOES THE FEMALE TAHR HAVE HORNS?

A. 30 Both the bull tahr and the female tahr have horns so we cannot tell a bull from a female by looking to see which has horns and which has not.

However, the bull tahr has something around his neck which the female tahr has not got around her neck and we can use this to distinguish one from the other.

Q. 31 WHAT IS IT THAT THE BULL TAHR HAS GOT AROUND HIS NECK?

A. 31 The bull tahr has a mane around his neck while the female tahr has not. This mane has a special name - it is called a ruff.

Q. 32 WHAT DO YOU CALL THE BULL TAHR'S MANE?

A. 32 The bull tahr's mane is called a ruff. The female tahr and the young tahr have the same names as the female goat and the young goat.

Q. 33 WHAT DO WE CALL A FEMALE TAHR?

A. 33 The female tahr is called a nanny.

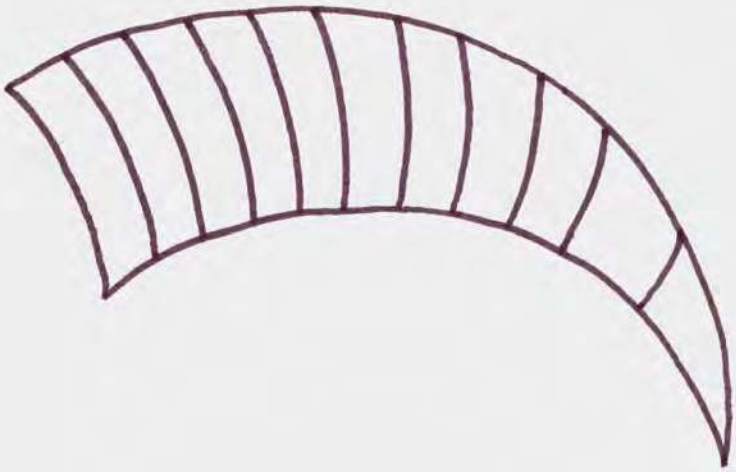
Q. 34 WHAT DO WE CALL THE YOUNG TAHR?

A. 34 The young tahr is called a kid. The bull tahr is not as big as the stag. In shape and size he is a bit like a large goat with long hair and he weighs about 200 pounds which is as much as the hind weighs. The nanny tahr is smaller and lighter than the bull. She weighs less than half his weight - about 80 pounds and, as you can see in photograph set two, she looks very much like a goat.

It is no wonder that the tahr looks like a goat because it is a member of the goat family and it is sometimes called the Himalayan Mountain Goat.

Q. 35 WHY DO YOU THINK IT IS CALLED THAT?

A. 35 The tahr is sometimes called the Himalayan Mountain Goat because it is a member of the goat family and it is a native of the Himalayan Mountains. The tahr does not lose its horns each year but they keep growing throughout life. Each year a new piece is added and that makes a ring on the horn. By counting these rings you can see how old the tahr is.



Q. 36 HOW OLD IS THIS TAHR?

A. 36 This tahr is eleven years old. You cannot tell how old a stag is from his antlers because the size of his antlers depends on a number of things, such as the feed he is getting, and they may be smaller this year than they were last year.

Q. 37 WHAT DOES HABITAT MEAN?

A. 37 Habitat means the area in which an animal lives.

Q. 38 WHAT DOES FERAL MEAN?

A. 38 Feral means wild or undomesticated. If the red deer and the tahr are feral or undomesticated they will not live on farms so let us find out what their habitats in the South Island are.

Q. 39 ABOUT HOW MANY POUNDS DOES THE BULL TAHR WEIGH?

A. 39 The bull tahr weighs about 200 pounds.

Q. 40 ABOUT HOW MANY POUNDS DOES THE NANNY TAHR WEIGH?

A. 40 The nanny tahr weighs about 80 pounds.

Q. 41 IN WHICH YEAR WAS THE TAHR FIRST INTRODUCED TO THE SOUTH ISLAND?

A. 41 The tahr was first introduced to the South Island in 1904.

Look at map set one. The three maps show, on the left, the tahr's habitat in the South Island, on the right, the red deer's habitat in the South Island and the map in the middle shows the height of the land in the South Island.

Q. 42 WHAT DO WE CALL A MAP WHICH SHOWS THE HEIGHT OF THE LAND IN A COUNTRY?

A. 42 A map which shows the height of the land in a country is called a relief map. Relief map is written at the top of the middle map. Look at the relief map for a moment.

Q. 43 WHAT COLOUR IS THE LAND ABOVE 6,000 FEET ON THE RELIEF MAP?

A. 43 The land above 6,000 feet has been coloured blue.

Q. 44 WHAT COLOUR IS THE LAND BELOW 1,200 FEET ON THE RELIEF MAP?

A. 44 The land below 1,200 feet has been coloured green.

Q. 45 WHAT COLOUR IS THE LAND ABOVE 1,200 FEET BUT BELOW 6,000 FEET ON THE RELIEF MAP?

A. 45 The land between 1,200 feet and 6,000 feet is white.

Now have a look at the map of the red deer's habitat which is the one on the right.

Q. 46 IS THE RED DEER FOUND ON THE LAND BELOW 1,200 FEET GENERALLY SPEAKING?

A. 46 The red deer is not usually found on the land below 1,200 feet. There is one other area on the map where the red deer is not found.

Q. 47 WHAT IS THIS LAND LIKE IN TERMS OF ITS HEIGHT?

A. 47 The red deer is not found on the high mountains above 6,000 feet. So generally speaking, the red deer, in the South Island, is found between 1,200 and 6,000 feet. Look at the map of the tahr's habitat which is the map on the left.

Q. 48 WHAT HEIGHT IS THE LAND ON WHICH THE TAHR IS FOUND GENERALLY SPEAKING?

A. 48 Generally speaking, we can say that the tahr is found in the high areas of the South Island above about 5,000 feet. You learnt before that the red deer and the tahr are exotic or introduced animals. Read principle one below.

PRINCIPLE ONE

Man always has reasons
for introducing animals to
countries in which they are
not naturally found.

Let us see why the red deer and the tahr were introduced to the South Island.

You may have a father or an older brother with a rifle at home.

Q. 49 GIVE ONE REASON FOR THE INTRODUCTION OF THE RED DEER AND THE TAHR TO THE SOUTH ISLAND.

A. 49 Sport. The red deer and the tahr were introduced to the South Island for shooting, and shooting is a sport, so they were introduced for sport. Sport was the only reason for the introduction of the tahr but the red deer was also introduced for two other reasons.

Q. 50 WHAT IS THE MEAT FROM THE RED DEER CALLED?

A. 50 Red deer meat is called venison.

Q. 51 GIVE A SECOND REASON FOR THE INTRODUCTION OF THE RED DEER TO THE SOUTH ISLAND.

A. 51 The red deer was introduced to the South Island for meat or venison, as well as for sport. The skins at the front of the room will help you get the third reason.

Q. 52 GIVE THE THIRD REASON FOR THE INTRODUCTION OF THE RED DEER TO THE SOUTH ISLAND.

A. 52 Red deer were introduced for their skins, which are used to make all kinds of leather goods.

Today both the red deer and the tahr are used for all three purposes. We hunt them for sport, we export the meat and skins from both animals, and we also use their meat and skins here ourselves.

Q. 53 NAME AS MANY OF THE DEER SPECIES FOUND IN NEW ZEALAND AS YOU CAN.

A. 53 The eight deer species found in the country are: the red deer, the fallow deer, the rusa deer, the sika deer, the sambar deer, the whitetail or Virginia deer, the wapiti or American elk, and the moose.

Q. 54 HOW MANY OF THESE SPECIES ARE FOUND IN THE SOUTH ISLAND?

A. 54 There are five deer species in the South Island.

Q. 55 WHAT DO WE CALL THE TAHR'S MANE?

A. 55 The tahr's mane is called a ruff.

Q. 56 HOW MANY WAYS MAY YOU PRONOUNCE 'TAHR'?

A. 56 'Tahr' may be pronounced two ways.

Q. 57 ABOUT HOW MUCH DOES THE STAG WEIGH?

A. 57 The stag weighs about 300 pounds.

Q. 58 ABOUT HOW MANY POUNDS DOES THE HIND WEIGH?

A. 58 The hind weighs about 200 pounds.

Q. 59 ABOUT HOW MANY POUNDS DOES THE NANNY TAHR WEIGH?

A. 59 The nanny tahr weighs about 80 pounds.

Q. 60 ABOUT HOW MANY POUNDS DOES THE BULL TAHR WEIGH?

A. 60 The bull tahr weighs about 200 pounds.

Q. 61 DURING WHICH MONTH DOES THE STAG LOSE HIS ANTLERS?

A. 61 The stag loses his antlers in October.

Q. 62 IN WHICH YEAR WAS THE RED DEER FIRST INTRODUCED TO THE SOUTH ISLAND?

A. 62 The red deer was first introduced to the South Island in 1851.

Q. 63 HOW MANY MALE RED DEER WERE LIBERATED IN THE FIRST LIBERATION OF RED DEER IN THE SOUTH ISLAND?

A. 63 One male and one female red deer were liberated in the first liberation in the South Island.

Q. 64 IN WHICH YEAR WAS THE FIRST SUCCESSFUL LIBERATION OF RED DEER IN THE SOUTH ISLAND?

A. 64 The first successful liberation of red deer in the South Island was in 1861.

Q. 65 HOW MANY FEMALE RED DEER WERE LIBERATED IN THE FIRST SUCCESSFUL LIBERATION OF RED DEER IN THE SOUTH ISLAND?

A. 65 Two female and one male red deer were liberated in the first successful liberation of red deer in the South Island.

Q. 66 HOW MANY FEMALE TAHR WERE LIBERATED IN THE SOUTH ISLAND IN THE FIRST LIBERATION IN 1904?

A. 66 Three female and two male tahr were liberated in the first liberation of tahr in the South Island.

Q. 67 THE RED DEER IS SELDOM FOUND BELOW ABOUT HOW MANY FEET?

A. 67 The red deer is seldom found below about 1, 200 feet or above 6, 000 feet.

Q. 68 NAME AS MANY OF THE DEER SPECIES FOUND IN NEW ZEALAND AS YOU CAN?

A. 68 The sika deer, the sambar deer, the rusa deer, the fallow deer, the whitetail or Virginia deer, the wapiti or American elk, the moose, and the red deer.

Q. 69 WHY DID THE FIRST LIBERATION OF RED DEER IN THE SOUTH ISLAND FAIL?

A. 69 The first liberation of red deer in the South Island failed because the hind was shot.

We have already found out what the red deer's habitat in the South Island is like and what the tahr's habitat in the South Island is like so we had better find out what the environments would be like in these habitats.

Q. 70 WHAT DOES ENVIRONMENT MEAN?

A. 70 Environment means the conditions in which an animal lives.

Q. 71 WOULD IT BE VERY COLD IN THE TAHR'S ENVIRONMENT?

A. 71 The tahr lives in a very cold environment as you can tell from all the snow in the background of photograph set two, and of course, we have already learnt that the tahr lives high up in the mountains where it is cold.

Q. 72 WOULD THE RED DEER'S ENVIRONMENT BE AS COLD AS THE TAHR'S ENVIRONMENT?

A. 72 The tahr's environment is colder than the red deer's but the red deer still lives in a fairly cold environment as you can see from the snow up on the tops of the mountains in photograph set one. Read principle two below.

PRINCIPLE TWO

Animals have bodies which suit them to their environments and help them to survive in those environments.

Q. 73 WHAT SORT OF SKIN OR COAT WOULD A RED DEER OR A TAHR NEED IF IT WERE TO BE SUITED TO THE COLD CONDITIONS IN WHICH IT LIVES?

A. 73 If principle two is true, we would expect the red deer and the tahr to have warm skins or coats. The skins at the front of the room are a red deer skin and a tahr skin. If you look closely at these two skins you will see that they are both fairly warm, which supports principle two.

Q. 74 WHICH ANIMAL WOULD HAVE THE WARMER COAT, THE RED DEER OR THE TAHR?

A. 74 We would expect the tahr to have a warmer coat than the red deer.

Q. 75 WHY WOULD WE EXPECT THE TAHR TO HAVE A WARMER COAT THAN THE RED DEER?

A. 75 We would expect the tahr to have a warmer coat than the red deer because it lives in a colder environment.

Q. 76 WHICH OF THE TWO SKINS AT THE FRONT OF THE ROOM IS THE TAHR SKIN, THE ONE ON THE LEFT OR THE ONE ON THE RIGHT?

A. 76 The skin on the left is the tahr skin. The skin on the left has the longer hair and it also has very fine wool next to the skin.

Go up quietly to the front of the room and look for the fine wool next to the skin.

Q. 77 IS THE TEMPERATURE THE SAME ALL THE YEAR ROUND OR DOES IT CHANGE WITH THE SEASONS?

A. 77 The temperature varies with the seasons. Principle two tells us that animals have bodies which suit them to their environments and help them to survive in those environments.

Q. 78 DO YOU THINK THE RED DEER AND THE TAHR WILL HAVE COATS WHICH ARE OF THE SAME WARMTH ALL YEAR ROUND OR WOULD YOU EXPECT THEM TO VARY WITH THE SEASONS?

A. 78 We would expect the coats to vary with the seasons.

Q. 79 DURING WHICH SEASON WOULD YOU EXPECT THE TAHR TO HAVE THE WARMEST COAT?

A. 79 We would expect the tahr to have its thickest coat in winter when the weather is coldest and this is what we find. Another example of principle two is that the red deer and the tahr are both ruminants. The cow is a ruminant and we say she chews something.

Q. 80 WHAT IS IT THAT THE COW CHEWS?

A. 80 The cow chews the cud.

Q. 81 WHAT IS A RUMINANT THEN?

A. 81 A ruminant is an animal which chews the cud.

Q. 82 WHAT IS THIS CUD WHICH A RUMINANT CHEWS?

A. 82 The cud is a ball of regurgitated food.

Q. 83 WHAT DOES THIS WORD REGURGITATE MEAN?

A. 83 Regurgitate means to bring food from the stomach to the mouth. Actually it is not quite as simple as this because a ruminant has more than one part to its stomach. Look at diagram set one which shows what a ruminant's stomach is actually like.

Q. 84 HOW MANY PARTS ARE THERE ALTOGETHER IN A RUMINANT'S STOMACH?

A. 84 There are four parts to a ruminant's stomach. When a ruminant collects its food it swallows it without chewing it and it passes into the largest part of the stomach where it is stored. The large black arrow shows what happens.

Q. 85 WHAT IS THE NAME OF THE PART OF THE STOMACH IN WHICH A RUMINANT STORES ITS FOOD?

A. 85 The unchewed food passes into the paunch when the ruminant swallows it and it is here that it is stored.

When the paunch is full the animal goes to a safe place to digest the stored food. The food in the paunch passes into the second part of the stomach, a little at a time, and here it is made into cud. The small black arrow shows what happens.

Q. 86 WHAT IS THE SECOND PART OF THE STOMACH CALLED?

A. 86 The second part of a ruminant's stomach is called the honeycomb and it is here that the stored food is made into cud. The cud is then regurgitated, and as the orange arrow shows, it passes back up into the mouth.

Q. 87 IS THE FOOD CHEWED OR NOT AT THIS STAGE?

A. 87 The cud is a ball of unchewed food. When the cud gets to the mouth the animal chews it up thoroughly and swallows it for the second time, and it goes down into the third part of the stomach. The blue arrow shows what happens.

Q. 88 WHAT IS THE THIRD PART OF A RUMINANT'S STOMACH CALLED?

A. 88 The third part of a ruminant's stomach is called the manyplies. From the manyplies the food passes into the fourth part of the stomach and down through the rest of the system and is digested.

Q. 89 WHAT IS THE FOURTH PART OF THE STOMACH CALLED?

A. 89 The fourth part of the stomach is called the belly.

Ruminants are plant eating animals.

Q. 90 WHAT DO WE CALL A PLANT EATING ANIMAL?

A. 90 A plant eating animal is called a herbivor. Herbivors eat a large volume of food in a day when compared with meat eating animals of equal size because plants are a less concentrated food than meat. The exact amount red deer and tahr eat in a day is not known but the cow eats about 150 pounds of grass each day which is a lot of food.

Q. 91 IF A RUMINANT HAD TO CHEW EVERY MOUTHFUL OF THIS LARGE VOLUME OF FOOD AS IT COLLECTED IT, WOULD IT TAKE A LONG TIME TO GATHER IT?

A. 91 If ruminants had to chew every mouthful of their food before they swallowed it they would take a long time to gather it. Because they do not have to chew every mouthful as they collect it they are able to gather it in a fairly short time.

Q. 92 WHAT WAS THE REASON FOR THE INTRODUCTION OF BOTH THE RED DEER AND THE TAHR TO THE SOUTH ISLAND?

A. 92 The red deer and the tahr were both introduced to the South Island because they can be hunted for sport. Back in the countries they came from they were not only hunted by men, but also by other animals.

There is a special word for an animal which hunts or preys upon other animals.

Q. 93 WHAT IS THIS WORD?

A. 93 An animal which hunts or preys upon other animals is a predator. While we do not usually call man a predator we will in this book because man hunts the red deer and the tahr. Read principle two below.

PRINCIPLE TWO

Animals have bodies which suit them to their environments and help them to survive in those environments.

Now we have all the facts to apply our principle to. Red deer and tahr have predators in their environments which they must escape from if they are to survive. They are both herbivors, which means that they need to collect a lot of food to give them the energy they need, and they are both ruminants which means that they can collect their food quickly because they do not have to chew it as they collect it.

Q. 94 EXPLAIN HOW BEING RUMINANTS MIGHT HELP THE RED DEER AND THE TAHR TO KEEP OUT OF THEIR PREDATOR'S WAY AND SO HELP THEM TO SURVIVE.

A. 94 This is in fact what happens. The red deer and the tahr come out early in the morning and in the evening and collect their food and store it in the paunch. Then they go away to a safe place and hide, regurgitate the food, chew it, and digest it. During the time they are hiding they are out of the way of their predators and therefore they are more likely to survive. Of course you can see how this illustrates principle two very nicely. Now let us have a look at another example of principle two.

Q. 95 WHAT ARE THE THREE SENSES WHICH AN ANIMAL CAN USE TO DETECT ITS PREDATORS?

A. 95 An animal can use smell, hearing, and sight to detect its predators. Principle two states that animals have bodies which suit them to their environments and help them to survive in those environments.

Q. 96 BEARING IN MIND PRINCIPLE TWO DO YOU THINK THE RED DEER AND THE TAHR WOULD HAVE GOOD SENSES?

A. 96 Both the red deer and the tahr live in environments in which there are predators they need to detect, and so we would expect them to have good senses which they both have. Now while it is true that the red deer and the tahr have very good senses, it is also true that each animal uses one sense more than the others in detecting its predators.

Q. 97 DO YOU THINK THE RED DEER AND THE TAHR WOULD USE THE SAME SENSE AS THEIR MOST IMPORTANT SENSE?

A. 97 Red deer and tahr rely on different senses as their most important sense.

Q. 98 WHY SHOULD THIS BE SO?

A. 98 Red deer and tahr live in different environments, and they rely most on the sense which works best in their particular environment. Let us see which sense the red deer relies on most.

Look at photograph set one.

Q. 99 IS THERE MUCH BUSH IN THE RED DEER'S ENVIRONMENT?

A. 99 There is a lot of bush in the red deer's environment.

Q. 100 WOULD THE SENSE OF SIGHT BE VERY USEFUL IN DETECTING PREDATORS IN THE BUSH IN WHICH THE RED DEER LIVES?

A. 100 Because the bush provides cover behind which a predator could hide, the sense of sight is not as effective in bushy country as it is in open country where the view is not obstructed. We would not expect the red deer to rely most on its sense of sight and this is exactly what we find.

Q. 101 WHICH WOULD BE MORE IMPORTANT IN DETECTING APPROACHING PREDATORS, THE ABILITY TO SEE COLOUR, OR THE ABILITY TO SEE MOVEMENT?

A. 101 The ability to see movement is more important in detecting predators than is the ability to see colour. If you think of the T.V., which is in black and white, you will realize that we can get along without colour vision quite well. The red deer is colour blind but it is very good at seeing movement. Generally speaking the red deer's sense of sight is about as good as our own.

Look at photograph set one.

Q. 102 ARE THERE ANY RIVERS AND STREAMS IN THE RED DEER'S ENVIRONMENT?

A. 102 There are rivers and streams in the red deer's environment which make a lot of noise because they are fast flowing. It is also fairly easy to walk silently in the bush because of the moss on the ground and because the trees absorb the noise.

Q. 103 WOULD YOU EXPECT THE RED DEER TO RELY ON ITS SENSE OF HEARING AS ITS MOST IMPORTANT SENSE?

A. 103 We would not expect the red deer to rely on its sense of hearing as its most important sense because of the rivers and streams, moss, and trees and this is what we find.

Q. 104 WHICH SENSE DOES THE RED DEER RELY ON AS ITS MOST IMPORTANT SENSE?

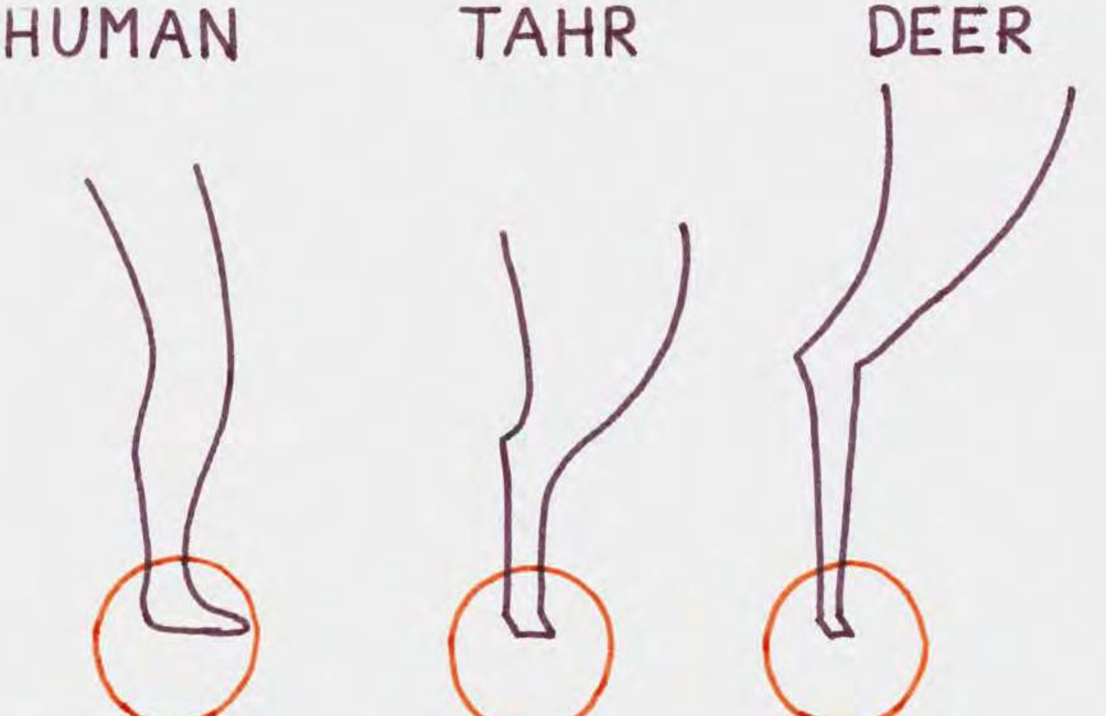
A. 104 The sense of smell is the red deer's most important sense. While an animal can move fairly silently through the bush without being seen it cannot cover up its scent. The red deer's sense of smell is very well developed and some people have suggested that it is 100 times as good as our own.

Q. 105 WHAT IS THE TAHR'S ENVIRONMENT LIKE, OPEN OR BUSH COVERED?

A. 105 The tahr lives in an open environment.

Q. 106 WHICH SENSE SHOULD BE THE MOST USEFUL TO THE TAHR IN AN ENVIRONMENT LIKE THIS?

A. 106 The sense of sight is the most useful in an open environment and this is the sense which the tahr relies on mostly. The tahr has a very well developed sense of sight and, while they are not as well developed as its sense of sight, the tahr's sense of smell and sense of hearing are good too. What you have learnt about the senses of the red deer and the tahr illustrates principle two very well - animals have bodies which suit them to their environments and help them to survive in those environments. A fourth example of principle two is that the red deer and the tahr are both ungulates.



This drawing of a man's leg, a tahr's leg, and a red deer's leg will help you to work out what an ungulate is. The important part of the leg has been circled in orange.

Q. 107 WHAT DO YOU CALL THE PART OF THE MAN'S LEG WHICH HAS BEEN CIRCLED IN ORANGE?

A. 107 The man's foot has been circled.

Q. 108 WHAT DO YOU CALL THE PART OF THE RED DEER'S LEG WHICH HAS BEEN CIRCLED IN ORANGE?

A. 108 The red deer's hoof has been circled in orange. Both the red deer and the tahr are ungulates while the man is not.

Q. 109 WHAT IS AN UNGULATE?

A. 109 An ungulate is a hoofed animal. Principle two tells us that being ungulates should help the red deer and the tahr to survive so let us see how it does. We will deal with each animal separately because each is helped in a slightly different way. Look at diagram set two. This is a drawing of a man's leg showing the bones and a red deer's leg also showing the bones. The two lines running across the drawings divide the legs up into three parts.

Q. 110 WHICH PART OF THE MAN'S LEG DOES THE TOP LINE RUN THROUGH?

A. 110 The top line runs through the man's knee.

Q. 111 WHICH PART OF THE MAN'S LEG DOES THE BOTTOM LINE RUN THROUGH?

A. 111 The bottom line runs through the man's ankle.

Q. 112 WHAT IS THE PART OF THE RED DEER'S LEG THAT THE TOP LINE RUNS THROUGH EQUIVALENT TO ON THE MAN'S LEG?

A. 112 The top line runs through the equivalent of the man's knee.

Q. 113 WHAT IS THE PART OF THE RED DEER'S LEG THAT THE BOTTOM LINE RUNS THROUGH EQUIVALENT TO ON THE MAN'S LEG?

A. 113 The bottom line runs through the equivalent of the man's ankle. You can see that the lines divide the legs up into equivalent parts.

Q. 114 WHAT IS THE PART OF THE RED DEER'S LEG BELOW THE BOTTOM LINE EQUIVALENT TO ON THE MAN'S LEG?

A. 114 It is equivalent to the man's foot. Man stands flat on his foot while the red deer stands on the tips of its toes. By tipping on to the tips of its toes the red deer has a longer leg than it would otherwise have. You will probably have noticed that sprinters at the Olympic Games have fairly long legs.

Q. 115 HOW IS BEING AN UNGULATE GOING TO AFFECT THE RED DEER'S RUNNING ABILITY?

A. 115 Being an ungulate helps the red deer run faster by increasing the length of its leg.

Q. 116 WHAT WOULD HAPPEN TO YOUR TOES IF YOU TRIED TO STAND ON THE TIPS OF THEM IN BARE FEET?

A. 116 If you try to stand on the tips of your toes in bare feet your toes bend. The red deer's hoof, like all other ungulates' hooves, is made of the same material as your toe nails. This hard material provides a band around the toes which stops them from bending. This helps the red deer to run fast by providing support for the toes.

Earlier in this book we said that the red deer is a bit like a horse in shape. Horses can run fast and they are ungulates too. The red deer is built for speed because of its long leg and protecting hoof.

Q. 117 WHICH ANIMAL HAS THE LONGER LEG, THE RED DEER OR THE TAHR?

A. 117 The red deer has a longer leg than the tahr.

Q. 118 IS THE TAHR BUILT AS MUCH FOR SPEED AS THE RED DEER?

A. 118 The tahr is not built as much for speed as the red deer is, but it is helped by being an ungulate just as the red deer is.

Q. 119 WHAT SORT OF A CLIMBER WOULD THE TAHR HAVE TO BE IF IT WERE TO SURVIVE IN THE ENVIRONMENT YOU CAN SEE IN THE PICTURES OF THE TAHR IN PHOTOGRAPH SET ONE?

A. 119 Because it lives in a very steep environment the tahr must be a good climber. If it were not a good climber it would fall and be killed.

Q. 120 WHICH ANIMAL HAS THE MORE POWERFUL LEG, THE RED DEER OR THE TAHR?

A. 120 The tahr has a more powerful leg than the red deer.

Q. 121 WHICH LEG WOULD BE BETTER SUITED TO CLIMBING UP STEEP CLIFFS AND JUMPING FROM ROCK TO ROCK, A SHORTER MORE POWERFUL ONE OR A LONGER THINNER ONE?

A. 121 A leg, the shape of the tahr's, is better suited to climbing than one like the red deer's. You can see that while the tahr's leg is shorter than the red deer's, the fact that the tahr is an ungulate gives it a longer leg than it would otherwise have. The tahr has something even more important than the shape of its leg which helps it to climb well and that is its very special hoof.

This drawing shows a tahr's hoof looking at it from the bottom.
The drawing is of one leg.

Q. 122 WHAT ARE THE TIPS OF THE HOOF LIKE?

A. 122 The tahr has a very pointed hoof which is much more pointed than the red deer's. The black part around the edge is called a horny rim which is a hard raised piece around the outside of the hoof. The orange part is a soft pad which is inside the horny rim.

Q. 123 HOW MANY TOES HAS THE TAHR GOT ON EACH FOOT?

A. 123 The tahr has two toes on each foot like the red deer. Because of this, the red deer and the tahr are both two toed ungulates. The horse is a one toed ungulate and so is a little different from the red deer and the tahr. The tahr's toes can move independently because they are split up the middle.

The tahr uses the point of its hoof and its horny rim to get a grip in the small nitches in the rock. Because it can move its toes independently the tahr can get a better grip than it could if its toes could only move together. The soft pad helps it to get a grip on the flatter rocks. The tahr is suited to climbing because of its powerful leg and its special hoof. There are some other things which help the tahr to climb well. For example, its very good eyesight, which we have already mentioned, and its very good sense of balance, but we will not worry any more about these.

Q. 124 IN WHICH PART OF A RUMINANT'S STOMACH IS THE CUD MADE?

A. 124 The cud is made in the honeycomb.

Q. 125 AFTER THE CUD HAS BEEN CHEWED WHICH PART OF THE STOMACH DOES IT PASS INTO?

A. 125 The cud passes into the manyplies after it has been chewed.

Q. 126 INTO WHICH PART OF A RUMINANT'S STOMACH DOES THE FOOD PASS LAST?

A. 126 The food passes into the belly last and from there into the rest of the system and is digested.

Q. 127 WHAT IS A HOOFED ANIMAL CALLED?

A. 127 A hoofed animal is called an ungulate.

Q. 128 WHAT IS AN ANIMAL WHICH CHEWS THE CUD CALLED?

A. 128 An animal which chews the cud is called a ruminant.

Q. 129 ABOUT HOW MANY POUNDS OF FOOD DOES A COW EAT IN A DAY?

A. 129 A cow eats about 150 pounds of food each day.

Q. 130 IT HAS BEEN SAID THAT THE RED DEER'S SENSE OF SMELL IS HOW MANY TIMES BETTER THAN OUR OWN?

A. 130 It has been suggested that the red deer's sense of smell is 100 times better than our own. Now we know that the temperatures in the environments in which the red deer and the tahr live vary with the season and that the temperatures are coldest in winter.
Read principle three below.

PRINCIPLE THREE

Animals behave in ways suited to their bodies and their environments which helps them to survive.

Q. 131 WHICH SEASON WOULD BE THE WORST FOR THE KIDS AND FAWNS TO BE BORN IN?

A. 131 Winter is the worst season for the kids and fawns to be born in.

Q. 132 WHY IS WINTER THE WORST SEASON FOR THE KIDS AND FAWNS TO BE BORN IN?

A. 132 Winter is the worst season for the kids and fawns to be born in because it is the coldest season. New born animals are not very strong, and if they were born in the winter many of them would die of the cold, so it is better if they are born in the warmer half of the year. The warmer half of the year would be from mid October to mid April, roughly speaking.

Q. 133 WOULD IT BE BETTER FOR THE KIDS AND FAWNS TO BE BORN NEARER THE BEGINNING OR THE END OF THE WARMER HALF OF THE YEAR?

A. 133 It is better for the kids and fawns to be born near the beginning of the warmer half of the year.

Q. 134 WHY IS IT BETTER FOR THE KIDS AND FAWNS TO BE BORN AT THIS TIME?

A. 134 If the kids and fawns are born near the beginning of the warmer half of the year it gives them time to grow strong before the winter comes. So it would be better if they were born from mid October to mid January rather than from mid January to mid April.

Now, if the kids and fawns are to be born in these months, the red deer and the tahr must mate earlier than this because they have a gestation period of several months.

Q. 135 WHAT IS THE GESTATION PERIOD?

A. 135 The gestation period is the time from mating to the birth of the young. The gestation period of the red deer is about eight months, so if the fawns are to be born from mid October to mid January the red deer must mate eight months earlier than this. Principle three tells us this should be so. Let us see what we actually find.

Q. 136 HOW LONG IS THE RED DEER'S GESTATION PERIOD?

A. 136 The red deer's gestation period is about eight months. In New Zealand red deer mate from the middle of March through to the middle of May, with most of the mating taking place in April. The fawns are born eight months later from the middle of November through to the middle of January, with most of them being born in December. This fits principle three very well. The gestation period of the tahr is about seven months, so if the kids are to be born in the early part of the summer, the tahr must mate seven months earlier than this. Principle three tells us this should be so.

Q. 137 HOW LONG IS THE TAHR'S GESTATION PERIOD?

A. 137 The tahr's gestation period is about seven months.

What we actually find is that the tahr mates a month after the red deer, mating being from mid April until mid June, with most mating taking place in May. The kids are therefore born at the same time as the fawns. This is, of course, what principle three told us should be so. Both the kids and fawns are born in the late spring and early summer which gives them the warm summer months to grow in, so that they are strong before the winter comes, which helps them to survive. Normally red deer and tahr have only one fawn or kid each year, but occasionally twins are born.

Q. 138 WHICH COUNTRY WERE THE RED DEER IN THE SOUTH ISLAND INTRODUCED FROM?

A. 138 The red deer in the South Island were introduced from England.

Q. 139 WHEN IT IS SUMMER HERE, WHAT SEASON IS IT IN ENGLAND?

A. 139 When it is summer here, it is winter in England because England is on the opposite side of the world from New Zealand. Red deer fawns are mostly born in December in New Zealand.

Q. 140 WOULD THE FAWNS MOSTLY BE BORN DURING DECEMBER IN ENGLAND?

A. 140 Red deer fawns are mostly born in June in England.

Q. 141 WHY ARE THE RED DEER FAWNS MOSTLY BORN IN JUNE IN ENGLAND AND NOT IN DECEMBER AS IN NEW ZEALAND?

A. 141 The fawns are mostly born in England during June because this is late spring and early summer in England.

Q. 142 IF THE RED DEER INTRODUCED TO THE SOUTH ISLAND FROM ENGLAND HAD CONTINUED TO MATE DURING THE MONTHS THEY NORMALLY MATED IN, DURING WHICH SEASON WOULD THE FAWNS HAVE BEEN BORN IN HERE?

A. 142 The fawns would have been born in winter.

Q. 143 WHAT WOULD HAVE HAPPENED TO A LOT OF THEM?

A. 143 If the fawns had been born in the winter many of them would have died of the cold. Red deer in England mate from mid September to mid November, and the fawns are born from mid May until mid July, which is six months later than in New Zealand. Most of the mating takes place in October, and most of the fawns are born in June.

Q. 144 WOULD THE TAHR MATE DURING THE SAME SEASON IN NORTHERN INDIA AND IN THE SOUTH ISLAND?

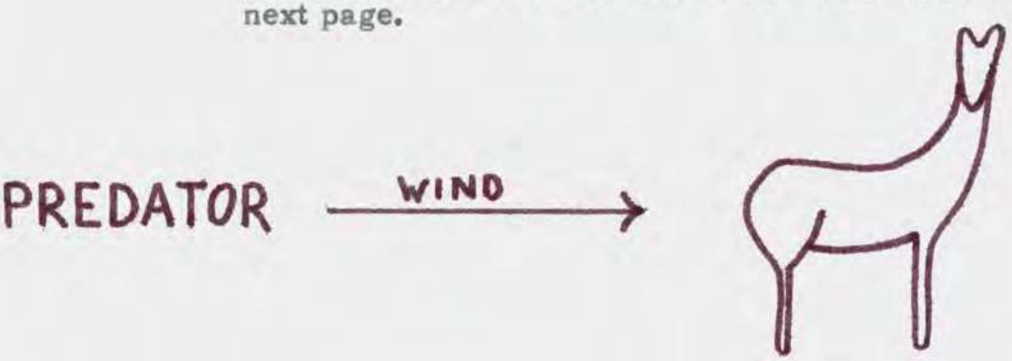
A. 144 The tahr, like the red deer, mates during the same season anywhere in the world.

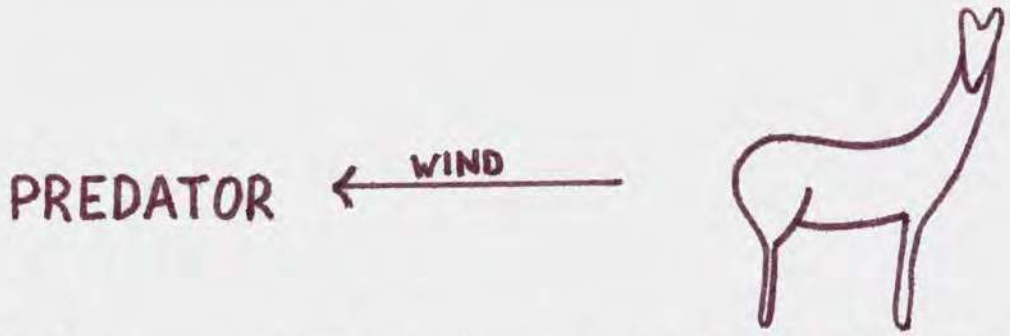
Q. 145 WOULD THE TAHR MATE DURING THE SAME MONTHS IN NORTHERN INDIA AND IN THE SOUTH ISLAND?

A. 145 Mating takes place during different months because the seasons occur during different months in the two countries. All this illustrates principal three, which states that animals behave in ways suited to their bodies and their environments which helps them to survive. Let us look at another example of principle three. We learnt earlier in the book that the red deer and the tahr are ruminants, which means that they can collect a large volume of food quickly so that they are not exposed to their predators for too long. Now while the red deer and the tahr can collect their food at any time they like, they only collect it at two particular times, and by collecting it at these times they behave in a way which makes full use of their bodies and helps them to survive.

Q. 146 WHEN DO THE RED DEER AND THE TAHR ACTUALLY COLLECT THEIR FOOD?

A. 146 Red deer and tahr collect their food early in the morning and during the evening which is when their predators are not so likely to be around, and when they are not so likely to be caught and killed. By collecting their food at these times the red deer and the tahr give us another example of principle three. Let us look at another example. We learnt earlier in the book that the red deer relies most on its sense of smell to detect its predators. There is one problem with the sense of smell and that is that the scent must be carried on the wind to the red deer. You can see this in the drawing on the next page.





Q. 147 WHICH OF THESE TWO RED DEER IS GOING TO BE ABLE TO PICK UP THE SCENT OF ITS PREDATOR MORE EASILY - THE TOP ONE OR THE BOTTOM ONE?

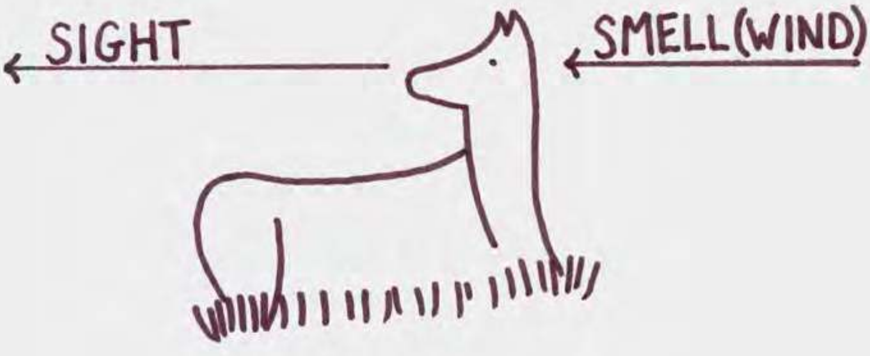
A. 147 The one at the top of the drawing will be more likely to detect its predator.

Q. 148 DO YOU THINK THE SAME PROBLEM APPLIES TO THE SENSE OF HEARING AS WELL?

A. 148 To some extent the same problem applies to the sense of hearing as well. It is much easier to hear someone when the wind is coming past them towards you. The red deer often uses two senses together to give it the best possible all round protection.

Q. 149 WHICH TWO SENSES WILL IT USE?

A. 149 The two senses are the sense of smell and the sense of sight.



You can see that the red deer in this picture is lying with its back to the wind so that any animal coming up behind it can be detected by its scent being carried on the wind or possibly by a noise being carried on the wind. At the same time any animal coming up in front of the red deer will be likely to be seen. By lying in this way the red deer is making maximum use of its body and behaving sensibly which illustrates principle three.

Q. 150 WHAT IS PRINCIPLE THREE?

A. 150 Animals behave in ways suited to their bodies and their environments which helps them to survive. Before we leave the senses of the red deer and the tahr we can see one more example of principle three. Red deer and tahr live in groups, as you can see in the middle of photograph sets one and two, and often large numbers of them can be seen together.

Q. 151 WHAT DO WE CALL A GROUP OF RED DEER?

A. 151 A group of red deer is called a herd.

Q. 152 WHAT DO WE CALL A GROUP OF TAHR?

A. 152 A group of tahr is called a mob.

In the army during a war, when the soldiers are trying to detect their enemies, they do not all keep watch all the time but they post sentries and take it in turn to keep watch.

Q. 153 DO YOU THINK THAT RED DEER AND TAHR POST SENTRIES, BEARING IN MIND PRINCIPLE THREE?

A. 153 Both red deer and tahr post sentries. Red deer sentries warn others in the herd of approaching danger by making a noise called a bark. Tahr sentries warn the mob by giving quite a distinct whistle and by stamping their feet. We have one more example of principle three. We learnt that the red deer, because of its hoof and leg, is built for speed.

Q. 154 HOW WOULD YOU EXPECT THE RED DEER TO BEHAVE WHEN IT DETECTS A PREDATOR?

A. 154 When the red deer detects a predator it runs away at high speed making use of its body which helps it to run fast. It does not strike out with its legs or do anything else because this is too dangerous.

Q. 155 WHAT ARE THE TAHR'S LEG AND HOOF ESPECIALLY SUITED TO?

A. 155 The tahr's leg and hoof are suited to climbing.

Q. 156 WHAT WOULD THE TAHR DO WHEN IT DETECTED A PREDATOR COMING?

A. 156 When the tahr sees a predator coming it runs to a high cliff where the enemy cannot reach it, and there it is safe. The way red deer and tahr behave when they detect predators is suited to their bodies and illustrates principle three. Read principle four below.

PRINCIPLE FOUR

Introducing animals to countries in which they are not naturally found often causes problems because this upsets the balance of nature.

Q. 157 WHAT IS THE BALANCE OF NATURE?

A. 157 The plants and animals naturally found in a country live together in a balanced way. Each animal or plant has its place and each can survive. When new and different animals are introduced this balance may be upset and some of the plants and animals may die out.

Q. 158 WHAT SORT OF FOOD DO RED DEER AND TAHR EAT?

A. 158 Red deer and tahr eat plants. Now the plants in New Zealand were in balance when there was only one native mammal, the native bat. Many of these plants cannot survive being eaten and die.

Now plants have a very important function in keeping the soil from being blown away by the wind and washed away by the rain. There is a word we use when the soil is washed away by the rain and blown away by the wind.

Q. 159 WHAT IS THIS WORD?

A. 159 Erosion. Both the red deer and the tahr cause erosion by eating, and treading on plants and killing them. Another problem is that both animals often eat pasture and crops which farmers have grown for domestic animals.

Q. 160 WHICH ANIMAL WOULD CAUSE THE BIGGER PROBLEM HERE?

A. 160 The red deer is the bigger problem.

Q. 161 WHY IS THE RED DEER THE BIGGER PROBLEM?

A. 161 The red deer's habitat is closer to farms than is the tahr's. However, the tahr is a problem on some high country farms. While the problem of the red deer and the tahr eating domestic pasture is not a balance of nature problem, it is a serious problem in some areas because of the large number of animals involved. Without natural enemies, other than man, in New Zealand the red deer and the tahr have multiplied rapidly. It has been estimated that there were as many as 5 million red deer in New Zealand a few years ago.

Q. 162 DURING WHICH MONTHS DOES THE RED DEER MATE IN THE SOUTH ISLAND?

A. 162 In the South Island the red deer mates from mid March to mid May, with most of the mating taking place in April.

Q. 163 DURING WHICH MONTHS DOES THE TAHR MATE IN THE SOUTH ISLAND?

A. 163 In the South Island the tahr mates from mid April to mid June, with most of the mating taking place in May.

Q. 164 DURING WHICH MONTHS ARE THE KIDS AND FAWNS BORN IN THE SOUTH ISLAND?

A. 164 In the South Island the kids and fawns are born from mid November to mid January, with most of them being born in December.

Q. 165 DURING WHICH MONTH ARE RED DEER MOSTLY BORN IN ENGLAND?

A. 165 In England red deer are mostly born in June, which is six months later than in New Zealand.

Let us see if we can apply our principles to a new animal. This animal is the chamois (pronounced shamwa). Look at map set two, which shows a map of the chamois' habitat in the South Island and gives some information about the chamois. Read the information about the chamois through twice and use it to answer the following questions. You may refer to map set two, but you may not use any of the other maps or diagrams.

Q. 166 DOES THE CHAMOIS HAVE A SMALLER HABITAT IN THE SOUTH ISLAND THAN THE RED DEER?

A. 166 The chamois has a smaller habitat in the South Island than the red deer.

Q. 167 GENERALLY SPEAKING, IS THE CHAMOIS' HABITAT IN THE SOUTH ISLAND HIGHER OR LOWER THAN THE TAHR'S?

A. 167 Generally speaking, the chamois' habitat in the South Island is lower than the tahr's.

Q. 168 GENERALLY SPEAKING, IS THE CHAMOIS' HABITAT IN THE SOUTH ISLAND COLDER THAN THE RED DEER'S?

A. 168 Generally speaking, the chamois' habitat in the South Island is colder than the red deer's.

Q. 169 DOES THE CHAMOIS HAVE A THICKER COAT THAN THE TAHR?

A. 169 The chamois has a thinner coat than the tahr.

Q. 170 DOES THE CHAMOIS HAVE ITS THICKEST COAT AT THE SAME TIME AS THE TAHR HAS ITS THICKEST COAT IN THE SOUTH ISLAND?

A. 170 The chamois has its thickest coat in the winter like the tahr.

Q. 171 DOES THE CHAMOIS LIVE IN A MORE OPEN ENVIRONMENT THAN THE RED DEER?

A. 171 The chamois' environment is more open than the red deer's.

Q. 172 WOULD THE CHAMOIS HAVE A BETTER SENSE OF SMELL THAN THE RED DEER?

A. 172 The chamois has a poorer sense of smell than the red deer.

Q. 173 DOES THE CHAMOIS LIVE IN A STEEPER ENVIRONMENT THAN THE TAHR?

A. 173 The chamois lives in a less steep environment than the tahr.

Q. 174 IS THE CHAMOIS A BETTER CLIMBER THAN THE TAHR?

A. 174 The chamois is a poorer climber than the tahr.

Q. 175 IS THE CHAMOIS LIKELY TO BE AN UNGULATE?

A. 175 The chamois is an ungulate.

Q. 176 DOES THE CHAMOIS HAVE A MORE POWERFUL LEG THAN THE RED DEER?

A. 176 The chamois has a more powerful leg than the red deer.

Q. 177 WOULD THE CHAMOIS' HOOF BE BETTER SUITED TO CLIMBING THAN THE RED DEER'S?

A. 177 The chamois' hoof is better suited to climbing than the red deer's.

Q. 178 WHEN WOULD THE CHAMOIS COLLECT ITS FOOD?

A. 178 The chamois collects its food early in the morning and during the evening.

Q. 179 WOULD THE CHAMOIS HAVE ITS YOUNG LATER IN THE YEAR THAN THE TAHR IN THE SOUTH ISLAND?

A. 179 The chamois and the tahr have their young at the same time in the South Island.

Q. 180 WOULD THE CHAMOIS AND THE RED DEER MATE AT THE SAME TIME IN THEIR NATIVE LANDS?

A. 180 The red deer mates before the chamois.

Q. 181 WOULD THE CHAMOIS AND THE TAHR MATE AT THE SAME TIME IN THE SOUTH ISLAND?

A. 181 The chamois and the tahr mate at the same time in the South Island.

Q. 182 DO YOU THINK THE CHAMOIS WOULD CAUSE EROSION IN THE SOUTH ISLAND?

A. 182 The chamois causes erosion in the South Island.

Q. 183 WOULD THE CHAMOIS BE A BIGGER OR A SMALLER PROBLEM THAN THE RED DEER THROUGH EATING DOMESTIC PASTURE IN THE SOUTH ISLAND?

A. 183 The chamois is a smaller problem than the red deer.

Q. 184 WHAT IS THE MOST LIKELY EXPLANATION FOR THE INTRODUCTION OF THE CHAMOIS TO THE SOUTH ISLAND?

A. 184 The chamois was introduced for sport.

THE END

THE PROGRAMME MATERIALS

1. The maps on pages 354-6 were sellotaped together to form Map Set One.

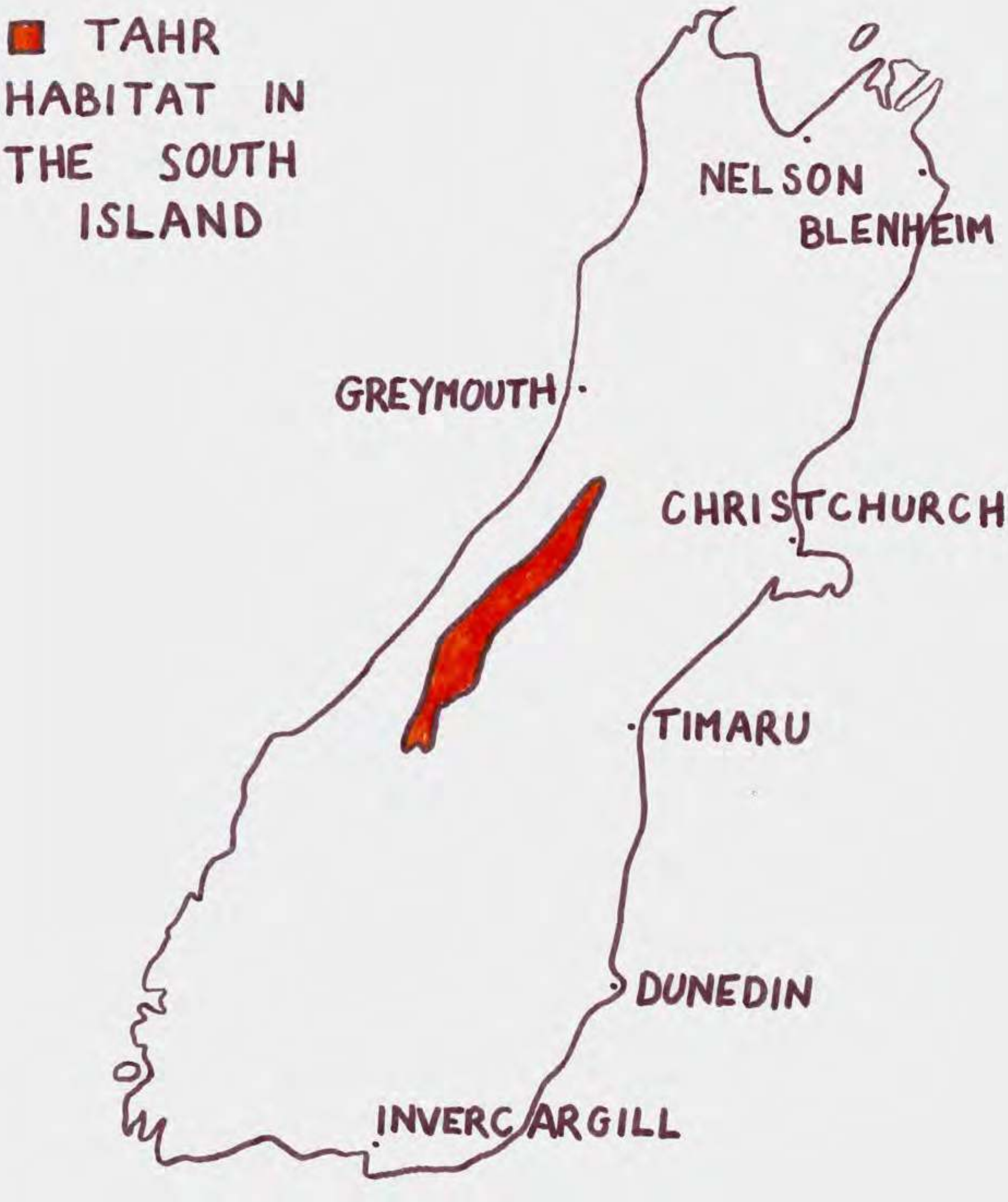
2. The map and chart on pages 357-8 were sellotaped together to form Map Set Two.

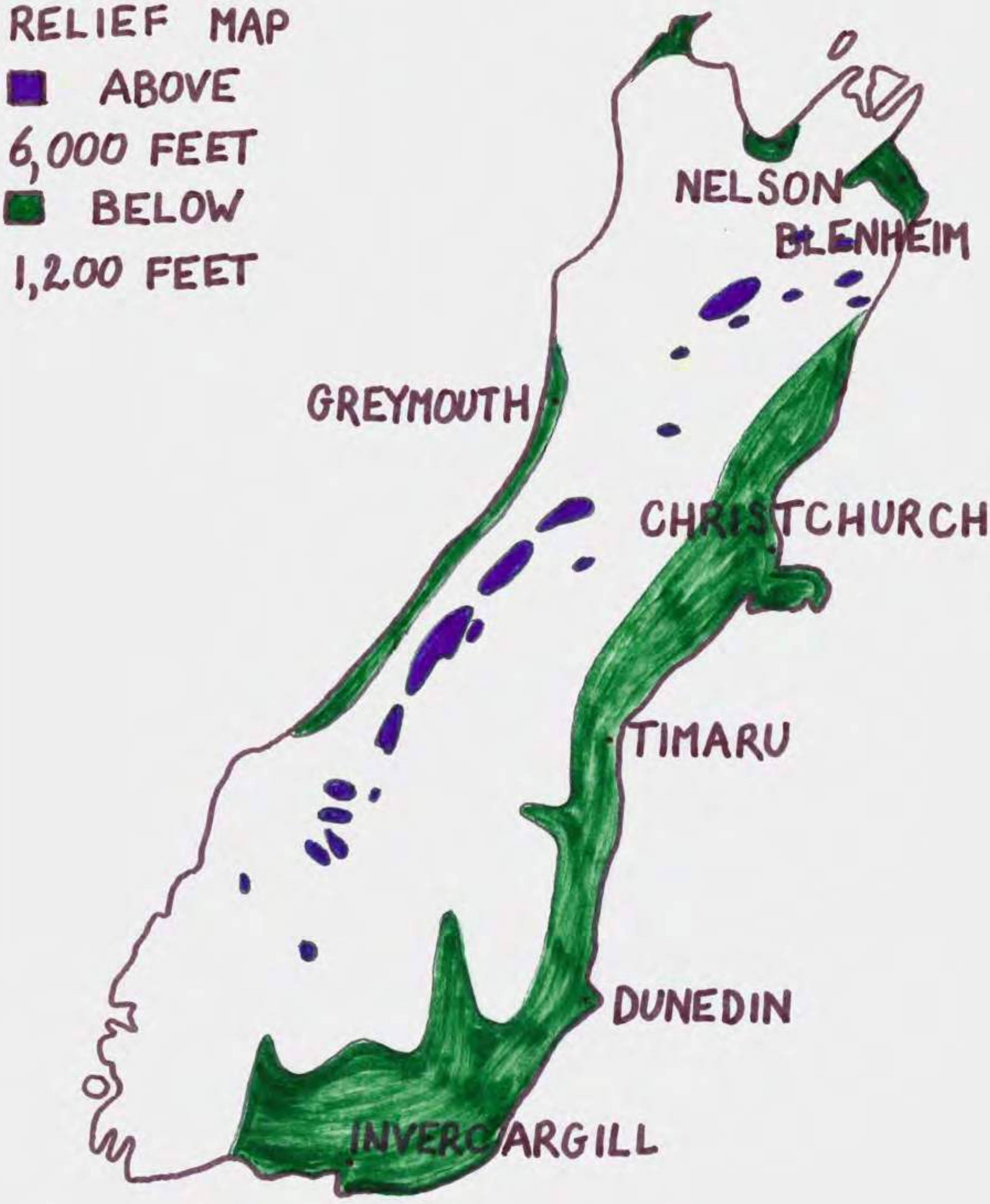
3. Diagram Set One is presented on page 359.

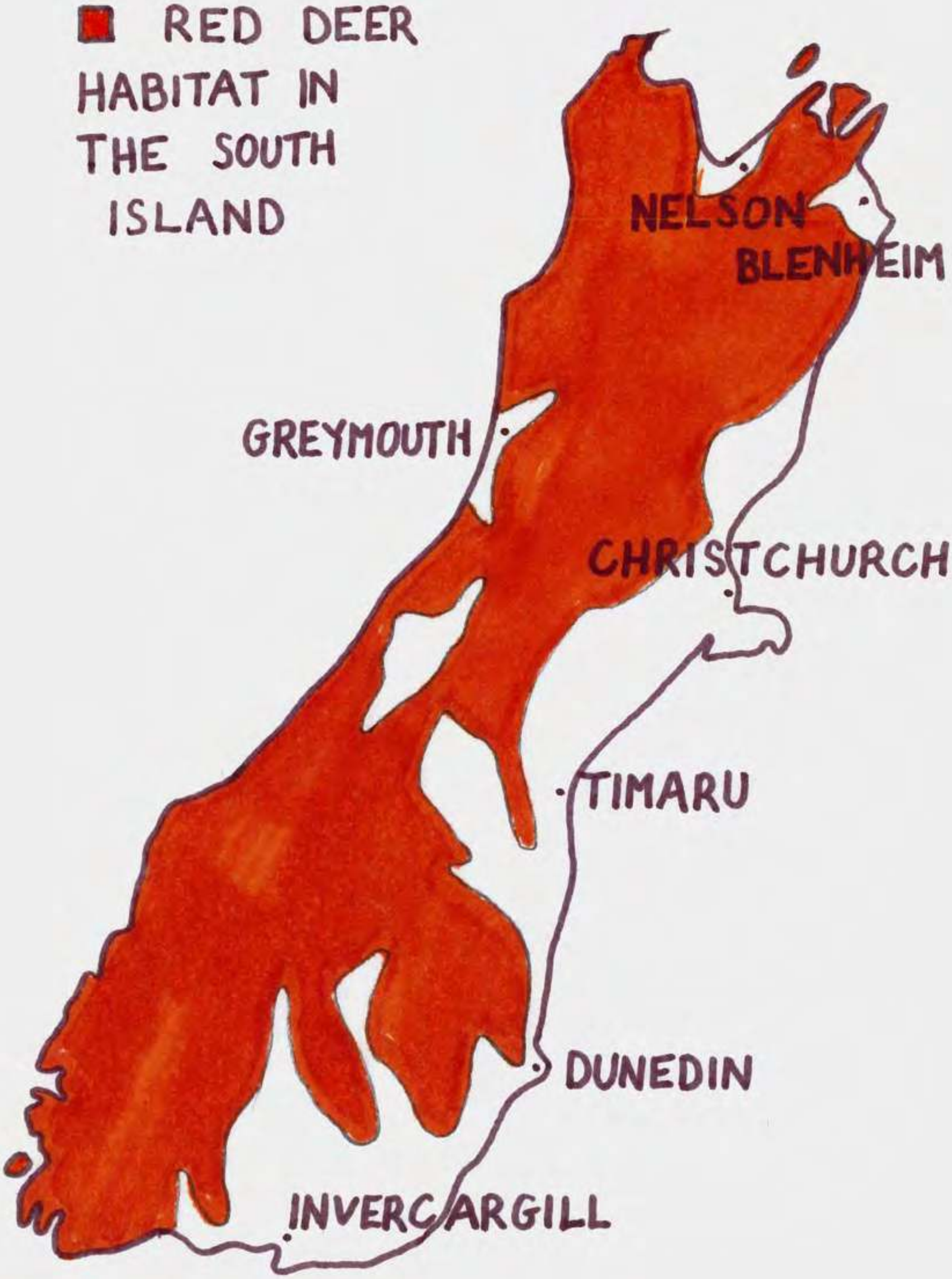
4. Diagram Set Two is presented on page 360.

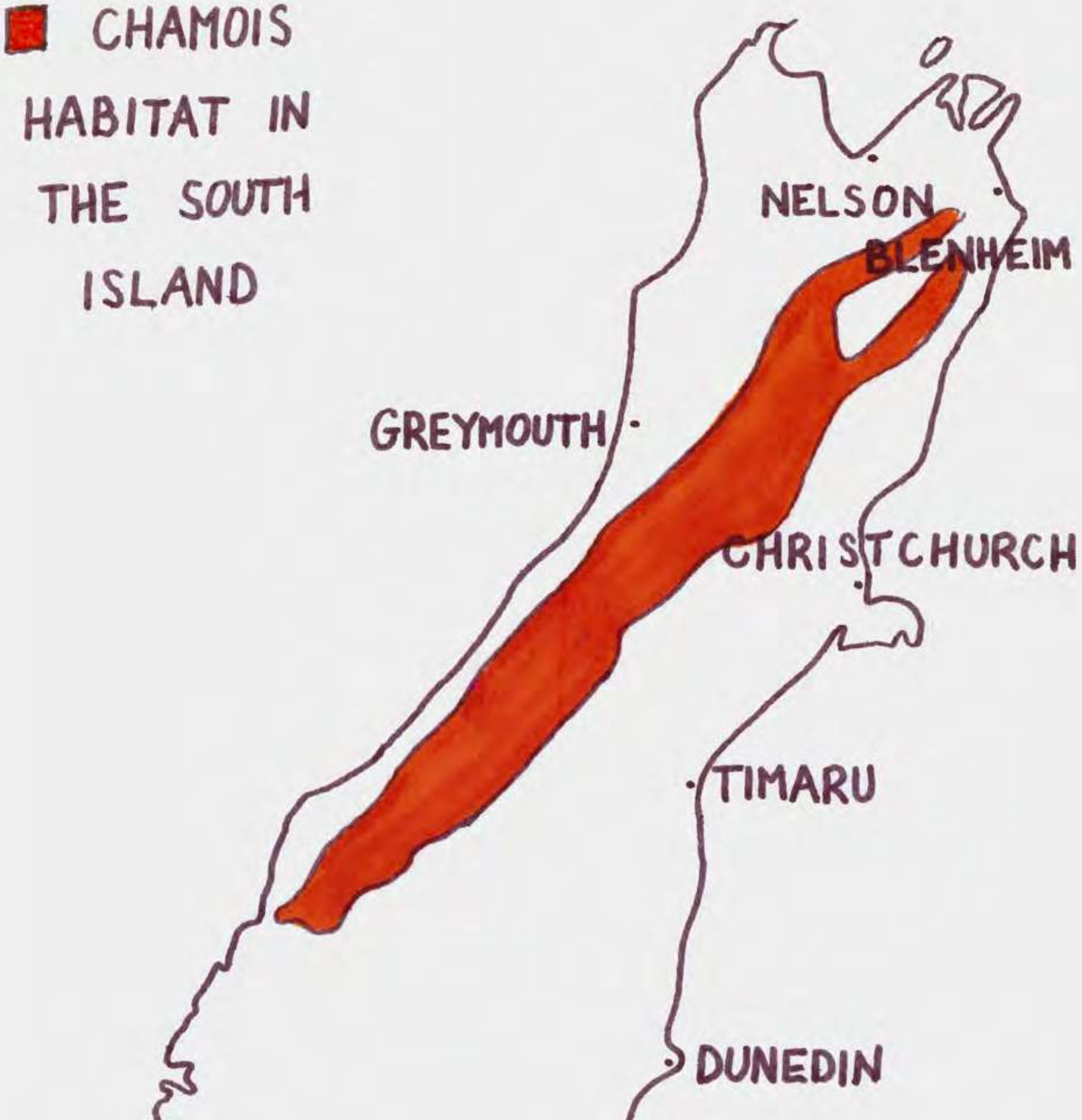
5. Photograph Sets One and Two are presented on page 361.

6. The pupils were also given a plain orange card measuring eight inches x five inches and a booklet with numbered spaces in which to write their answers.


TAHR
HABITAT IN
THE SOUTH
ISLAND
NELSON
BLENHEIM
GREYMOUTH
CHRISTCHURCH
TIMARU
DUNEDIN
INVERCARGILL

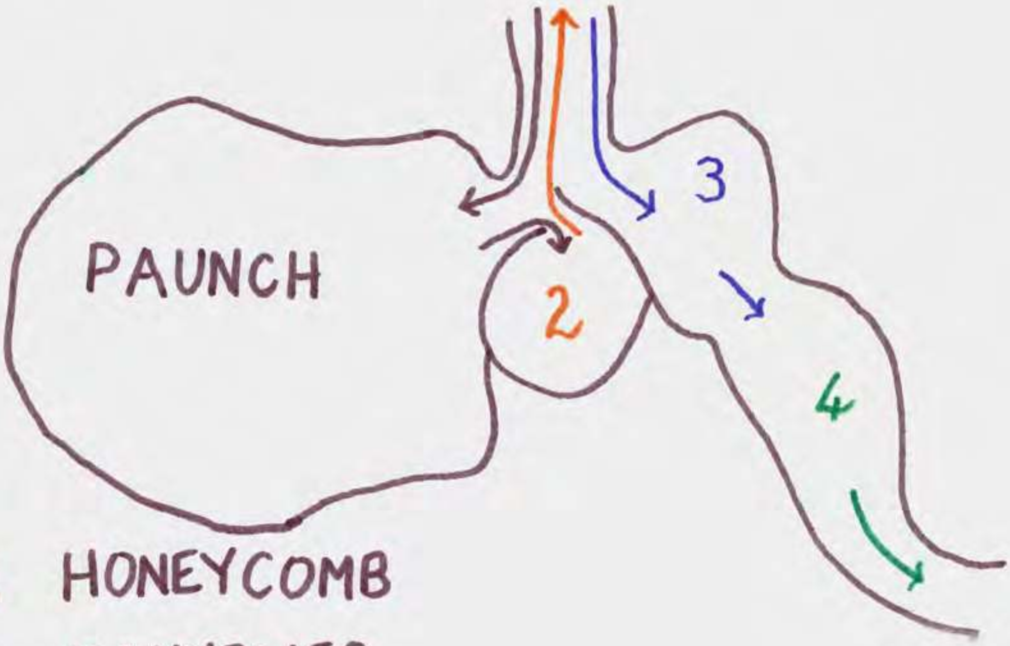

RELIEF MAP
ABOVE
6,000 FEET
BELOW
1,200 FEET
NELSON
BLENHEIM
GREYMOUTH
CHRISTCHURCH
TIMARU
DUNEDIN
INVERCARGILL


RED DEER
HABITAT IN
THE SOUTH
ISLAND
NELSON
BLENHEIM
GREYMOUTH
CHRISTCHURCH
TIMARU
DUNEDIN
INVERCARGILL

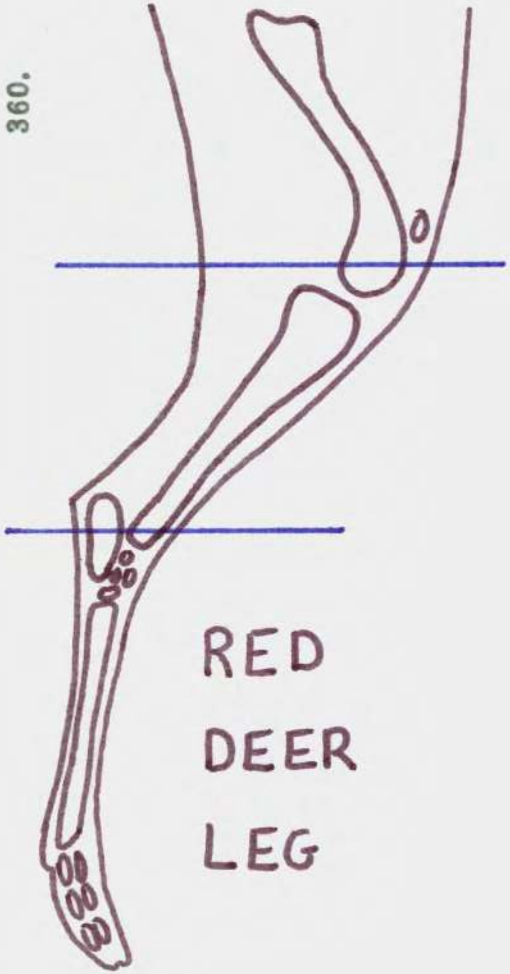

CHAMOIS
HABITAT IN
THE SOUTH
ISLAND
NELSON
BLENHEIM
GREYMOUTH
CHRISTCHURCH
TIMARU
DUNEDIN
INVERCARGILL

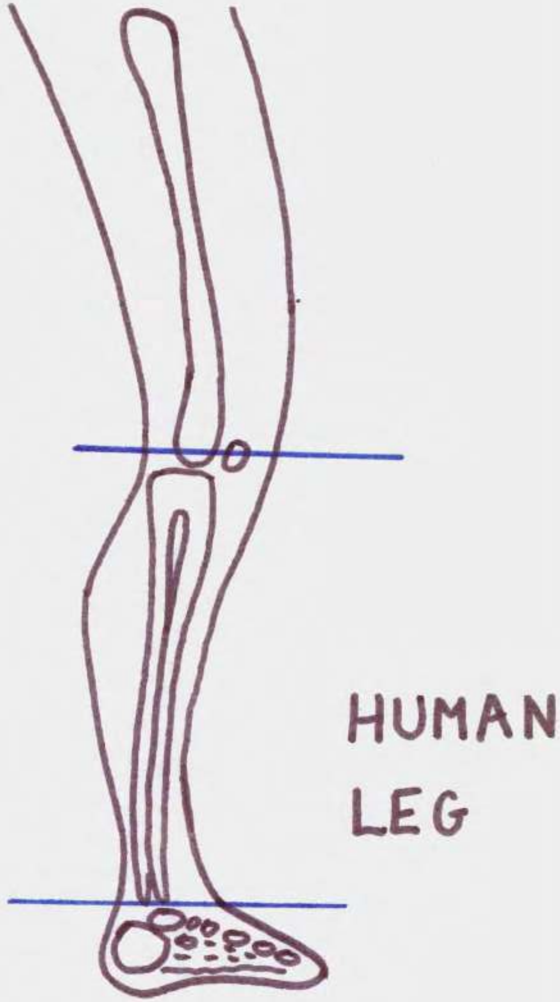
THE CHAMOIS

THE CHAMOIS WAS INTRODUCED TO THE SOUTH ISLAND FROM CENTRAL EUROPE IN 1907 WHEN EIGHT ANIMALS WERE LIBERATED AT MOUNT COOK. THE CHAMOIS IS A RUMINANT WITH A GESTATION PERIOD OF ABOUT SEVEN MONTHS. THE MALE CHAMOIS IS CALLED A BUCK AND WEIGHS ABOUT 80 POUNDS. THE FEMALE CHAMOIS IS CALLED A DOE AND WEIGHS ABOUT 50 POUNDS. A YOUNG CHAMOIS IS CALLED A KID.



2 HONEYCOMB
3 MANYPLIES
4 BELLY


RED
DEER
LEG


HUMAN
LEG

PHOTOGRAPH
SET ONE

PHOTOGRAPH
SET TWO

INSTRUCTIONS FOR ADMINISTERING THE PROGRAMME IN EXPERIMENT THREE

1. Take the children to their room and get them seated.

2. Distribute the folders and place the skins at the front of the room with the tahr skin on the left when viewed from the class. The skins should be about three feet apart and where they can be easily seen by the children e. g. on a desk. Note: If possible set this up before the children arrive. To save time we will attempt to get the envelope of maps, diagrams, and photographs and the answer booklet out of the folder before the period starts (this will also help keep the pages in good order).

3. Tell the children OPEN YOUR BOOKLET AT THE FRONT PAGE AND READ THE INSTRUCTIONS THROUGH TO YOURSELF WHILE I READ THEM ALOUD TO YOU. Read the instructions through giving the children enough time to complete anything they are asked to do e. g. write their name, and demonstrate what they are to do. Answer any questions the children have unless they are directly related to the programme content or the real reason for doing the programme.

4. When the children have all understood what to do say CARRY ON BEGINNING ON THE NEXT PAGE MARKING ALL YOUR ANSWERS IN THE SEPARATE ANSWER BOOKLET.

5. As soon as you have said 4 above begin timing with the stop watch. Note the time the pupils spend working on the material in each period and stop all pupils after 108 minutes. Note the time taken by pupils who finish within 108 minutes on their answer booklets.

6. At the end of each period get the children to put their answer booklet and envelope of maps, diagrams, and photographs in the folder at the place they are up to before handing the folder in.

DO NOT LET THE CHILDREN TALK OR WASTE TIME IN OTHER WAYS.

APPENDIX E

THE NOTE TO TEACHERS

THE EFFECTS OF CERTAIN METHODS OF SELECTING PUPILS TO RESPOND TO CLASSROOM QUESTIONS

Introduction:

This study is part of the Teaching Research Project being undertaken at the University of Canterbury, and grows directly from the work of C.J. Wright of Christchurch Teachers' College.

Wright attempted to isolate teaching behaviours, or teaching strategies, which were related to pupil learning in a series of Nature Study lessons at the standard two level. A number of teachers and teachers' college students each took a set of three, ten minute lessons on the Black Backed Gull. These lessons were tape recorded and transcribed. Working from these transcripts, Wright established the frequencies of a number of teaching strategies, for each teacher, and correlated these with pupil achievement, as measured by an achievement test given after the lessons.

Wright found, among other things, that directions of solicitations were significantly correlated with pupil achievement. Pupils achieved better where teachers, after obtaining a response to an initial question, passed the question on to one or more other pupils for further comment. Where teachers continued to question a pupil they had already asked to respond, or closed the discussion on the particular topic without passing the question to another pupil, pupils achieved less.

Wright explained these results by suggesting that passing questions on to other pupils, after an initial response, functioned to keep the class alert. When pupils are expecting to have questions redirected to them they are more likely to prepare a response to the question than if they do not expect to be asked to respond. Wright thought that the stimulation of the thinking of the pupils in this way could lift the achievement of the class.

The Present Study

The present study aims to test this hypothesis in a series of closely controlled lessons where the pupils will be able to predict, to a greater or lesser degree, when they will be required to respond to questions. If Wright's hypothesis is correct, classes in which the children cannot predict when they will be questioned should learn more than classes in which the children are able to predict when they will be questioned. If, for example, questions and subsequent redirections are distributed randomly around the class, children cannot predict when they will be questioned, and they should learn more than they would if the questions and subsequent redirections were distributed systematically around the class. An example of systematic distribution is to begin at the back left hand side of the class, working across to the front right hand side, and then returning to the original starting point.

Method

A series of three lessons dealing with the red deer, tahr (thar), and chamois, suitable for average ability Form II children, will be given to three classes in each of three schools. It is assumed that children will not have been taught about these animals during the normal intermediate science lessons, and that the bulk of the material is new. Each lesson, which lasts about 35 minutes, is planned in detail and runs to just over 20 typewritten quarto pages. Materials and their sequencing within the lessons, the wording of each question and its sequencing, teacher reaction to pupil responses, and so on are all predetermined. This makes it possible to come as near to giving identical lessons on different occasions as can be managed without the use of film or video tape. The lessons will vary only in the method used to select pupils to respond to the questions in the lessons. Three different selection procedures will be used - one in each of the three classes in each school.

An achievement test to measure the pupil learning in the lessons will be given when the lesson series is finished. This test, which is in two parts, takes not more than two forty minute class periods to complete.

Because the classes to be used in the study are likely to vary on such things as intelligence, four short tests are given before the lessons and the scores on the achievement test are corrected, using these measures. The tests are: a 15-minute vocabulary test, a 20-minute non-verbal intelligence test, a short achievement test to measure what the pupils already know about the topic, and a short measure of the pupils' attitudes to nature study type activities. These four tests can be comfortably given in two forty minute periods.

The total time spent with each class is not more than seven class periods of forty minutes or their equivalent. Differences between the corrected achievement test score for classes treated in different ways will be investigated.

Requirements for the Study

1. Timing of Tests and Lessons

The plan of the research enables differences between schools to be taken account of provided that, within each school, the conditions are constant. For example, the time of the day at which the lessons are taken may make a difference to the pupils' achievement scores. However, provided the lessons are taken at the same time in any one school, the influence of this factor can be accounted for. It is desirable, therefore, that the lessons in any one school are taken at exactly the same time for each of the three classes, or, where this is not possible, as close to the same time as can be managed.

Other than this, the timing of the lessons is not important, except for two things. Firstly, it is hoped that the latter part of the afternoon can be avoided, and, secondly, it is desirable that the lessons begin after a break. This makes it possible to set up the necessary materials while the children are not in class, so the smallest possible disruption to the normal class routines can be achieved. However, where this is not possible the time involved in setting up the materials is only a few minutes. As the lessons are only 35 minutes long, there is a spare five minutes, in a forty minute period, which is set aside for removal of materials after the lessons are finished.

The following plan for the sequencing of the tests and lessons will provide a base to work from, and will be adjusted to suit the individual schools taking part. The two period pretesting will be done on Tuesday, the lessons will be taken on Wednesday, Thursday, and Friday, and the achievement test on the following Monday.

2. Class Size

To ensure that the number of questions directed to each pupil is constant, it is essential that each class in the study is of equal size. As classes stand, this is not the case, some being bigger than others. To overcome this problem a programmed text of the lesson content has been prepared. A standard size for all classes will be set, and children withdrawn at random to do the programme when class size goes above this number.

The children doing the programmed text will be supervised by an assistant. A room in which the programme children can work will be necessary. However, as there will be only a small group from any one class doing the programme, a store room, or some other small room, will be sufficient.

3. Teachers

Teachers are not asked to do anything during the research except to help keep conditions standard within the one school. It will be appreciated if the teachers whose classes will be used can agree, either to all be present, or all be absent from the room when the lessons are taken. Whether teachers are present or not at the testing is not so important.

The following three points are aimed at preventing children from learning about the topic outside the lessons. While this is unusual practice, it is vital for the success of the project. The time between the first lesson and the test is only 5 days, and after the test has been sat the children may read as much as they like about the topic.

Teachers are asked to observe the following procedures. Firstly, to refuse to discuss any aspect of the lesson topic with their classes, should questions arise after the experimenter has gone. After the completion of the achievement test questions will be answered if the class teacher wishes this to be done. Secondly, not to mention the achievement test to the class, because this motivates some children to seek material from books, etc. which may upset the results. Thirdly, not to display any materials brought along by the children until after the achievement test has been completed. Children are interested in the topic and are likely to bring material from home. It would be very much appreciated if articles relevant to the topic, which are brought by the pupils, could be collected by the teacher, with a view to displaying them after the test is completed.

It would be appreciated if teachers could introduce the researcher to the class as "Mr. Hughes, who will be taking some lessons with you this week".

Test Results

Pupils' scores on the various tests will be made available to the class teacher concerned.

For any further information please telephone the University of Canterbury, 65-819, ask for the Education Department, then ask for David Hughes.

David Hughes
Education Department
University of Canterbury

APPENDIX F

CORRELATIONS BETWEEN THE PRETESTS AND POSTTESTS IN EXPERIMENTS ONE, TWO, THREE, AND FOUR

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT ONE

1. Posttest One
2. Posttest Two
3. Posttest One plus Two
4. Chamois Posttest
5. Generalization Posttest
6. Total Posttest
7. Age
8. A. P. T. Abstract Reasoning *
9. Vocabulary
10. Pretest of Achievement
11. Attitude Test
12. Question Expectation
13. Desired Question Frequency

* Scores were not available for three subjects, N for this test equals 203, for all other tests N equals 206.

	2	3	4	5	6	7	8	9	10	11	12	13
1.	.6941	.9088	.3751	.4739	.8913	-.1034	.1935	.4510	.4538	.0742	-.1082	-.0389
2.		.9312	.3827	.4378	.9006	-.2483	.2162	.5710	.4375	.1745	-.0787	.0148
3.			.4118	.4938	.9734	-.1963	.2240	.5593	.4834	.1388	-.1004	-.0111
4.				.1317	.4268	-.0211	.0369	.2655	.2509	.0503	-.0789	-.0834
5.					.6754	-.1057	.1599	.2817	.2728	.0565	-.0582	.0725
6.						-.1901	.2282	.5478	.4823	.1315	-.1020	.0054
7.							-.0005	-.0641	.0931	-.0555	.0145	-.0131
8.								.1274	.0024	.0311	-.1248	-.0270
9.									.4655	.1264	-.0278	.0253
10.										.2552	-.0738	-.0056
11.											.0094	-.0546
12.												.2467

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT ONE

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT TWO

1. Posttest One
2. Posttest Two
3. Posttest One plus Two
4. Chamois Posttest
5. Generalization Posttest
6. Total Posttest
7. Age
8. A. P. T. Abstract Reasoning

*9. Vocabulary: Verbal Aptitude

*10. Analogies: Verbal Aptitude

11. Pretest of Achievement
12. Attitude Test
13. Question Expectation
14. Desired Question Frequency

* Scores were not available for two subjects, N for these tests being 60, for all other tests N equals 62.

	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	.8787	.9622	.2965	.5530	.9474	-.0558	.3546	.5942	.6798	.6873	.1651	-.4744	-.3237
2.		.9755	.3326	.5356	.9568	.0132	.2749	.5873	.6551	.5969	.1757	-.4395	-.2944
3.			.3264	.5604	.9826	-.0182	.3203	.6089	.6870	.6573	.1763	-.4694	-.3172
4.				.4899	.4206	.0305	.0082	.2003	.2092	-.0003	-.0481	-.1672	-.1521
5.					.7015	.1316	.0602	.2761	.3638	.5437	.0225	-.3574	-.2091
6.						.0121	.2866	.5853	.6702	.6718	.1534	-.4807	-.3200
7.							-.0660	.0539	-.1932	.0557	.2417	.1813	.0253
8.								.1992	.2995	.2316	.1003	-.0424	-.1582
9.									.6389	.4265	.2098	-.2548	-.3249
10.										.3813	.0836	-.3316	-.2058
11.											.1913	-.4279	-.3674
12.												-.0462	.0949
13.													.3994

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT TWO

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT THREE

1. Posttest One
2. Posttest Two
3. Posttest One plus Two
4. Age
5. A.P.T. Abstract Reasoning
6. Vocabulary
7. Pretest of Achievement
8. Attitude Test
9. A.C.E.R. Intermediate Test 'D'
10. P.A.T. Vocabulary
11. P.A.T. Comprehension
12. Question Expectation
13. Desired Question Frequency

	2	3	4	5	6	7	8	9	10	11	12	13
1.	.5921	.8845	-.1071	.2478	.2541	.2177	-.1307	.1976	.3846	.4027	-.0516	-.0244
2.		.8997	.1513	.4183	.3800	.2763	.0529	.1351	.3755	.4461	-.1132	.0477
3.			.0295	.3764	.3576	.2779	-.0402	.1867	.4257	.4764	-.0935	.0144
4.				.1497	.1180	.2000	.1731	-.0776	-.1277	-.0072	-.2559	.1444
5.					.0702	-.0519	-.0701	.2785	.0508	.1908	-.0585	-.0686
6.						.5918	-.1374	.2183	.7044	.6600	-.1455	.0581
7.							-.0139	.0358	.3273	.3239	-.2161	-.0922
8.								-.1009	-.2867	-.2044	.0249	-.0460
9.									.2377	.2850	.0163	-.2213
10.										.5784	-.0653	-.0085
11.											-.0479	.0766
12.												.2552

<u>PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT THREE</u>

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT FOUR

1. Posttest One
2. Posttest Two
3. Posttest One plus Two
4. Chamois Posttest
5. Generalization Posttest
6. Total Posttest
7. Age
8. Vocabulary
9. Pretest of Achievement
10. Attitude Test
11. P.A.T. Comprehension
12. P.A.T. Vocabulary
13. Vocabulary: Verbal Aptitude
14. Analogies: Verbal Aptitude

	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	.5836	.8813	.4525	.4754	.8725	-.0308	.4798	.4927	.1811	.3498	.3191	.4449	.3367
2.		.8981	.2425	.3469	.8305	.1380	.3038	.2119	.0214	.4990	.2319	.4110	.4423
3.			.3862	.4594	.9559	.0636	.4367	.3902	.1106	.4799	.3078	.4802	.4398
4.				.3191	.4760	-.0480	.2881	.4607	.0894	.1317	.2765	.2784	.2281
5.					.6930	-.1547	.2009	.4042	.2263	.1403	.1008	.1881	.2523
6.						-.0013	.4264	.4653	.1633	.4300	.2934	.4558	.4402
7.							.0115	-.1475	.0231	-.1206	-.0143	.0407	.1025
8.								.4177	.0876	.6324	.7318	.7087	.5537
9.									.1004	.2654	.2575	.3198	.1428
10.										.1091	-.0244	.0282	.0347
11.											.5872	.6371	.4605
12.												.5548	.5598
13.													.3824

PRETEST AND POSTTEST INTERCORRELATIONS: EXPERIMENT FOUR

APPENDIX G

MULTIPLE REGRESSION DATA FOR EXPERIMENTS ONE, TWO, THREE, AND FOUR

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: POSTTEST ONE

PRETEST	MEAN	S. D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.43789	203
Pretest of Achievement	14.75	5.07	0.43704	203
A. P. T. Abstract Reasoning	28.79	11.93	0.19353	203
Age	151.16	5.76	-0.10796	203
Attitude Test	35.86	7.12	0.07794	203
POSTTEST				
Test One	40.76	10.78		
INTERCEPT	56.70110			
MULTIPLE CORRELATION	0.55240			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: POSTTEST TWO

PRETEST	MEAN	S. D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.56785	203
Pretest of Achievement	14.75	5.07	0.43324	203
A. P. T. Abstract Reasoning	28.79	11.93	0.21619	203
Age	151.16	5.76	-0.25680	203
Attitude Test	35.86	7.12	0.17166	203
POSTTEST				
Test Two	50.00	12.52		
INTERCEPT	100.81969			
MULTIPLE CORRELATION	0.66993			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: POSTTEST ONE PLUS TWO

PRETEST	MEAN	S.D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.55282	203
Pretest of Achievement	14.75	5.07	0.47361	203
A.P.T. Abstract Reasoning	28.79	11.93	0.22397	203
Age	151.16	5.76	-0.20464	203
Attitude Test	35.86	7.12	0.13970	203
POSTTEST				
Test One Plus Two	90.76	21.40		
INTERCEPT	157.52092			
MULTIPLE CORRELATION	0.66305			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: CHAMOIS POSTTEST

PRETEST	MEAN	S.D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.27094	203
Pretest of Achievement	14.75	5.07	0.24861	203
A.P.T. Abstract Reasoning	28.79	11.93	0.03685	203
Age	151.16	5.76	-0.02188	203
Attitude Test	35.86	7.12	0.05807	203
POSTTEST				
Chamois Test	1.96	1.42		
INTERCEPT	1.43279			
MULTIPLE CORRELATION	0.30596			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: GENERALIZATION POSTTEST

PRETEST	MEAN	S.D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.27048	203
Pretest of Achievement	14.75	5.07	0.26375	203
A.P.T. Abstract Reasoning	28.79	11.93	0.15993	203
Age	151.16	5.76	-0.11663	203
Attitude Test	35.86	7.12	0.05887	203
POSTTEST				
Generalization Test	13.89	6.84		
INTERCEPT	28.41940			
MULTIPLE CORRELATION	0.36504			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT ONE: TOTAL POSTTEST

PRETEST	MEAN	S.D.	CORRELATION	N*
Vocabulary	24.20	7.63	0.54029	203
Pretest of Achievement	14.75	5.07	0.47219	203
A.P.T. Abstract Reasoning	28.79	11.93	0.22816	203
Age	151.16	5.76	-0.20007	203
Attitude Test	35.86	7.12	0.13348	203
POSTTEST				
Total Test	106.61	26.03		
INTERCEPT	187.37366			
MULTIPLE CORRELATION	0.65545			

*

Information on the A.P.T. Abstract Reasoning Test was not available for three subjects. However, to keep cell numbers as constant as possible, it was decided to retain these pupils in the study. The multiple regression analyses presented above are based on the 203 subjects for whom all information was available. As a consequence, there is a slight discrepancy between the correlations presented here, and those presented in Appendix F where all 206 subjects were included, as the computer programme used to calculate these correlations had a missing data option. Residual achievement scores, for the three subjects with missing data, were calculated in separate regressions using all 206 subjects but excluding the A.P.T. Abstract Reasoning Test from the analyses. The multiple correlations obtained when the A.P.T. Abstract Reasoning Test was excluded were very similar to those obtained above, being 0.52973, 0.64704, 0.63746, 0.30813, 0.34024, and 0.62891 for test one, test two, test one plus two, chamois test, generalization test, and total test respectively.

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO, POSTTEST ONE

PRETEST	MEAN	S.D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.70101	60
Analogies (Verbal Aptitude)	10.28	4.28	0.67982	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.59424	60
Question Expectation	4.62	1.44	-0.46968	60
Desired Question Frequency	3.50	1.74	-0.31091	60
A.P.T. Abstract Reasoning	22.93	10.45	0.37113	60
Attitude Test	36.55	7.05	0.20612	60
POSTTEST				
Test One	32.07	12.80		
INTERCEPT	-0.03073			
MULTIPLE CORRELATION	0.85313			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO, POSTTEST TWO

PRETEST	MEAN	S.D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.61940	60
Analogies (Verbal Aptitude)	10.28	4.28	0.65508	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.58726	60
Question Expectation	4.62	1.44	-0.43751	60
Desired Question Frequency	3.50	1.74	-0.29390	60
A.P.T. Abstract Reasoning	22.93	10.45	0.28642	60
Attitude Test	36.55	7.05	0.22565	60
POSTTEST				
Test Two	39.60	15.73		
INTERCEPT	2.52116			
MULTIPLE CORRELATION	0.79040			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO: POSTTEST ONE PLUS TWO

PRETEST	MEAN	S. D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.67655	60
Analogies (Verbal Aptitude)	10.28	4.28	0.68703	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.60887	60
Question Expectation	4.62	1.44	-0.46609	60
Desired Question Frequency	3.50	1.74	-0.31097	60
A. P. T. Abstract Reasoning	22.93	10.45	0.33458	60
Attitude Test	36.55	7.05	0.22367	60
POSTTEST				
Test One Plus Two	71.67	27.66		

INTERCEPT 2.49068

MULTIPLE CORRELATION 0.84251

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO: CHAMOIS POSTTEST

PRETEST	MEAN	S. D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.00069	60
Analogies (Verbal Aptitude)	10.28	4.28	0.20920	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.20034	60
Question Expectation	4.62	1.44	-0.15551	60
Desired Question Frequency	3.50	1.74	-0.12660	60
A. P. T. Abstract Reasoning	22.93	10.45	0.02212	60
Attitude Test	36.55	7.05	-0.01113	60
POSTTEST				
Test Chamois	1.47	1.38		

INTERCEPT 2.24890

MULTIPLE CORRELATION 0.29378

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO: GENERALIZATION POSTTEST

PRETEST	MEAN	S. D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.54634	60
Analogies (Verbal Aptitude)	10.28	4.28	0.36280	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.27607	60
Question Expectation	4.62	1.44	-0.35390	60
Desired Question Frequency	3.50	1.74	-0.20228	60
A. P. T. Abstract Reasoning	22.93	10.45	0.06539	60
Attitude Test	36.55	7.05	0.03676	60
POSTTEST				
Generalization Test	10.43	6.59		

INTERCEPT 3.90347

MULTIPLE CORRELATION 0.59405

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT TWO: TOTAL POSTTEST

PRETEST	MEAN	S. D.	CORRELATION	N*
Pretest of Achievement	13.63	4.72	0.68972	60
Analogies (Verbal Aptitude)	10.28	4.28	0.67021	60
Vocabulary (Verbal Aptitude)	9.30	4.07	0.58534	60
Question Expectation	4.62	1.44	-0.47721	60
Desired Question Frequency	3.50	1.74	-0.31247	60
A. P. T. Abstract Reasoning	22.93	10.45	0.30031	60
Attitude Test	36.55	7.05	0.19824	60
POSTTEST				
Total Test	83.57	32.36		

INTERCEPT 8.64346

MULTIPLE CORRELATION 0.83468

* Information on the Analogies and Vocabulary tests was not available for two subjects. However, to keep cell numbers as constant as possible, it was decided to retain these pupils in the study. The multiple regression analyses presented above are based on the 60 subjects for whom all information was available. As a consequence, there is a slight discrepancy between the correlations presented here, and those presented in Appendix F where all 62 subjects were included, as the computer programme used to calculate these correlations had a missing data option. Residual achievement scores, for the two subjects with missing data, were calculated in separate regressions using all 62 subjects but excluding the Analogies and Vocabulary tests from the analyses. The multiple correlations obtained when the Analogies and Vocabulary tests were excluded were somewhat smaller than those obtained above being 0.74764, 0.65247, 0.71610, 0.21941, 0.57024, and 0.72107 for test one, test two, test one plus two, chamois test, generalization test, and total test respectively.

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT THREE: POSTTEST ONE

PRETEST	MEAN	S. D.	CORRELATION	N*
P. A. T. Comprehension	64. 32	19. 78	0. 40269	65
P. A. T. Vocabulary	69. 18	17. 45	0. 38463	65
Vocabulary	25. 71	7. 64	0. 25412	65
A. P. T. Abstract Reasoning	27. 15	11. 18	0. 24778	65
Pretest of Achievement	15. 51	4. 96	0. 21770	65
Question Expectation	4. 45	1. 06	- 0. 05162	65
POSTTEST				
Test One	41. 14	9. 42		
INTERCEPT	18. 10690			
MULTIPLE CORRELATION	0. 52670			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT THREE: POSTTEST TWO

PRETEST	MEAN	S. D.	CORRELATION	N*
P. A. T. Comprehension	64. 32	19. 78	0. 44608	65
P. A. T. Vocabulary	69. 18	17. 45	0. 37546	65
Vocabulary	25. 71	7. 64	0. 37996	65
A. P. T. Abstract Reasoning	27. 15	11. 18	0. 41833	65
Pretest of Achievement	15. 51	4. 96	0. 27631	65
Question Expectation	4. 45	1. 06	- 0. 11324	65
POSTTEST				
Test Two	49. 60	10. 07		
INTERCEPT	22. 61165			
MULTIPLE CORRELATION	0. 60737			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT THREE: POSTTEST ONE PLUS TWO

PRETEST	MEAN	S.D.	CORRELATION	N
P.A.T. Comprehension	64.32	19.78	0.47639	65
P.A.T. Vocabulary	69.18	17.45	0.42572	65
Vocabulary	25.71	7.64	0.35763	65
A.P.T. Abstract Reasoning	27.15	11.18	0.37640	65
Pretest of Achievement	15.51	4.96	0.27789	65
Question Expectation	4.45	1.06	-0.09351	65
POSTTEST				
Test One Plus Two	90.74	17.39		
INTERCEPT	40.71866			
MULTIPLE CORRELATION	0.62211			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: POSTTEST ONE

PRETEST	MEAN	S. D.	CORRELATION	N
Vocabulary	34.02	7.14	0.47976	65
Pretest of Achievement	15.37	5.03	0.49274	65
Attitude Test	34.58	6.43	0.18109	65
P. A. T. Comprehension	70.66	20.04	0.34979	65
P. A. T. Vocabulary	79.38	13.87	0.31910	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.44486	65
Analogies (Verbal Aptitude)	17.40	4.46	0.33670	65
POSTTEST				
Test One	50.15	9.46		
INTERCEPT	16.76617			
MULTIPLE CORRELATION	0.62473			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: POSTTEST TWO

PRETEST	MEAN	S. D.	CORRELATION	N
Vocabulary	34.02	7.14	0.30383	65
Pretest of Achievement	15.37	5.03	0.21188	65
Attitude Test	34.58	6.43	0.02144	65
P. A. T. Comprehension	70.66	20.04	0.49903	65
P. A. T. Vocabulary	79.38	13.87	0.23190	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.41102	65
Analogies (Verbal Aptitude)	17.40	4.46	0.44232	65
POSTTEST				
Test Two	59.51	10.17		
INTERCEPT	41.18028			
MULTIPLE CORRELATION	0.62121			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: POSTTEST ONE PLUS TWO

PRETEST	MEAN	S.D.	CORRELATION	N
Vocabulary	34.02	7.14	0.43666	65
Pretest of Achievement	15.37	5.03	0.39017	65
Attitude Test	34.58	6.43	0.11055	65
P.A.T. Comprehension	70.66	20.04	0.47989	65
P.A.T. Vocabulary	79.38	13.87	0.30779	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.48015	65
Analogies (Verbal Aptitude)	17.40	4.46	0.43979	65
POSTTEST				
Test One Plus Two	109.66	17.47		
INTERCEPT	57.94621			
MULTIPLE CORRELATION	0.63977			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: CHAMOIS POSTTEST

PRETEST	MEAN	S.D.	CORRELATION	N
Vocabulary	34.02	7.14	0.28811	65
Pretest of Achievement	15.37	5.03	0.46072	65
Attitude Test	34.58	6.43	0.08943	65
P.A.T. Comprehension	70.66	20.04	0.13173	65
P.A.T. Vocabulary	79.38	13.87	0.27645	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.27843	65
Analogies (Verbal Aptitude)	17.40	4.46	0.22813	65
POSTTEST				
Chamois Test	3.06	1.65		
INTERCEPT	-1.76740			
MULTIPLE CORRELATION	0.53438			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: GENERALIZATION POSTTEST

PRETEST	MEAN	S. D.	CORRELATION	N
Vocabulary	34.02	7.14	0.20088	65
Pretest of Achievement	15.37	5.03	0.40415	65
Attitude Test	34.58	6.43	0.22625	65
P.A.T. Comprehension	70.66	20.04	0.14032	65
P.A.T. Vocabulary	79.38	13.87	0.10076	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.18806	65
Analogies (Verbal Aptitude)	17.40	4.46	0.25225	65
POSTTEST				
Generalization Test	18.29	6.86		
INTERCEPT	0.87567			
MULTIPLE CORRELATION	0.51032			

MULTIPLE REGRESSION ANALYSIS:

EXPERIMENT FOUR: TOTAL POSTTEST

PRETEST	MEAN	S. D.	CORRELATION	N
Vocabulary	34.02	7.14	0.42635	65
Pretest of Achievement	15.37	5.03	0.46534	65
Attitude Test	34.58	6.43	0.16327	65
P.A.T. Comprehension	70.66	20.04	0.43004	65
P.A.T. Vocabulary	79.38	13.87	0.29336	65
Vocabulary (Verbal Aptitude)	15.80	3.91	0.45584	65
Analogies (Verbal Aptitude)	17.40	4.46	0.44021	65
POSTTEST				
Total Test	131.02	22.23		
INTERCEPT	57.05469			
MULTIPLE CORRELATION	0.66384			

APPENDIX H

MEANS AND STANDARD DEVIATIONS FOR THE PRETEST, POSTTEST AND RESIDUAL ACHIEVEMENT SCORES FOR EXPERIMENTS ONE, TWO, THREE, AND FOUR.

MEANS AND STANDARD DEVIATIONS FOR THE PRETESTS, POSTTESTS AND RESIDUAL ACHIEVEMENT SCORES FOR THE CLASSES, SCHOOLS AND TREATMENTS IN EXPERIMENT ONE. N = 206

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
TEST	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Age								
Random Responding	148.44	4.73	151.76	4.57	154.20	4.32	151.16	5.10
Systematic Responding	147.37	4.02	150.57	4.78	156.91	5.20	151.59	6.14
Self-Selected Responding	148.72	6.20	148.39	3.66	156.23	4.20	150.97	5.99
School	148.20	5.03	150.18	4.51	155.85	4.69		
Boys	152.01	5.56						
Girls	150.37	5.85						
A.P.T. Abstract Reasoning*								
Random Responding	26.52	11.74	24.48	9.46	25.95	11.24	25.72	10.81
Systematic Responding	26.04	12.31	30.81	12.25	27.61	12.54	28.04	12.34
Self-Selected Responding	29.92	12.35	32.52	10.23	35.58	12.21	32.42	11.67
School	27.49	12.08	29.37	11.09	29.52	12.53		
Boys	27.50	11.54						
Girls	30.06	12.19						
Vocabulary								
Random Responding	25.52	7.69	23.62	6.73	20.00	6.22	23.32	7.26
Systematic Responding	27.21	8.07	26.62	6.22	18.13	6.17	23.96	8.00
Self-Selected Responding	22.32	9.27	27.04	7.03	25.91	5.38	25.00	7.66
School	25.00	8.49	25.80	6.75	21.34	6.75		
Boys	25.01	8.16						
Girls	23.07	6.92						
Pretest of Achievement								
Random Responding	14.41	4.99	13.48	6.31	13.60	3.93	13.88	5.11
Systematic Responding	15.67	5.18	15.24	4.92	11.52	3.50	14.13	4.90
Self-Selected Responding	14.04	5.07	17.52	4.00	16.95	5.46	16.10	5.06
School	14.68	5.05	15.48	5.32	14.00	4.88		
Boys	16.00	5.16						
Girls	13.28	4.64						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Attitude Test								
Random Responding	35.93	6.87	34.67	7.00	35.15	7.73	35.31	7.09
Systematic Responding	36.87	7.39	40.24	6.94	33.09	5.61	36.63	7.20
Self-Selected Responding	35.96	8.73	35.30	5.32	36.36	6.46	35.87	6.96
School	36.24	7.60	36.69	6.80	34.83	6.65		
Boys	35.31	7.63						
Girls	36.64	6.34						
Question Expectation								
Random Responding	3.81	0.83	4.48	1.12	3.80	0.52	4.01	0.91
Systematic Responding	4.54	0.93	3.95	1.32	4.22	0.60	4.25	1.00
Self-Selected Responding	3.56	1.19	4.09	1.24	4.27	0.83	3.96	1.13
School	3.96	1.06	4.17	1.23	4.11	0.69		
Boys	4.04	1.11						
Girls	4.11	0.91						
Desired Question Frequency								
Random Responding	3.00	1.52	3.14	0.91	3.20	1.67	3.10	1.39
Systematic Responding	3.21	1.38	3.38	1.96	3.09	1.44	3.22	1.58
Self-Selected Responding	2.92	1.41	4.30	1.64	3.77	1.60	3.64	1.63
School	3.04	1.43	3.63	1.63	3.35	1.58		
Boys	3.28	1.68						
Girls	3.37	1.40						
Test One								
Random Responding	42.96	9.03	41.14	10.14	35.25	10.58	40.13	10.23
Systematic Responding	42.12	12.39	39.48	11.33	33.43	10.61	38.37	11.91
Self-Selected Responding	42.16	9.50	45.61	10.56	42.27	10.84	43.33	10.26
School	42.43	10.22	42.18	10.84	36.98	11.21		
Boys	42.81	11.22						
Girls	38.20	10.19						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Test Two								
Random Responding	54.81	10.82	50.90	11.63	41.65	8.67	49.74	11.73
Systematic Responding	54.83	11.73	51.67	10.86	36.70	11.59	47.72	13.83
Self-Selected Responding	51.76	12.02	55.39	12.59	49.55	10.25	52.26	11.77
School	53.82	11.45	52.74	11.73	42.57	11.50		
Boys	52.28	13.05						
Girls	47.29	11.47						
Test One Plus Two								
Random Responding	97.78	17.93	92.05	19.89	76.90	17.33	89.87	20.12
Systematic Responding	96.96	22.88	91.14	19.66	70.13	19.55	86.09	23.63
Self-Selected Responding	93.92	19.69	101.00	21.60	91.82	19.27	95.59	20.30
School	96.25	19.97	94.92	20.63	79.55	20.69		
Boys	95.08	22.38						
Girls	85.48	19.71						
Chamois Test								
Random Responding	2.15	1.70	2.05	1.28	2.15	1.46	2.12	1.49
Systematic Responding	2.00	1.29	2.19	1.29	1.39	1.34	1.85	1.33
Self-Selected Responding	1.64	1.29	2.22	1.73	1.95	1.29	1.93	1.45
School	1.93	1.45	2.15	1.44	1.82	1.38		
Boys	2.08	1.52						
Girls	1.84	1.30						
Generalization Test								
Random Responding	14.19	7.18	13.67	6.19	11.65	6.79	13.28	6.76
Systematic Responding	15.92	7.56	14.81	7.88	10.35	6.38	13.69	7.59
Self-Selected Responding	13.60	6.79	16.04	4.96	13.86	7.30	14.49	6.43
School	14.54	7.15	14.88	6.39	11.94	6.88		
Boys	15.39	7.24						
Girls	12.06	6.11						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Total Test								
Random Responding	114.11	21.56	107.76	24.31	90.70	20.94	105.26	24.04
Systematic Responding	114.87	28.59	108.14	26.39	81.87	24.08	101.63	29.82
Self-Selected Responding	109.16	23.47	119.26	24.90	107.64	23.54	112.00	24.18
School	112.72	24.38	111.95	25.40	93.31	25.12		
Boys	112.56	27.26						
Girls	99.38	23.55						
Question Estimate								
Random Responding	3.96	1.09	4.19	1.33	4.10	1.74	4.07	1.36
Systematic Responding	3.75	0.99	4.05	0.38	3.87	0.46	3.88	0.68
Self-Selected Responding	4.00	1.78	3.61	1.41	3.55	1.63	3.73	1.61
School	3.19	1.32	3.94	1.16	3.83	1.38		
Boys	3.76	1.43						
Girls	4.04	1.08						
Test One Residuals								
Random Responding	1.67	8.19	2.21	8.76	-2.06	8.25	0.74	8.46
Systematic Responding	-0.81	8.82	-2.53	8.93	-1.45	10.68	-1.56	9.41
Self-Selected Responding	1.86	9.04	0.49	8.76	-0.38	9.85	0.71	9.13
School	0.95	8.64	0.07	8.89	-1.27	9.58		
Boys	1.16	8.79						
Girls	-1.37	9.15						
Test Two Residuals								
Random Responding	3.07	9.16	3.26	7.73	-2.62	6.11	1.46	8.25
Systematic Responding	0.60	8.59	-1.11	9.02	-3.69	11.42	-1.38	9.78
Self-Selected Responding	1.93	10.02	-0.45	10.64	-1.33	8.30	0.12	9.69
School	1.92	9.21	0.53	9.31	-2.56	8.92		
Boys	1.63	9.06						
Girls	-1.69	9.29						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test One Plus Two Residuals								
Random Responding	4.76	15.31	5.47	14.34	-4.68	11.93	2.20	14.59
Systematic Responding	-0.20	15.12	-3.64	14.56	-5.13	19.14	-2.93	16.33
Self-Selected Responding	3.79	17.36	0.04	17.59	-1.71	16.33	0.83	17.03
School	2.87	15.88	0.60	15.84	-3.84	16.06		
Boys	2.79	15.50						
Girls	-3.05	16.27						
Chamois Test Residuals								
Random Responding	0.15	1.69	0.18	1.17	0.42	1.36	0.24	1.43
Systematic Responding	-0.12	1.22	0.13	1.21	-0.17	1.31	-0.06	1.23
Self-Selected Responding	-0.23	1.26	0.01	1.63	-0.14	1.30	-0.12	1.39
School	-0.06	1.40	0.10	1.34	0.02	1.33		
Boys	0.05	1.44						
Girls	-0.02	1.26						
Generalization Test Residuals								
Random Responding	-0.01	7.14	0.64	5.79	-0.67	6.23	-0.00	-6.41
Systematic Responding	1.03	7.12	0.34	7.03	-0.89	6.53	0.17	6.84
Self-Selected Responding	-0.30	6.84	0.21	4.80	-0.60	6.60	-0.22	6.08
School	0.23	6.96	0.39	5.82	-0.73	6.36		
Boys	1.25	6.62						
Girls	-1.45	5.89						
Total Test Residuals								
Random Responding	4.88	18.67	6.28	17.88	-4.92	13.43	2.43	17.47
Systematic Responding	1.75	20.51	-3.17	20.01	-6.20	24.12	-2.21	21.69
Self-Selected Responding	2.29	20.98	0.26	20.15	-2.45	19.23	-0.12	19.90
School	3.03	19.91	1.10	19.49	-4.54	19.43		
Boys	3.54	19.05						
Girls	-3.91	19.88						

*N = 203. Three pupils missed this test.

MEANS AND STANDARD DEVIATIONS FOR THE PRETESTS, POSTTESTS AND RESIDUAL ACHIEVEMENT SCORES FOR THE CLASSES, SCHOOLS AND TREATMENTS FOR THE MOST FREQUENT RESPONDING AND LEAST FREQUENT RESPONDING GROUPS IN THE SELF-SELECTED RESPONDING TREATMENT IN EXPERIMENT ONE.
N = 68

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
TEST	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Age								
Most Frequent Responding	150.17	3.38	149.27	3.85	157.27	2.72	152.18	4.85
Least Frequent Responding	147.33	8.24	147.36	3.53	155.18	5.21	149.88	6.96
School	148.75	6.33	148.32	3.73	156.23	4.20		
Boys	151.62	5.86						
Girls	150.44	6.30						
A.P.T. Abstract Reasoning*								
Most Frequent Responding	27.00	11.29	30.55	11.84	34.90	12.15	30.58	11.82
Least Frequent Responding	33.83	12.90	34.55	9.02	36.33	12.96	34.78	11.39
School	30.42	12.36	32.55	10.47	35.58	12.21		
Boys	30.12	11.24						
Girls	35.09	11.81						
Vocabulary								
Most Frequent Responding	23.75	10.23	29.91	6.52	26.55	5.07	26.65	7.89
Least Frequent Responding	21.33	8.77	24.82	6.84	25.27	5.85	23.74	7.31
School	22.54	9.40	27.36	7.02	25.91	5.38		
Boys	25.91	7.71						
Girls	24.47	7.71						
Pretest of Achievement								
Most Frequent Responding	15.75	5.10	17.09	4.68	17.09	4.93	16.62	4.81
Least Frequent Responding	12.08	4.68	18.27	13.35	16.82	6.19	15.62	5.45
School	13.92	5.14	17.68	4.02	16.95	5.46		
Boys	17.41	5.25						
Girls	14.82	4.72						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Attitude Test								
Most Frequent Responding	39.67	9.22	36.82	3.63	35.18	8.00	37.29	7.44
Least Frequent Responding	31.25	5.38	34.36	6.45	37.55	4.52	34.29	5.95
School	35.46	8.54	35.59	5.26	36.36	6.46		
Boys	34.68	7.42						
Girls	36.91	6.14						
Question Expectation								
Most Frequent Responding	3.50	1.38	4.00	1.41	4.00	0.63	3.82	1.19
Least Frequent Responding	3.75	0.97	4.18	1.17	4.55	0.93	4.15	1.05
School	3.62	1.17	4.09	1.27	4.27	0.83		
Boys	4.03	1.27						
Girls	3.94	0.98						
Desired Question Frequency								
Most Frequent Responding	2.33	0.98	3.73	1.68	3.55	1.92	3.18	1.64
Least Frequent Responding	3.67	1.44	4.82	1.54	4.00	1.26	4.15	1.46
School	3.00	1.38	4.27	1.67	3.77	1.60		
Boys	3.88	1.85						
Girls	3.44	1.33						
Test One								
Most Frequent Responding	43.17	7.85	49.91	11.25	42.64	8.92	45.18	9.70
Least Frequent Responding	41.75	11.38	43.18	7.05	41.91	12.92	42.26	10.45
School	42.46	9.59	46.55	9.79	42.27	10.84		
Boys	47.29	9.75						
Girls	40.15	9.29						
Test Two								
Most Frequent Responding	52.00	13.01	60.64	9.22	47.55	9.84	53.35	11.88
Least Frequent Responding	51.83	12.02	51.82	13.63	51.55	10.72	51.74	11.80
School	51.92	12.25	56.23	12.22	49.55	10.25		
Boys	55.15	11.24						
Girls	49.94	11.90						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test One Plus Two								
Most Frequent Responding	95.17	19.07	110.55	19.30	90.18	15.41	98.53	19.53
Least Frequent Responding	93.58	21.67	95.00	19.03	93.45	23.17	94.00	20.72
School	94.37	19.98	102.77	20.33	91.82	19.27		
Boys	102.44	19.11						
Girls	90.09	19.44						
Chamois Test								
Most Frequent Responding	2.00	1.21	2.18	1.78	2.00	1.48	2.06	1.46
Least Frequent Responding	1.33	1.37	2.45	1.69	1.91	1.14	1.88	1.45
School	1.67	1.31	2.32	1.70	1.95	1.29		
Boys	2.12	1.55						
Girls	1.82	1.34						
Generalization Test								
Most Frequent Responding	13.67	6.77	16.45	4.16	13.91	7.70	14.65	6.33
Least Frequent Responding	13.17	7.27	16.55	5.13	13.82	7.26	14.47	6.62
School	13.42	6.88	16.50	4.55	13.86	7.30		
Boys	15.41	7.21						
Girls	13.71	5.52						
Total Test								
Most Frequent Responding	110.83	20.32	129.18	19.90	106.09	19.23	115.24	21.67
Least Frequent Responding	108.08	27.93	114.00	23.80	109.18	28.08	110.35	26.03
School	109.46	23.93	121.59	22.78	107.64	23.54		
Boys	119.97	23.15						
Girls	105.62	22.75						
Question Estimate								
Most Frequent Responding	2.92	1.00	3.00	1.48	2.45	1.37	2.79	1.27
Least Frequent Responding	5.33	1.37	4.09	1.14	4.64	1.03	4.71	1.27
School	4.12	1.70	3.55	1.41				
Boys	3.56	1.73						
Girls	3.94	1.43						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test One Residuals								
Most Frequent Responding	2.23	8.22	4.73	9.72	-0.12	9.38	2.28	9.04
Least Frequent Responding	1.88	10.42	-2.33	4.65	-0.64	10.76	-0.30	9.00
School	2.06	9.18	1.20	8.27	-0.38	9.85		
Boys	3.73	8.23						
Girls	-1.75	9.10						
Test Two Residuals								
Most Frequent Responding	1.25	8.91	3.94	8.20	-3.09	7.36	0.72	8.46
Least Frequent Responding	2.70	11.76	-3.93	11.71	0.43	9.16	-0.18	10.99
Schools	1.97	10.23	0.01	10.66	-1.33	8.30		
Boys	2.34	8.81						
Girls	-1.80	10.32						
Test One Plus Two Residuals								
Most Frequent Responding	3.48	15.47	8.67	16.67	-3.21	13.59	3.00	15.61
Least Frequent Responding	4.58	20.36	-6.26	14.53	-0.22	19.24	-0.48	18.30
School	4.03	17.69	1.21	17.06	-1.71	16.33		
Boys	6.07	15.06						
Girls	-3.55	17.61						
Chamois Test Residuals								
Most Frequent Responding	0.02	1.12	-0.10	1.71	-0.12	1.52	-0.06	1.42
Least Frequent Responding	-0.44	1.43	0.28	1.58	-0.16	1.12	-0.12	1.38
School	-0.21	1.28	0.09	1.62	-0.14	1.30		
Boys	-0.03	1.40						
Girls	-0.16	1.39						

	SCHOOL D		SCHOOL B		SCHOOL C		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Generalization Test Residuals								
Most Frequent Responding	-0.34	7.15	0.72	4.70	-0.52	6.92	-0.06	6.21
Least Frequent Responding	-0.71	6.93	0.44	4.67	-0.69	6.60	-0.33	6.01
School	-0.53	6.89	0.58	4.57	-0.60	6.60		
Boys	0.44	6.77						
Girls	-0.82	5.30						
Total Test Residuals								
Most Frequent Responding	3.16	17.47	9.29	17.55	-3.85	15.28	2.88	17.16
Least Frequent Responding	3.43	25.84	-5.54	18.23	-1.06	23.22	-0.93	22.37
School	3.29	21.57	1.88	19.04	-2.45	19.23		
Boys	6.48	17.99						
Girls	-4.53	20.40						

* N = 65 Three pupils missed this test.

MEANS AND STANDARD DEVIATIONS FOR THE PRETESTS, POSTTESTS AND RESIDUAL ACHIEVEMENT SCORES FOR THE GROUPS, CLASSES AND TREATMENTS IN EXPERIMENT TWO. N = 62

	CLASS ONE		CLASS TWO		TREATMENT	
TEST	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Age						
Responding	151.47	7.80	151.87	5.08	151.68	6.43
No Responding	149.59	7.38	152.00	6.67	150.68	7.06
Class	150.47	7.52	151.93	5.77		
Boys	152.23	6.43				
Girls	150.19	6.93				
A.P.T. Abstract Reasoning						
Responding	26.93	11.49	21.06	10.57	23.90	11.24
No Responding	18.82	6.81	25.21	10.99	21.71	9.36
Class	22.62	10.02	23.00	10.79		
Boys	22.03	10.27				
Girls	23.53	10.47				
Vocabulary (Verbal Aptitude)*						
Responding	10.21	4.82	9.87	3.54	10.03	4.14
No Responding	7.24	2.70	10.29	4.65	8.61	3.96
Class	8.58	4.03	10.07	4.04		
Boys	9.18	3.97				
Girls	9.41	4.22				
Analogies (Verbal Aptitude)*						
Responding	11.57	5.09	10.73	4.42	11.14	4.69
No Responding	9.24	4.10	9.79	3.42	9.48	3.76
Class	10.29	4.65	10.28	3.93		
Boys	9.96	3.82				
Girls	10.56	4.68				
Pretest of Achievement						
Responding	13.87	5.42	13.56	4.57	13.71	4.92
No Responding	13.59	4.20	13.50	4.88	13.55	4.44
Class	13.72	4.73	13.53	4.64		
Boys	14.97	4.72				
Girls	12.37	4.28				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Attitude Test						
Responding	36.13	7.64	34.81	5.46	35.45	6.53
No Responding	36.06	8.17	38.50	6.90	37.16	7.60
Class	36.09	7.80	36.53	6.34		
Boys	35.57	7.14				
Girls	37.00	7.06				
Question Expectation						
Responding	3.93	1.53	4.56	1.36	4.26	1.46
No Responding	4.65	1.32	5.29	1.27	4.94	1.31
Class	4.31	1.45	4.90	1.35		
Boys	3.97	1.22				
Girls	5.19	1.35				
Desired Question Frequency						
Responding	3.13	1.96	2.94	1.48	3.03	1.70
No Responding	3.82	1.67	3.93	1.82	3.87	1.71
Class	3.50	1.81	3.40	1.69		
Boys	3.30	1.86				
Girls	3.59	1.64				
Test One						
Responding	36.80	13.61	32.69	12.88	34.68	13.18
No Responding	29.76	12.35	30.79	12.34	30.23	12.15
Class	33.06	13.23	31.80	12.45		
Boys	33.47	13.40				
Girls	31.50	12.29				
Test Two						
Responding	44.27	16.63	42.94	14.83	43.58	15.48
No Responding	36.00	16.69	37.21	14.71	36.55	15.58
Class	39.87	16.92	40.27	14.81		
Boys	43.17	16.32				
Girls	37.16	14.98				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test One Plus Two						
Responding	81.07	29.29	75.62	26.86	78.26	27.73
No Responding	65.76	28.31	68.00	26.10	66.77	26.91
Class	72.94	29.35	72.07	26.34		
Boys	76.63	28.76				
Girls	68.66	26.55				
Chamois Test						
Responding	2.07	1.44	1.44	1.26	1.74	1.37
No Responding	1.24	1.52	1.36	1.28	1.29	1.40
Class	1.62	1.52	1.40	1.25		
Boys	1.63	1.56				
Girls	1.41	1.21				
Generalization Test						
Responding	11.87	7.43	9.75	6.89	10.77	7.12
No Responding	11.12	6.08	9.21	5.75	10.26	5.92
Class	11.47	6.65	9.50	6.28		
Boys	12.70	6.96				
Girls	8.47	5.37				
Total Test						
Responding	95.00	35.48	86.81	29.94	90.77	32.45
No Responding	78.12	33.94	78.57	29.70	78.32	31.57
Class	86.03	35.16	82.97	29.61		
Boys	90.97	34.11				
Girls	78.53	29.93				
Question Estimate						
Responding	1.47	0.83	3.00	1.10	2.26	1.24
No Responding	7.00	0.00	6.86	0.53	6.94	0.36
Class	4.41	2.86	4.80	2.14		
Boys	4.53	2.56				
Girls	4.66	2.54				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Test One Residuals						
Responding	1.40	7.35	0.49	7.84	0.93	7.50
No Responding	0.36	6.10	-0.80	6.90	-0.17	6.39
Class	0.85	6.63	-0.11	7.32		
Boys	-0.39	7.61				
Girls	1.11	6.26				
Test Two Residuals						
Responding	1.03	9.89	2.89	10.46	1.99	10.06
No Responding	-0.47	11.76	-1.80	7.90	-1.07	10.06
Class	0.23	10.78	0.70	9.50		
Boys	1.83	11.76				
Girls	-0.82	8.23				
Test One Plus Two Residuals						
Responding	2.44	15.45	3.38	17.31	2.92	16.17
No Responding	-0.12	17.11	-2.60	12.84	-1.24	15.13
Class	1.08	16.14	0.59	15.43		
Boys	1.44	18.21				
Girls	0.29	13.14				
Chamois Test Residuals						
Responding	0.42	1.38	-0.14	1.21	0.13	1.30
No Responding	-0.08	1.51	-0.02	1.17	-0.05	1.35
Class	0.16	1.45	-0.08	1.17		
Boys	0.15	1.59				
Girls	-0.07	1.01				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Generalization Test Residuals						
Responding	0.86	5.48	-0.90	6.29	-0.05	5.88
No Responding	0.58	4.88	-0.35	4.28	0.16	4.57
Class	0.71	5.09	-0.64	5.36		
Boys	1.03	5.72				
Girls	-0.86	4.62				
Total Test Residuals						
Responding	3.71	18.81	2.34	19.84	3.01	19.04
No Responding	0.38	21.87	-2.96	12.74	-1.13	18.12
Class	1.94	20.24	-0.13	16.84		
Boys	2.62	21.70				
Girls	-0.64	15.21				

*N = 60. Two pupils missed this test.

MEANS AND STANDARD DEVIATIONS FOR THE PRETESTS, POSTTESTS AND RESIDUAL ACHIEVEMENT SCORES FOR THE GROUPS, CLASSES AND TREATMENTS IN EXPERIMENT THREE. N = 65

	CLASS ONE		CLASS TWO		TREATMENT	
TEST	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Age						
Lessons	153.56	4.03	151.20	5.37	152.42	4.80
Programme	153.06	5.27	151.82	2.77	152.44	4.19
Class	153.30	4.65	151.53	4.13		
Boys	152.94	5.23				
Girls	151.94	3.57				
A. P. T. Abstract Reasoning						
Lessons	29.75	11.10	26.60	14.26	28.23	12.61
Programme	26.18	9.69	26.18	10.20	26.18	9.80
Class	27.91	10.39	26.37	12.06		
Boys	27.47	11.08				
Girls	26.85	11.45				
Vocabulary						
Lessons	26.19	8.83	25.27	7.91	25.74	8.27
Programme	27.71	6.41	23.65	7.45	25.68	7.15
Class	26.97	7.59	24.41	7.59		
Boys	27.66	8.22				
Girls	23.82	6.63				
Pretest of Achievement						
Lessons	16.06	5.23	14.67	3.60	15.39	4.50
Programme	16.94	5.40	14.29	5.23	15.62	5.40
Class	16.52	5.26	14.47	4.47		
Boys	16.19	5.06				
Girls	14.85	4.84				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Attitude Test						
Lesson	37.94	6.69	39.33	7.69	38.61	7.10
Programme	32.82	6.90	36.47	3.95	34.65	5.84
Class	35.30	7.18	37.81	6.07		
Boys	35.09	7.06				
Girls	37.94	6.17				
P.A.T. Vocabulary						
Lessons	64.81	21.18	68.20	18.49	66.45	19.67
Programme	75.71	15.21	67.65	14.11	71.68	15.02
Class	70.42	18.88	67.91	16.04		
Boys	69.87	20.87				
Girls	68.52	13.65				
P.A.T. Comprehension						
Lessons	69.06	20.79	63.40	20.24	66.32	20.39
Programme	67.65	17.97	57.35	19.78	62.50	19.33
Class	68.33	19.10	60.19	19.91		
Boys	67.47	23.65				
Girls	61.27	14.87				
Question Expectation						
Lessons	4.44	0.96	4.53	1.19	4.48	1.06
Programme	4.18	0.73	4.65	1.32	4.41	1.08
Class	4.30	0.85	4.59	1.24		
Boys	4.12	1.01				
Girls	4.76	1.03				
Desired Question Frequency						
Lessons	3.81	1.38	3.60	1.12	3.71	1.24
Programme	3.59	1.58	3.88	1.27	3.74	1.42
Class	3.70	1.47	3.75	1.19		
Boys	3.37	1.48				
Girls	4.06	1.09				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Test One						
Lessons	46.31	8.80	40.73	9.98	43.61	9.66
Programme	37.76	8.50	40.00	9.08	38.88	8.73
Class	41.91	9.55	40.34	9.37		
Boys	40.22	9.71				
Girls	42.03	9.18				
Test Two						
Lessons	55.75	8.85	50.60	9.02	53.26	9.16
Programme	46.94	9.88	45.59	9.98	46.26	9.80
Class	51.21	10.27	47.94	9.73		
Boys	49.94	10.98				
Girls	49.27	9.25				
Test One Plus Two						
Lessons	102.06	15.38	91.33	16.36	96.87	16.52
Programme	84.71	15.81	85.59	17.54	85.15	16.45
Class	93.12	17.71	88.28	16.98		
Boys	90.16	18.15				
Girls	91.30	16.88				
Test One Residuals						
Lessons	4.89	6.87	0.18	9.84	2.61	8.63
Programme	-4.74	5.97	-0.02	6.63	-2.38	6.66
Class	-0.07	7.99	0.07	8.15		
Boys	-1.01	7.24				
Girls	0.98	8.68				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test Two Residuals						
Lessons	5.03	6.85	1.71	7.26	3.42	7.13
Programme	-3.94	7.82	-2.30	7.38	-3.12	7.53
Class	0.41	8.56	-0.42	7.49		
Boys	-0.45	7.64				
Girls	0.44	8.43				
Test One Plus Two Residuals						
Lessons	9.92	10.78	1.89	15.09	6.03	13.45
Programme	-8.68	10.30	-2.33	11.81	-5.50	11.38
Class	0.34	14.02	-0.35	13.39		
Boys	-1.47	11.44				
Girls	1.42	15.48				

MEANS AND STANDARD DEVIATIONS FOR THE PRETESTS, POSTTESTS AND RESIDUAL ACHIEVEMENT SCORES FOR THE GROUPS, CLASSES AND TREATMENTS IN EXPERIMENT FOUR. N = 65

	CLASS ONE		CLASS TWO		TREATMENT	
TEST	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Age						
Reacting	152.88	3.60	157.07	5.15	154.84	4.81
No Reacting	152.39	4.08	155.20	4.97	153.67	4.65
Class	152.63	3.81	156.13	5.06		
Boys	153.68	5.21				
Girls	154.76	4.27				
Vocabulary						
Reacting	37.88	6.91	29.13	6.84	33.78	8.09
No Reacting	36.06	5.99	32.07	5.91	34.24	6.20
Class	36.94	6.43	30.60	6.46		
Boys	34.71	6.91				
Girls	33.38	7.39				
Pretest of Achievement						
Reacting	16.88	4.87	13.13	4.00	15.12	4.80
No Reacting	15.67	4.90	15.53	5.94	15.61	5.31
Class	16.26	4.85	14.33	5.12		
Boys	16.61	5.17				
Girls	14.24	4.69				
Attitude Test						
Reacting	35.29	4.44	32.87	7.11	34.16	5.88
No Reacting	34.83	7.88	35.20	6.04	35.00	7.00
Class	35.06	6.35	34.03	6.59		
Boys	32.16	6.60				
Girls	36.79	5.49				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
P. A. T. Vocabulary						
Reacting	86.65	9.77	69.33	15.89	78.53	15.50
No Reacting	83.06	13.35	76.80	10.26	80.21	12.28
Class	84.80	11.72	73.07	13.68		
Boys	82.81	9.38				
Girls	76.26	16.50				
P. A. T. Comprehension						
Reacting	84.88	9.45	52.07	19.75	69.50	22.34
No Reacting	79.00	12.85	63.13	19.41	71.79	17.80
Class	81.86	11.55	57.60	20.05		
Boys	71.32	18.44				
Girls	70.06	21.65				
Vocabulary (Verbal Aptitude)						
Reacting	17.71	3.74	14.20	4.07	16.06	4.23
No Reacting	16.67	3.48	14.20	3.43	15.55	3.62
Class	17.17	3.59	14.20	3.70		
Boys	15.65	3.97				
Girls	15.94	3.91				
Analogies (Verbal Aptitude)						
Reacting	18.41	3.50	15.00	5.61	16.81	4.85
No Reacting	19.94	2.44	15.60	4.39	17.97	4.05
Class	19.20	3.06	15.30	4.96		
Boys	17.77	3.77				
Girls	17.06	5.04				
Test One						
Reacting	54.94	7.54	47.93	8.28	51.66	8.54
No Reacting	50.17	8.96	46.93	11.57	48.70	10.19
Class	52.49	8.53	47.43	9.90		
Boys	50.26	10.22				
Girls	50.06	8.86				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S. D.	MEAN	S. D.	MEAN	S. D.
Test Two						
Reacting	65. 65	8. 46	58. 13	9. 86	62. 12	9. 77
No Reacting	61. 11	9. 21	52. 00	8. 88	56. 97	10. 04
Class	63. 31	9. 02	55. 07	9. 73		
Boys	59. 61	10. 65				
Girls	59. 41	9. 86				
Test One Plus Two						
Reacting	120. 59	13. 81	106. 07	16. 21	113. 78	16. 47
No Reacting	111. 28	15. 21	98. 93	18. 65	105. 67	17. 72
Class	115. 80	15. 09	102. 50	17. 54		
Boys	109. 87	18. 28				
Girls	109. 47	16. 97				
Chamois Test						
Reacting	3. 65	1. 69	2. 67	1. 91	3. 19	1. 84
No Reacting	3. 06	1. 66	2. 80	1. 21	2. 94	1. 46
Class	3. 34	1. 68	2. 73	1. 57		
Boys	3. 35	1. 68				
Girls	2. 79	1. 59				
Generalization Test						
Reacting	20. 12	5. 66	17. 47	7. 43	18. 87	6. 58
No Reacting	19. 50	6. 61	15. 60	7. 47	17. 73	7. 18
Class	19. 80	6. 08	16. 53	7. 38		
Boys	19. 13	6. 37				
Girls	17. 53	7. 29				
Total Test						
Reacting	144. 35	16. 06	126. 20	21. 59	135. 84	20. 70
No Reacting	133. 83	19. 39	117. 33	24. 31	126. 33	22. 98
Class	138. 94	18. 38	121. 77	23. 03		
Boys	132. 55	22. 81				
Girls	129. 79	21. 97				

	CLASS ONE		CLASS TWO		TREATMENT	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Test One Residuals						
Reacting	2.07	6.23	1.48	6.90	1.80	6.45
No Reacting	-1.72	8.52	-1.76	7.38	-1.74	7.90
Class	0.12	7.64	-0.14	7.21		
Boys	-0.21	7.42				
Girls	0.19	7.46				
Test Two Residuals						
Reacting	3.20	7.97	2.87	6.29	3.04	7.12
No Reacting	-1.77	7.20	-4.36	8.33	-2.95	7.72
Class	0.64	7.88	-0.75	8.13		
Boys	0.12	8.09				
Girls	-0.11	7.97				
Test One Plus Two Residuals						
Reacting	5.27	12.46	4.35	11.87	4.84	12.00
No Reacting	-3.50	13.29	-6.12	13.45	-4.69	13.22
Class	0.76	13.46	-0.89	13.56		
Boys	-0.09	13.15				
Girls	0.08	13.86				
Chamois Test Residuals						
Reacting	0.35	1.64	-0.03	1.57	0.17	1.59
No Reacting	-0.14	1.29	-0.19	1.04	-0.16	1.17
Class	0.10	1.47	-0.11	1.31		
Boys	0.12	1.45				
Girls	-0.11	1.35				