CURRICULUM CHANGE : THE INTRODUCTION OF A THINKING SKILLS COURSE INTO AN UPPER SECONDARY SCHOOL.

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ABSTRACT

The thesis commences by considering the changes in the concept of intelligence over the last thirty years and the rise of programmes such as those of Lipman, de Bono, Sternberg and Feuerstein that make claims of improving the intellectual skills of school students. The Somerset Thinking Skills Course (STSC) is an example of such a programme based on Feuerstein's theory. The author seeks to evaluate the course to establish if it is a practical and effective medium for students across the full ability range of an upper school. The research takes as its core a traditional experimental quantitative paradigm, but with an additional action research methodology enabling qualitative questions to be answered by students self-reporting during and immediately after the course and again approximately twelve months later. A review format and structured staff interviews provide additional inputs. The qualitative methods are set within the evaluative report framework of Stufflebeam's (CIPP) model. The pilot study and the changes in the full study as it was carried out within a modular framework with different groups thus enabling an action reflection spiral is described. For a sample of 322 pupils aged 13+ allocated to four ability bands and to either a control or experimental group, three hypotheses are developed:

i) that exposure to the first module of the Somerset Thinking Skills Course will have the effect of increasing the scores of non-verbal IQ tests administered before and after the intervention;

ii) that there will be positive qualitative reports to suggest that the STSC is helpful in developing a heuristic approach to problem solving and learning as reported by pupils;

iii) and that the effects are sufficiently robust for the change to happen within the milieu of an upper secondary school given the common major constraints on time and resources, with staff of different academic backgrounds, lacking experience and detailed training in this general area.

The hypothesis are all substantiated by the research described. The results show that the STSC is of differential benefit to groups in the lower ability bands, whereas pupils in the higher ability bands reported that they had already developed the metacognitive skills of clear mental label, analysing and synthesising, following instructions, comparing and considering alternative possibilities. There were differences, by gender, to specific parts of the course. The conclusions lead to critical consideration of improving the results by a more longitudinal approach and the difficulties of measuring the changes in learning of a large number of students organised traditionally.

"Except in the most severe instances of genetic and organic impairment the human organism is open to modifiability at all ages and stages of development"

Feuerstein et al., 1980, p. 9.

PREFACE

This thesis commences with a discussion of the concept of intelligence that is seen **as the key** to making the dependent variable operational. The essential features of the research project are indicated followed by the different types of results and a discussion of each. Mediation, whose significance was discovered as a part of the action research approach is emphasised before the final discussions.

The author considers the changes in the concept of intelligence over the last thirty years and the rise of programmes such as those of Lipman, de Bono, Sternberg and Feuerstein that make claims of improving the intellectual skills of school students. The Somerset Thinking Skills Course is an example of a programme based on Feurstein's theory. The author seeks to evaluate the course to establish if it is a practical and effective course for students across the ability range of a Dorset Upper School.

The evaluation is reported in detail and is put in context in a discussion of the concept of intelligence and recent developments in cognitive skills theory and how the concept of metacognition has been applied in teaching and learning. A brief description of Feuerstein's Instrumental Enrichment Programme and his emphasis on `mediation' is included together with a review of the Somerset teams evaluation of his work. The implications for the design of the Somerset Thinking Skills Course (STSC) are analysed.

Three hypotheses are developed.

1. For a sample of 322 pupils aged 13+ allocated to four ability bands and to either a control or experimental group, that exposure to the first module of the Somerset Thinking Skills Course will have the effect of increasing the scores of non-verbal IQ tests administered before and after the intervention.

2. That there will be positive qualitative reports to suggest that the STSC is helpful in developing a heuristic approach to problem solving and learning as reported by pupils.

3. That the effects are sufficiently robust for the change to happen within the milieu of an Upper Secondary School given the common major constraints of time and resources, with staff of different academic backgrounds, lacking experience and detailed training in this general area.

This education research is seen as being eclectic in epistemology and methodology.

The research takes as its core a traditional experimental quantitative paradigm, but with an additional action research methodology enabling qualitative questions to be answered. For example, how can teaching be improved here? The pilot study and the changes in the full study as it was carried out within a modular framework with different groups enabled an action reflection spiral. Please see the following three Introductory Diagrams.

The qualitative methods are set within the evaluative report framework of Stufflebeam's (CIPP) model as illustrated in the following diagram. The work is

evaluative because of the study's purpose in supporting curriculum innovation. The author has sought to exploit the advantages of this illuminative paradigm because of the innovatory nature of the study in its practical use within an institution.

The qualitative methods consisted of the students self-reporting during and immediately after the course and again approximately twelve months later. An additional review format and staff structured interviews provided additional inputs.

The discussion of the findings includes questions of validity and reliability as well as practicality. The results show that the STSC is of differential benefit to groups in the lower ability bands, whereas pupils in the higher ability bands reported that they had already developed these metacognitive skills. The conclusions lead to consideration of improving the results by a more longitudinal approach in view of the marked difficulties of measuring the changes in learning of a large number of students organised traditionally.

EVALUATION CHART AFTER STUFFLEBEAM'S 1971 CIPP MODEL.

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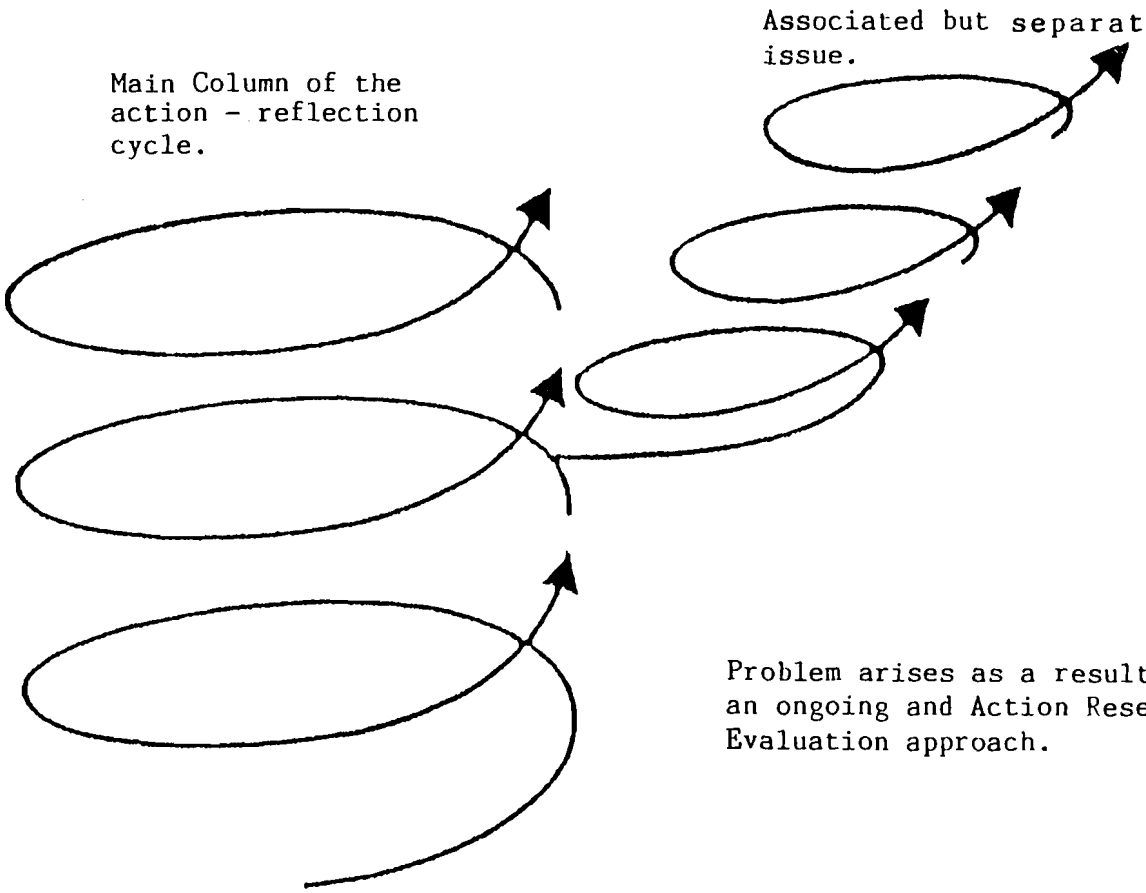

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CHAPTER 1:

A Literature Review of Intelligence, Cognitive Skills and Metacognition

"It is a great nuisance that knowledge can only be acquired by hard work. It would be fine if we could swallow the powder of profitable information made palatable by the jam of fiction."

William Somerset Maugham (1875-1965)

1.1 The Concept of Intelligence

The writer reviews the concept of intelligence as the view we take of this concept is the key to making the dependent variable operative in the study. The writer notes how the scholarship in the field has moved **from** the ideas of Binet full circle **towards** emphasising and modifying his insights.

The early psychologists tended to seek general laws about cognitive growth and human knowing. This parallelled the philosophers who sought general laws for governing logic. Within the psychological debate there were two persistent controversies 'nature versus nurture' and 'continuity versus discontinuity'. Firstly, let us consider nature versus nurture. Psychologists have argued, from the very beginnings of the discipline, over the relative importance of heredity and environment in human development, so that Benjamin (1987) et al is able to say

> "human development is influenced by both heredity and environment in such a way that the two factors appear to be inseparable".
> (p.407)

He then goes on to refer to Gottlieb (1983) who suggests it is more productive to think of one's genetic endowments in setting limits on interaction with the environment; both on a person's ability and inability to react to certain features of the environment, as being genetically determined. With this distinct position many psychologists could not agree.

The heredity versus environmental controversy is often couched in terms of maturation versus experience because of the assumption held by some psychologists that maturation is controlled by genetic factors whereas experience is lodged solely in the environment. Gottlieb (1983).

The second controversy in the study of human development, 'continuity versus discontinuity' revolves around two key questions! Does development proceed smoothly in a different pattern direction for each individual depending on variables of experience in the family culture? Or does development occur in universal stages that are discrete and separate from one another?

Francis Galton - a pioneer in the field (1822 - 1911) was very interested in genius. He devised statistical methods of ranking people by their physical and intellectual power. He then linked this to genealogy and superior minds. He developed two principal assumptions.

1. That genius was an innate genetic inheritance.

2. Superior minds would be superior in every capacity.

These principles survived, although modified, and became the basis of our now more traditional view that intelligence is a general factor largely inherited, and is the property of the brain as a whole. The question therefore is, now could you improve intellectual performance if the child was deemed **not** to have the innate genetic inheritance? Society and educationalists of the past have tended to be pessimistic and tended to answer this question negatively.

However, Alfred Binet (1857 - 1911) thought you could affect the performance of students by specific training. [Binet and Simon (1905)]. Binet based his work upon a psychometric perspective, he devised the first mental test in France as practical instruments that could help him give appropriate teaching to "mentally backward children". The key issue that was important to Binet was not what

facilities we are born with but how they were used and developed. What children need to do is to be able to learn how to learn. To do this Binet proposed a system he called mental orthopaedics, which was a kind of mental physical exercise. These exercises were specific to strengthening attention, memory, perception, invention, analysis, judgment and will. Binet gave his students intensive training and he had a hidden factor that was motivation. He assumed that given adequate motivation children could be trained to become more intelligent in their thinking. Binet's tests, later to become IQ Tests, were viewed as practical instruments to identify these children. He would have been disappointed to see this IQ testing tool reinforcing the traditional view of intelligence. He was very critical of a claim that a person's intelligence is fixed and cannot be improved. Mays (1985) suggests that we should protest against this "brutal pessimism".

Binet was particularly critical of Spearman (1863 - 1945) who led a school of thought that suggested our thinking derives from a single function called intelligence. Spearman was a student of Galton. He believed that all intellectual activities shared a common characteristic that he called the **G factor** that stood for general intelligence or general intellectual energy. Thurstone later called this factor "reason". The general factor was common on all tests performance and could be used to measure intelligence with an additional specific factor that was evolved in a particular test. Intelligence then equalled **g + s**.

Thurstone (1938) went on to suggest that a better description of intelligence is that of seven primary mental abilities. He suggested that any general factor should be viewed as a lower or second order to these primary mental abilities.

With the later work of Lewis, Telman and colleagues in the United States [Telman and Merrill (1960)], Telman examined the school records of 250,000 Californian children to find 1,528 of the most gifted, those with IQs between 135-196, he followed Allen, and predicted the outstanding success of these children in later life. That is financial success. They came out well but 82% of them came from professional and business families, not the average Californian school child with which Telman had compared them. When they were compared with children from the same social class, they achieved no more than what we might expect.

Binet sought to understand more about intelligence. This they did by putting increasing ability of children, to solve complicated problems by the use of the abilities they met in everyday experience to detailed analysis. A way of conceptualising intelligence was by factor analysis. Different sets of factors have been proposed by theorists to account for the structure of mental abilities.

The above psychologists could be loosely classified as coming from a psychometric perspective. To these we should add in more recent times research workers such as Guilford (1967; 1982) who represents a school of thought that suggests that intelligence comprises of at least 150 factors, each involving an operation, a content and a product.

Probably the most widely accepted view among factor theorists today is a hierarchical one. This has been proposed by several theorists, for example, Burt (1940); Snow (1978); Vernon (1971). These all seem to be a variation on the same general theme. Vernon (1971) sees general intelligence at the top of the factors with verbal-education ability and practical-mechanical at the next level with

succeeding lower levels. A similar theory is proposed by Cattell (1971) and Horn (1968).

Different theorists according to Sternberg (1985) postulate

> "latent structures that in combinations generate differences in observational test performance".
>
> (Sternberg, 1985, p.216)

Wagner and Sternberg conclude (talking of Vernon's model) that:

> "hierarchical models such as this one seem to account for much of the correlation data on the structure of intelligence".
>
> (Wagner and Sternberg, 1985, p.181)

The above have demonstrated an increased understanding, from a psychometric point of view, of intelligence. It seems to have moved away from the very rigid traditional view that intelligence is mostly a genetic inheritance and therefore not easily changed. However, some psychologists such as Hans Eysenck continue to have faith in the traditional IQ tests and take the view of intelligence as a fixed entity. Modgil and Modgil (1987) quote Eysenck as estimating that intelligence is the product of 80% hereditary and 20% environmental factors. This is the familiar 'nature versus nurture' debate. Arthur Jensen in the same source suggests that IQ scores can be increased only a few points on most IQ scales because of the inherited genes. The writer would argue that given a limited knowledge and ability to change any aspect of the complex human persona that a small change on existing IQ scales is valid and significant.

In opposing this generic view of intelligence many would wish to emphasise the part played by the social environment. Leon Kamin (1967) for example, develops this point of view in his controversy with Eysenck. (See The Science and Politics

of IQ). For the debate between Eysenck and Kamin see their Intelligence: The Battle for the Mind, H F Eysenck versus Leon Kamin (1981).

In opposition to the genetic point of view Vygotsky (1897 - 1934) argues that psychological processes are the result of social and cultural interaction. A child's thinking develops essentially through social experience and it is through the use of language that children take control of their thinking and make meaning from the world. For Vygotsky intelligence is a dynamic and not a static force and he goes on to suggest that all children have a potential development in collaboration with others

> "what the child can do in cooperation in a day, he will do alone tomorrow".
>
> Vygotsky (1978, p.158)

No attempt at the overview of the concept of intelligence can avoid the significant contribution of Jean Piaget (1896 - 1980), particularly that he confronted the two persistent controversies nature versus nurture and continuity versus discontinuity. What then is the Piagetian perspective? This perspective is usually put into a different category to that of the psychometric psychologists although Piaget worked for Binet in his laboratory who after looking at the incorrect answers to Binet's test items, he concluded that there were logical structures underlying children thoughts. Although they had coherence, these structures had marked differences to adult patterns.

Piaget, for over sixty years, sought to establish what these different cognitive structures might be at each stage of development and how they evolved from one stage to the next. In his theory the rôle of intelligence was **adaptation**. This provided continuity with the "lower" biological acts. With a biologists background, he saw no sharp dichotomy, as others did, between intelligent

insightful acts and those unintelligent acts that were supposed to require only reflexive actions and habits. He preferred to see such acts as extremes as a continuum in which behaviour became more intelligent as the interaction between the subjects and the objects became more complex.

Piaget further suggested that the organisational structure of intelligence and how it is shown varies with age. As a child progresses from one discrete stage to the next the cognitive structures were reorganised and extended. Piaget proposed three distinct stages of development. For further details see Ginsburg and Opper (1979) and Piaget (1970, 1976).

Wagner and Sternberg (1984) suggested that Piaget had three core assumptions about the nature of the developmental process.

1. There are four factors that interact to bring about the child development. They are maturation, experience of the physical environment, and the influence of the social environment. Importantly Piaget added the idea of equilibrium, which is the child's own self regulation processes. This coordinates and guides the other three factors.

   Piaget's theory therefore rests on the assertion that a child is a very active participant in the construction of his/her own intelligence.

2. Piaget stipulated that intellectual development shows up in the developmental stages in sequence, with each succeeding stage incorporating and extending the preceding one.

3. The stages and sequence are universal, although the rate of development will

range from child to child. Individual differences he suggests came from different rates of progression, or stopping along the way, rather than completion.

Therefore there is a single root of intellectual development for all human beings. We can then see how Piaget confronted directly the two major controversies of the field. Piaget maintained his belief in the discontinuity of development: hence his discrete stages. Some psychologists however have suggested that he refused to consider alternative accounts of development that were also consistent or in their view, more consistent with the date. Gelman and Barillargeon (1983) refers to the dominant tendencies rather than absolutes. Piaget by contrast, has been challenged over the origin of cognitive structures, (which he suggested were constructed by the child rather than inherited). Critics doubt that development would go along the same course for all normal children if inherited structures did not some how guide cognitive function. (Gelman and Barillargeon, 1983). There are however other ways of looking at intelligence and it is now appropriate to consider a contrasting information processing perspective.

1.2 The Information - Processing Perspective

The information processing perspective is another major influence that we should consider as information processing conceptions of intelligence seem to command a lot of support currently. The common theory of this intellectual community is that intelligence has to do with the ways in which people process information and represent it mentally. Associated with this area are

1. Newel, Shaw and Simon's (1960). 'Report of a General Problem - Solving Programme'

and

2. Miller, Galinter and Pribram (1960). 'Plans and The Structure of Behaviour'

Both these works suggest that information processing theories should be tested via computers.

Traditional psychometric psychologists mentioned above, agree the "Factor" as the basic unit of analysing intelligence/intellectual behaviour. Most information processing psychologists would agree that the basic unit is the elementary information process Newel and Simon (1972). From this general idea, researchers have tried to specify multiple elementary information processes might combine to perform a task. For further elaboration cf Miller, Galinter and Pribram (1960).

Sternberg, Professor of Psychology and Education at Yale University has extended this basic notion by suggesting that the two processes of information conversion

can be viewed as three basic types - metacomponents, performance components and knowledge - acquisition components.

1. Metacomponents are higher order control processes that are used for executive decision making in problem solving. This includes deciding on the type of problem being confronted, deciding on the strategy and correctly interpreting external feedback.

2. Performance components are those processes actually used in executing task performance. These include encoding the terms of the problem, they suggest relations between these terms, and comparing possible solutions.

3. Knowledge - acquisition components are processes used in learning new information and its consequences. These processes include selective encoding so distinguishing relevant from irrelevant information in material being learnt. It also includes selective comparison by which new information is assimilated/related to old information.

According to Wagner and Sternberg (1984) the

> "Information processing approach has provided a major step forward in our understanding of intelligence by specifying in intelligent functioning with precision and testability unrivalled by other accounts".
>
> (p. 184)

Wagner and Sternberg (1984) go on to suggest, with some force, that these three main approaches to understanding intelligence, intellectual capacity or thinking are largely complimentary rather than exclusive. That is, one can be eclectic between Psychometric, Piagetian and the Information Processing Perspectives. Sternberg (1982 and 1984) and Jensen (1982) postulate that there is no need to adopt only one approach only but rather view each as dealing with a different or overlapping aspects of intelligence.

They continue to characterise intelligence, when used in the everyday world, as involving adaptation to, or shaping, or selection of real world environments relevant to you. Although intelligence remains undefined, the above has several implications.

1. Intelligence needs to be considered in real world situations.

2. Intelligence is characterised in terms of its application to the environment as it is relevant to one's life. It may show differently in very distinct cultures and subcultures. Neisser (1976) pointed out that the characteristics of tasks in classrooms and on tests were the following:

   Devised by others.
   Of little or no interest.
   Have all the needed information available from the beginning.
   Being disembodied from an individual's ordinary experience.

   In 1984 Wagner and Sternberg added that academic tasks are usually very well defined, but that they often have **no** correct answer and that they often only have one method of correct solutions.

3. Intelligence is characterised in its application, adaptation to, shaping of and selection of environments. Relations between the above areas need to be pointed out. None of our tests deals directly with adaptation or shaping or selection.

Lastly, intelligence is seen as having a purpose. Plans assessed by current tests are much more microscopic than the kinds of plans we assume are relevant in the real worlds they suggest. Therefore test and theories that exist major on the internal world or the individual. The lack seems to be in the area between intelligence and the external world in which that intelligence operates. This is the world outside the scientific laboratory. Studying such functioning as intelligence outside the lab is more difficult but Sternberg suggests that the world should already be heavily involved in this type of enquiry as part of the work of psychologists. The writer agrees with the force of these arguments and seeks to use the action research paradigm because of its social basis and involvement. [cf Reason and Rowen, eds (1981)]. Further as McNiff (1988) suggests

> "action research attempts to answer the macro - micro problem ... It is researched WITH rather than research ON ... It means rather that action research has as its philosophical base an overarching awareness and respect for integrity of individuals,".
>
> (p.4)

McNiff goes on to make two further points, first that a theory has no value really, unless it can be demonstrated to have a practical implication. The works of Schutz (1972), Gadamer (1975) and Habermas (1979) are the philosophical base underpinning this view. McNiff further suggests

> "it is the living reality of people that thought is turned into action".
>
> (p.8)

For one paradigm, the information processing theories of intelligence allow for a subdivision of intelligent thinking behaviour into components. Any of which could form a focus for intervention training but with particular emphasis on metacognition. We have with an action research paradigm an involvement in the real world of the person being tested or studied which Sternberg and others suggest is so important.

We have noted that the concept of "intelligence" has undergone many changes and is still has a whole range of definitions. The impact of intelligence testing as measuring underlying fixed general intelligence has been largely demolished by the demonstration that what is measured by intelligence tests can be changed by educational experience. (cf Clarke and Clarke 1976). We can further agree with Blagg (1987) and Blagg et al (1988) that at a very basic level

> "the whole status of intelligence has a hypothetical construct is undergoing a major reappraisal".
>
> (p.3)

Howe (1988) asserts that

> "Information provided by intelligence test score fails to explain an observed level of paramount".
>
> (p.543)

Although he does concede they can usefully describe a person's test ability, they

> "neither account for it nor identify the reasons for it".
>
> [Howe (1988) p.543]

Miles (1988) is also against the

> "learned person's view that there is something called intelligence. That its absence or presence provides a scientific basis for understanding individual differences in performance".
>
> (p.535)

Miles explains six 'false' assumptions. The sixth on the matching for IQ and its dangers we find particularly relevant. Also we should note his comment that the presence of something provides minimal information but its absence provides much more. For example, the failure of certain language tasks may be due to brain damage, but

> "there would be something very odd about invoking the presence of an intact brain as the cause of success. Logically you cannot claim as an agent of cause any of the necessary conditions for the occurrence of an event but only the sufficient conditions. The absence of a necessary condition however, is a sufficient for the event not taking place and can therefore be invoked as a cause; for example, the presence of oxygen does not cause a match to catch alight but the absence of oxygen causes it not to do so".
>
> (p.537)

He suggests that this may be the reason that we are happier in allocating failure to lack of intelligence than in ascribing success to its presence.

Sternberg suggests that Howe has dismissed the field or the problem and encourages us to recognise that the future is in broadening our conception of intelligence beyond the present conventional view. [Sternberg (1985), (1988)]. He does not agree with Howe that the concept of intelligence never has an explanatory value. Nor would he follow Hilliard (1987).

Asa Hilliard (1987) is much more radical; talking in the ideology of IQ of its **utility** he states

> "The standardised IQ tests that are in use in the schools are scientifically and pedagogically without merit. The construct "intelligence" is a hypothetical notion whose valid expression has yet to be born. IQ tests and the construct of intelligence can now be discarded and teaching strategies would be unaffected. To successful teachers the tests are at best a pure nuisance and at worst a reactive influence on teaching and learning. The tests are not simply culturally biased. The bias is only a symptom of the problem, which is their scientific inadequacy. To say that "they are the best we have", is not to say that they contribute anything useful at all to instruction. The construct "intelligence" is embryonic and has heuristic value for research. Its utility for instruction remains to be demonstrated. School teachers and students should be relieved of the burden of this bad science and psychological ideology. Test-makers should come again when this product can help to make education better"
>
> (p.145)

Indeed we could add such a reassessment as encouraging the original interventionists' philosophy of Binet, after the great distortion of his work in to tests and allocating children to "appropriate" types of education by virtual IQ score. There has been an increasing realisation that children's thinking abilities are

underestimated, [cf Margot Donaldson's (1978) Critique and Reinterpretation of Piagetian Theory] for just one example that challenges previous assumptions about children's limited capacity for reasoning and abstraction. Refer also to Brown and Desforges (1979) and Modgil and Modgil (1982). Also see the significant summary article in the Independent (13 April 1991, p.25) by Gillie.

Rather, to read Binet today in such works as Brown (1985) does make him sound amazingly contemporary. Norman (1979) sums up the position that we have moved on from Binet but

> "Binet and some of his contemporaries spelt out the philosophy, but it is today's cognitive scientists who are developing the practical technology of cognitive engineering".
> [Quoted in S F Chapman et al (Eds) (1985), p.329]

Brown (1985) sums up on behalf of the article on Binet with the following:

> "you would be in essential agreement with the approach taken by today's psychologists and educators who advocate: (1) training in general thinking skills as self criticism as well as task specific skills; (2) interactive learning situations where the teacher acts as a coach; (3) instruction aimed at increasing the students self-confidence; (4) instruction aimed at the child's existing level of knowledge; (5) preceding from the simple to the complex and; (6) receding from the concrete specific experience to the general principle, all at the child's own rate and you advocate that such a programme is applicable for both the gifted and the slow as well as normal children?
> Binet: Yes, in a nutshell that fits and it works!"
> (p.329)

Given that teaching can significantly enhance cognitive ability and taking into account Sternberg's work we should also note that a small team of workers led by Professor Reuven Feuerstein have had a marked influence. This group has sought to bridge the gap in a practical manner between the developments of cognitive theory and the call of Sternberg towards bringing the world into testing and the psychologists laboratory. This group believes in the modifiability and plasticity of the human intellect and the central rôle of significant adults in a child's development.

So we can suggest that the early insights of Binet are again being emphasised. However it would be dishonest to dismiss all the scholarship in between as of little value. Rather it emphasises the value of the insights by supplying reliable theoretical and practical evidence for using the concept to operationalise our dependent variable and exploring the world of cognitive skills theory. This is the area that the writer now looks at in more detail.

1.3 Recent Developments in Cognitive Skills Theory.

There have been many overlapping developments in the fields of behaviourism, psychometrics, and cognitive psychology. Behaviourism has broadened its scope with the various techniques developed in the sixties and has now been seen as a set of resources in more of a comprehensive problem-solving approach [Blagg (1987)]. It is now more acceptable and useful to a practitioner to consider and analyse the 'affective' world and the internal processes.

Meichendaum (1985) suggested "that a set of strange bed-fellows" had come together to give rise to particular cognitive- behavioural training. He points out that social learning theory, referring to children's cognitive strategies help them to control their behaviour has been very influential. He mentions research in the early seventies demonstrating that children who are impulsive were not so intrinsically or by nature impulsive but lacked the self-mediating strategies that caused them to stop and think. This connects with the work of Vygotsky (1962) and Luria (1961).

Luria (1959) postulated three stages of development in which children began to learn to control their motor behaviour. The first stage was when young children were controlled by the speech of others. In the second stage their overt speech began to regulate and mediate their behaviour until in the third stage "inner" speech took on a regulatory function for themselves.

It was on the basis of this model that Meichendaum and Goodman (1971) developed their cognitive behaviour modification training approach in which the children were very involved in their learning process. However, transfer and

generalisation seemed to have been rather elusive. This may have been because the training procedures were very closely tied to particular tasks and the idea of transitions from external to inner thought had been rather simplistic in approach. By 1977, Meichendaum acknowledged these difficulties and suggested several ways where transfer might be enhanced.

These suggestions have not yet been researched and developed in any depth.

In the psychometric field, the Illinois Test of Psycholinguistic Abilities (the ITPA), caused a lot of enthusiasm in the early sixties because it provided a model for assessing and teaching skills that were lacking but were essential for learning. Kirk, McCarthey and Kirk (1968) suggested that the ITPA did not lead to general improvement in attainment or on general learning abilities. Ysseldyke and Salvia (1974); Hammill and Larsen (1974); Newcomer, Larsen and Hammill (1975) all pointed out basic assumptions and weaknesses that underlay this training model. More forcibly Bradley (1983) said that disillusion was widespread and the tragedy was that children were being subjected to interventions that although exciting in themselves were of unproven effectiveness. These critical evaluations led to the training procedures being largely abandoned. Sternberg (1985) suggested that such factors as verbal comprehension or reason did not tell us what it was being trained. The psychometric model does not seem a useful way of teaching or training in the cognitive skills.

The most recent current development seems to be the Vygotskyan idea that intellectual development is an outcome of educational experience. This is in many ways to override the more pessimistic biologically based Piagetian view. Vygotsky's approach (1935 - 1978a) was a dynamic approach to intellectual

assessment and talked about the need to identify a "zone of proximal development", which is the distance between the actual mental development level as determined by independent problem-solving and the level of potential development as determined by problem- solving under adult guidance or in collaboration with peers who are more capable. Lidz (1987) has a very good review of the state of the art of dynamic intellectual assessment.

Feuerstein and his colleagues were talking in similar terms about the need to assess a learner's potential for learning by carefully analysing the amount and the sort of mediation required to help a child acquire a new concept or skill. They evolved a package of materials known as the Learning Potential Assessment Device (LPAD) the basis of which is indicated in Feuerstein, Rand and Miller (1979). Although the tests are similar to aptitude instruments and the old IQ Tests in which formal assessment both the examiner and the examinee have to follow the standardised instructions has been transformed into an approach in which the examiner plays a crucial mediational rôle.

So we can appreciate that active learning approaches that attempt to change an individuals' cognitive skills are now gaining favour over a more passive approach. The part played by social interaction as a developmental force is being recognised alongside the other self-regulatory features that have been described as metacognition, which the writer now considers.

1.4 Cognitive Skills - Metacognition

In the past few years a considerable amount of research has been devoted to the study of metacognition particularly in its role in cognitive development and in effective teaching and learning. A lot of the research was linked to the critical thinking skills movement.

In its most general sense, metacognition could be defined as 'learning about learning'. It has been defined as "knowledge and control of one's own cognitive processes" by Flavell (1978), and again in 1979 as "knowledge and cognition about cognitive phenomena". Baker and Brown (1984) described it as "the knowledge and control one has over his or her own thinking and learning activities". Flavell (1976) seems to have the most quoted example

> "For example, I am engaging in metacognition ... if I notice that I am having trouble learning (a) than (b); if it strikes me that I should double check (c) before accepting it as a fact; if it occurs to me that I have better scrutinise each and every alternative any multiple choice type task situation before deciding which is the best one; if I become unaware that I am not sure what the experimenter really wants me to do; if I sense that I had better make a note of (d) because I may forget it; if I think to ask someone about (e) to see if I had it right."
>
> (P.232)

In their review of the current literature relating to the expanding field of instructional psychology, Gagne and Dick (1983) noted the increasing contributions coming from research in the domain of cognitive psychology. They felt it was significant that the concept of metacognition relating to instructional design was having a promising impact. Schmitt and Newby (1986) noted that the phenomena started with an initial interest in memory phenomena [Flavell (1971)] has led to a widespread investigation in the field of reading research Baker and Brown (1984). Since then there has been an explosion in research on 'thinking about thinking'. It has been shown that young children and low achievers are less

able than adults or high achievers to talk about techniques and methods of learning and problem-solving employed in specific tasks. Campione, Brown and Ferrara (1982), Blagg (1991), Paris and Lindauer (1982).

Bracewell (1983) felt that the term remained imprecise although it did provide a potentially useful framework for examining quality differences between thinking of gifted and other persons. Research on metacognition has become popular among developmental and processed orientated psychologists and has provided a bridge between cognitive behaviour modification [Meichendaum (1980)] educational technology Gagne (1980) and the theories of intelligence such as Sternberg (1979). Metacognitive knowledge is generally assessed through verbalisations about one's learning characteristics, state of knowledge or understanding of features of the task that may influence a person's performance. A variety of criteria has been used to operationalise the concept of metacognitive skill. Bracewell (1983) argues that the distinction between metacognitive knowledge and skill may not entirely be necessary or useful.

Metacognition implies control over mental activities and strategies which enhance learning. The general concept is especially relevant to education, the more knowledge about their abilities and learning strategies the more they are apt to acquire new knowledge and skills [Lawson (1984)].

Ellis (1989) noted that students who had metacognition training in the use of executive processes generally had the use of these strategies to novel problems in the classroom spontaneously. This involved verbal expression of metacognitive knowledge. Dirkes (1985) quotes Lawson (1984) arguing that knowledge of cognitive processes can be separated logically and empirically from their control

and that both aspects are causally involved in performance from an early age. She goes on to advocate for gifted students, a metacognitive approach to learning. In particular for increasing the awareness and as a way of maximising the variation in abilities. Federico (1980) indicated that as students develop metacognition, they acquire unique problem-solving strategies that become an aptitude for learning. Individuals find that they can help themselves additionally to have a teacher who can help them. Strategies are used when students don't know what to do as well as when they do know [Coster (1984)]. Therefore the students multiply opportunities for learning and the transfer of skills and what they know to the new situations.

Dirkes (1985) goes on to suggest that a lot of support exists in learning theory literature for increased development of many abilities related to self-direction with increasing age. Among them are flexibility, appropriate strategy or making use of information, and exhaustive exploration of reality and possibility [Sternberg and Powell (1983)]. See also Ennis (1985). She appears to see metacognition and transfer and generalisation as the same thing. Blagg (1987) suggests that this wider repertoire of skills and the conscious control over them does provide the key to transfer and generalisation. He draws our attention to the work of Annett and Sparrow (1985) who proposed an information processing theory of transfer in which a skill is regarded as a complex pattern of behaviour controlled by a plan or schema that specifies and controls the actions appropriate in particular situations so that Annett (1989) indicates

> "when detailed skills are not readily transferred from one situation to another, this is an indication that they are not under the control of the plan which is currently in operation .... This theory of transfer leads, to a different prescription of what to do to encourage transfer and that is to identify the higher level skills that should be controlling behaviour in a given problem area and to teach these in such a way they incorporate a set of appropriate, and if necessary verify specific skill components."
>
> (p.12)

Annett (1989) equated transfer skills with metacognitive skills but not as a simple area rather, it is complex and confusing. It is difficult to distinguish between specific skill components and metacognitive skills. Can these skills and strategies be defined with sufficient clarity to be taught in the classroom? We can agree that giving a process a name does not necessarily tell you what is involved in that process.

In the literature from curriculum and cognitive stand points a multitude of metacognitive skills and processes have been suggested. Blagg (1991) suggests that at this time there is no accepted taxonomy nor commonly accepted lists. Nisbit and Shucksmith's (1986) review illustrates the lack of common language and the highlighting of overlapping views of many researchers.

One of these areas was the process referred to as mediational skills [Resnick and Beck (1976)]. Belmont and Butterfield (1977) called controlled processes and Kirby (1984) referred to microstrategies. Then these same authors went on to refer to higher order processes as general strategies. Nisbit and Shucksmith (1986) made a helpful clarification by an analogy, which was a football team and its trainer. The individual players needed to acquire and practice individual or control skills, and so on. Prior to the match or at half time, groups of players may plan tactics together or strategies that involve a careful selection, secrets in, coordination of skills, for a specific purpose. Nisbit and Shucksmith took the analogy further by inquiring into what happens when the strategy does not work. A poor team might

continue with the same tactics, irrespective of the outcome. A good team would be able to monitor and assess the situation and flexibly adapt the strategy to achieve the desired goals. They pointed out that it does not matter how proficient the individual players are at their individual skills if they cannot coordinate them into a useful strategy. Furthermore the analogy demonstrates the different levels of strategic thinking, with monitoring, checking, and revision procedures requiring high level processes then the generating and planning of tactics. Blagg (1991) makes much of this and we agree with him that it is a very useful analogy. He goes on to link this with the information processing model of cognition, which he suggests Sternberg (1985) worked out as a model in the light of the implications of this analogy and surrounding implications. We have referred to his model previously but should note that it does not provide a comprehensive guide of how to go about teaching the different processes involved in intelligent behaviour, but it does provide a structure for analysis and teaching of many different aspects of such behaviour.

Neisser (1976) pointed out the unique characteristics of tasks in classrooms. In 1984, Wagner and Sternberg added that academic tasks are usually very well defined. That they often have no correct answer. They often only have one method of correct solution. How then has the concept of metacognition been applied in real learning situations?

1.5 How the Concept of Metacognition Has Been Applied

As the movement to help students in achieving well in their academic work moved away from all sorts of hints and tips, people such as Gibbs (1977), really began to point out how much such hints do **not** help. The work from the cognitive psychologists point of view seems linked to more specific skill area perspectives in applying metacognition to studying from the text. Taylor and Beach (1984); Tei (1985); Stewart (1985); Englert, Stewart and Heibert (1988); and Englert and Taffy (1989). In relating metacognition to writing prose, Boss and Filip (1984) indicated that unsuccessful students in writing prose were not able to regulate their comprehension and to monitor or correct the potential confusions in their own or other people's text. In addition, research on students metacognition suggested that the disabled writers exhibit less control of the writing process and are clearly more dependent on external criteria and resources, for example on the teachers, rather than on their own internal resources to help them monitor the completeness and accuracy of their writing. When Englert, Raphael, Fear and Anderson (1988) asked students whether a pretended students paper was finished those with difficulties tended to differ from normal achievers in that they invoked external criteria in evaluating the completeness, such as a teacher criteria, saying "she needs to show it to the teacher".

Further, when the **same** students asked how they could organise their ideas before starting the paper, the majority of students with problems in this area, concentrated on generating and organising individual words, rather than operating on text at the idea or structure level. They suggested that they should organise words by asking the teacher or looking up at the board. This indicated an undue focus on mechanics and external cues rather than internal cues to decide what to do and when to do it.

Much of the work of Palincsar and Brown (1987) stems from a concern not with writing but with manipulating the text. They described a relationship between a metacognition defined as 'awareness and regulation of cognitive activity' and the needs of students who are 'having learning difficulties' in the academic sense. Investigations they carried out including the increasing of text comprehension and improved written expression. They pay particular attention to the role of the teacher and the learner in the acquisition and control of a targeted strategy.

In 1984, Palincsar and Brown suggested that metacognition strategies could be modelled and they developed a reciprocal teaching method to help teenage remedial readers improve their comprehension. Using short segments from the texts, the researchers developed modelling, summarising, questioning, clarifying and predicting as a methodology. The students were working in small groups where they took turns as the teacher, generating a single sentence summary of material asking comprehension questions, clarifying and making predictions about what would come next. Participants made significant gains in their science and social studies course work.

Palincsar and Brown (1987) continued to develop a metacognition instruction as they endeavoured to help students to plan, implement and evaluate strategic approaches to learning or problem solving. They sought to influence how the learner interacts with the learning situation, they were working with exceptional children, structuring the dialogue based upon Brown's work of 1980,1982 & 1986.

In 1987 Palincsar and Brown published a good example of the development of the metacognitive concept in relating to instruction. They were attempting to enhance

teaching and instructional time through attention to this idea. Their review of 1987, included from the teachers' point of view five major aspects of their methodology.

1. Careful analysis of the task in hand.

2. The identification of strategies that will promote successful task completion.

3. The explicit instruction of these strategies accompanied by metacognitive information regarding their application.

4. The provision of feedback regarding the usefulness of the strategies and the success with which they were being acquired.

5. The instruction regarding the generalised use of these strategies.

Brown and Sproson (1987) when examining the cognitive and metacognitive demands made on secondary school pupils in their normal schooling (although this was a small sample) they used a mnemonic strategy to aid recall in history lessons. The students were enthusiastic and the technique did develop some improvement but they felt that this involved and structuring of material to apply these strategies. Ellis et al by 1989 found that the intervention processes resulted in increase in the students' verbal expression of metacognitive knowledge and the ability to generate task specific strategies. Students' regular marks tended to increase.

Ellis and her colleagues gave specific strategy instruction to those students who did not spontaneously generalised the use of the strategy to problems encountered in

2. There are studies that try to increase the student motivational process directly. Schunk (1984) and McCombes and Schunk (1986) are good examples of this approach.

3. Those studies that attempt to improve classroom or home support systems [see Corno (1980)]. Corno (1986) felt that these were ambitious programmes that changed classrooms support systems significantly. Because they altered the environment considerably, various versions of cooperative learning that have been more widely used seemed to exemplify such ambitious efforts. [See Slavin et al (1985)].

By 1985, Biggs refined the concept of metacognition when related to learning within a school or college as a Metalearning. He suggests, perhaps bringing Corno's three research strands together, that effective learning under institutional conditions requires, that students are aware of the task demands of their intentions. That students assess realistically and exert control over their cognitive resources. The fulfilment of such conditions involves a more sophisticated type metacognition, which Biggs calls Metalearning. He developed a series of studies in Australia that account for the role of Metalearning in the study and learning processes of secondary and tertiary students. Ability patterns, locative control, variety and quality of certain non-school experiences and the extent and kind of motivation all seemed involved in the development of the metalearning capacity. A model was developed on the three main approaches to learning.

1. Deep

2. Achieving and

and

3. Surface.

These led to qualitatively different learning outcomes. Those motives and strategies that collectively comprised these three broad approaches to learning were also observed by Entwistle et al (1979); Watkins (1983); O'Neil and Child (1984); and Entwistle and Kozeki (1985) independently of Biggs whose study was marked by good design and the large size of his sample.

The Learning Process Questionnaire - (LPQ), and the Study Process Questionnaire - (SPQ), in Biggs (1988) are designed to assess the more important aspects of the three approaches to learning for each student within an **integrated** theory. This, together with its ease in administration has made it a useful tool in examining the profile of a student in teaching or counselling, but it is not yet normed for British Students.

The only other useful instrument with similar purposes would be the Lancaster Approaches to Study Inventory - (ASI), Entwistle and Ramsden (1983), which with sub-scales is longer to administer, although normed on British subjects and is for tertiary students only. As with other models they do stress the complex nature of the learning process and the importance of the metacognitive aspects whatever the age or ability of the students falling within the group. We are then left with the question 'How can we teach these cognitive styles?' The writer looks at four of these approaches.

1.6 Programme Teaching Cognitive Skills

In the USA there is a range of cognitive skills programmes which, their advocates claim, provide the teaching materials for the various processes and components involved in academic/intellectual tasks.
Particularly well known are:

1. De Bono's (1973). CoRT System.

2. Lipman's Philosophy for Children. Lipman (1980) and Sharp and Oscanya (1980).

3. Instrumental Enrichment. (Feuerstein, et al 1980).

4. More recently Sternberg's Componential Training Programme (1985, 1986) has appeared although this does not yet seem a fully comprehensive version.

These and other programmes have been comprehensively reviewed and discussed particularly in Lipman, Segal and Glaser (1985a and 1985b) and more recently in Blagg, Ballinger and Gardner (1989). Each programme seems based upon theoretical considerations and models which, although different in style and intentions, seem to overlap.

Blagg (1991) suggests that each tends to emphasise different higher and lower order metacognitive processes. The programme that has attracted most attention and has been subject to the most extensive research is Feuerstein's Instrumental Enrichment. However, we turn first to the older but popular programme of De Bono.

1.6.1 De Bono's CoRT System

De Bono's CoRT System tends to be more concerned with pragmatic than theoretical issues in contrast to say Instrumental Enrichment. The article in Schwerdel and Maher (eds), International, Perspectives, Programmes and Practices, (1986) supports this contention. It is entitled "The Practical Teaching of Thinking Using the CoRT Method" by Edward De Bono in which he suggests the widely used CoRT Programme is founded on the beliefs that if thinking skills are to be learnt well, they must be taught directly, not incidentally, and that regular teachers in regular classes are, with brief training equipped to teach these skills. Because CoRT focuses on processes by the use of thinking tools rather than on content:

> "learners can readily transfer thinking skills from one type of problem to another".
>
> (p.33).

He continues

> "Practicality! Practicality! Practicality! I want to emphasise that very strongly as the most important point in the direct teaching of thinking is a skill. I have seen far too many complex and confusing programmes which are possible in theory but are impossible to teach. The only true test of Practicality is use in the classroom".
>
> (p.33).

As much as we would agree with the practicality comment, we must also note that Mays (1985) suggests that De Bono believes that thinking as a skill can be improved, and that he differentiates between thinking and intelligence. He compares intelligence to the engine power to a car and thinking to the skill with which the car is driven, thus he tells us that innate intelligence can be compared with the intrinsic power of the car. The skill with which the power is used is the skill of thinking. Thinking is seen as an operating skill through which innate intelligence is put into action. Mays (1985) suggests that this is an awfully muddled analogy, especially as it comes from someone concerned to make us think more clearly. De Bono seems to regard intelligence as a unitary factor, like the

rated cc of a motor car engine. Some of us presumably are three litre intelligence, others only 750 cc Mini. In De Bono's view, we could train a 750 cc intelligence so that it functions more effectively than an untrained three litre engine. However as May indicates, De Bono ignores our present lack of discrimination, that we cannot separate intellectual potential from actual performance.

De Bono (1985, p. 364) enumerates the CoRT Programme Design objectives.

1. The programme should be simple and practical.

2. The programme should have utility across a wide range of ages, abilities and cultures.

3. Thinking skills trained should be the thinking skills required in real life.

4. Training in thinking skills should not be dependent on prior acquisition of a knowledge base.

5. Students should be able to transfer the thinking skills they have learnt to a variety of real life situations.

6. Instruction should be based on an understanding of the information handling characteristics of the mind. That is, a central assumption underline the programme is that the mind is pattern making and pattern using. (cf. De Bono, 1969).

His model has been translated into a full computer simulation by Lee and Madurajan (1982) with results that support the behavioural predictions made for it. The CoRT Programme places a great emphasis on the importance of perception in thinking. De Bono (1986) went on to explain that the CoRT thinking is concerned with the perceptual aspects of thinking specifically how we build our maps of the world around us. He suggests that we are pretty good at mathematics and other processing systems but remain poor at perception where most ordinary thinking takes place. He suggests that skill in thinking is more than knowing the rules of logic. It involves much more perception and attention directing. It also involves exploring experience and applying knowledge.

> "It requires looking broadly at a situation, and not just in terms of immediate available information and certainly not in terms of an egocentric view... Perception is the activity of extracting information from experience and many other sources. In formal education however, such information is presented in the textbook of a teachers' lecture, outside the school one must find it out for oneself with a broad base of information, interviews are more likely to be successful engaging such thinking skills as planning, problem-solving and decision-making."
>
> (p.44).

He goes on to say that to be successful depends on "operacy" that is the skill required in getting things done and making things happen. Together with perception that takes place in an active self-organising system, he suggests that we need to build a metacognitive pattern system that would be used to direct attention. He suggests that this is done with the CoRT tools that become operator concepts. More detail is given in De Bono (1969).

In summary, he suggests that these considerations at a deep and fundamental level of system information behaviour, must be translated into practical and usable devices. He suspects that brain chemistry itself may be slightly altered when we look at something in a positive or negative way. That is why it is advantageous to carry out sequentially the three segments of PMI, without hopping back and forth

from one to the other. Such deeper points do not have to be explained or understood for the tools to be used as operating instruments. Yet it is for these considerations that the tools were designed. Mays (1985) agrees with our previous conclusions that this is a very down to earth approach that would appeal to the no-nonsense teacher and businessman. May (1985) goes on to criticise de Bono by saying

> "However, he is not much of a theoretician, judging by one of his books, in which he puts forward simplistic mechanical model of the mind".
>
> (p.151)

He adds that his impression is that the system is a little **to** cut and dried, despite the ideas of lateral thinking. De Bono is primarily concerned with introducing better techniques and strategies to make the best of what intelligence one has. The writer concludes that at least theoretically, his views are **not** in conflict with the intelligence testers who believe in the immutability of IQ.

The above model is brought into stark contrast by the work of Reuven Feuerstein, who is a clinical psychologist who studied with Andrea Ray and Jeanne Piaget in Geneva in the nineteen fifties. Before outlining his ideas and making a contrast we should take passing note of Lipman's philosophy for children and Sternberg's componential training programme.

1.6.2 Lipman's Philosophy for Children

The Philosophy for Children Programme (Lipman) is different from both the CoRT and the Feuerstein Programme, yet seeks to promote the development of many similar intellectual/academic skills.

> "... it is not enough for students simply to learn the content of academic disciplines; to be truly educated, students must be able to think in those disciplines".
>
> (1984, p.55)

The programme is not based on any psychological theory but has its roots in the nature of philosophical thinking. Lipman is a philosopher, and argues that although it is difficult to define philosophical thinking, it not only involves thinking and reasoning but also includes thinking about thinking. Socrates emphasised that there were criteria that could be used to evaluate such thinking. These were:

1. The internal consistency of arguments.

2. The nature of the assumptions underlying the arguments. (Lipman et al 1980, Bransford, Arbitman-Smith, Stein, and Vye, 1985).

Lipman and his colleagues seemed to have extended Socrates' idea that thinking things through in a logical and philosophical way can help people. They suggested that it can not only benefit adults but also children, capitalising on their natural wonderment about the world leads them to question similar issues that exercise the minds of early philosophers.

Lipman then analysed the teaching of traditional philosophy and exposed a wealth of ideas that can be debated and discussed in terms of logic. He wrote children's

novels in which the characters spend a lot of time reflecting of ways in which better thinking can be distinguished from weaker thinking. The novels and exercises are explained in an accompanying teacher's manual. Each lesson involves the children reading the text and discussing the story and doing follow-up exercises. The pupils identify with the characters and rehearse their thinking processes and 'mull over dilemmas'. It appears to be targeted at children who already have reasonable cognitive abilities. Lipman identifies first the thinking skills that the teaching programme intends to foster, many of which overlap with some of the higher level metacognitive skills promoted by Feuerstein. The essence of Lipman's programme is discussion and reading, there is very little emphasis placed on recording answers. There is discussion and recording but little reading in Feuerstein's work.

Lipman's programme has been tested and evaluated with some encouraging findings although the quality and objectivity of the evaluation studies have been seriously questioned by Sternberg and Bhana (1986) who highlighted major flaws in the twenty studies they reviewed. Blagg (1991) suggests that apparently, the programme seems to offer a lot to pupils who already possess a minimum cognitive resources to cope with the course.

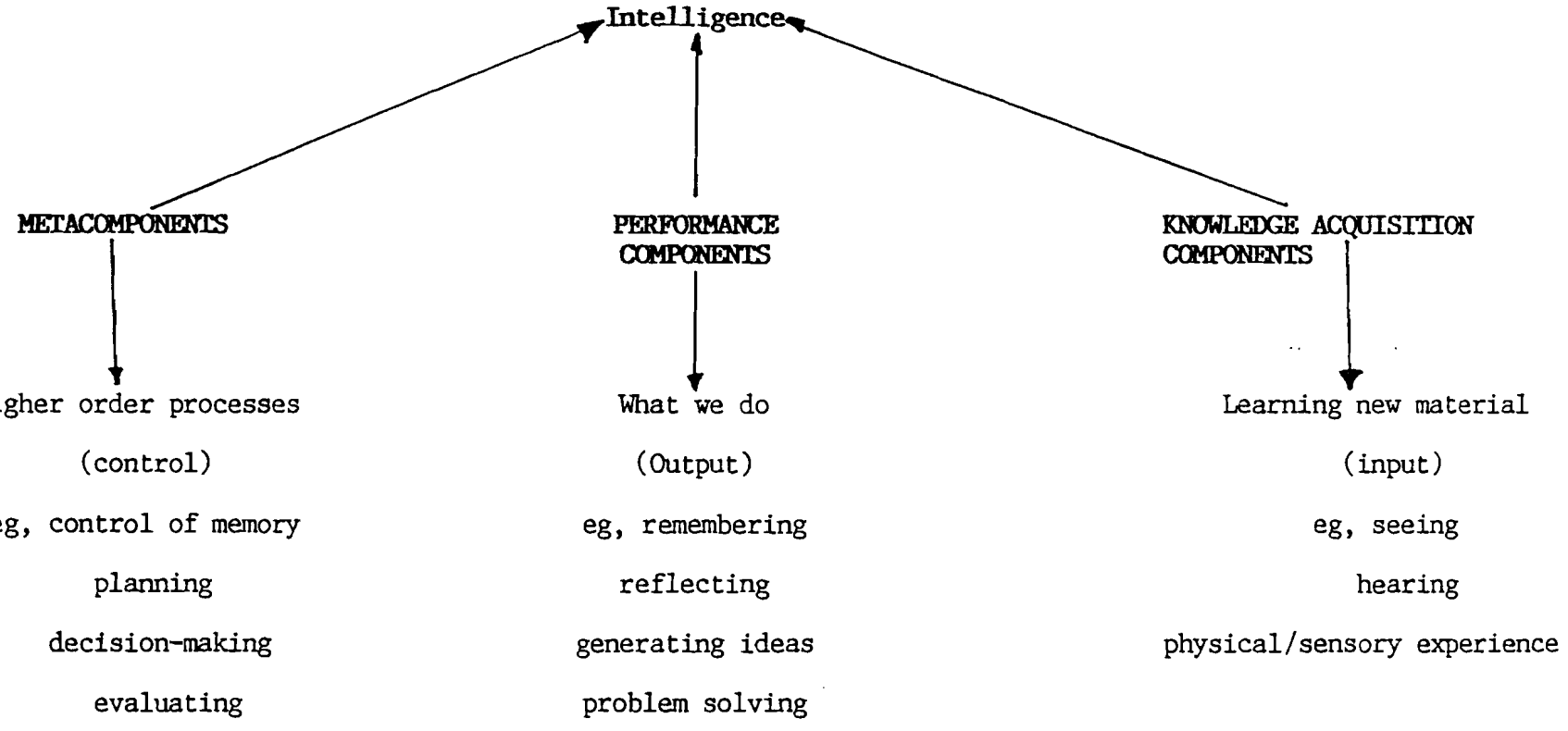
1.6.3 Sternberg's Componential Training Programme

In contrast to programmes that are associated with loose metaphors, like CoRT, or with philosophical enquiry such as Lipman, Sternberg (1985) and Feuerstein's (1979) are much more closely linked to psychological theory. Both have an information processing orientation but this is expressed in different ways. Both Sternberg and Feuerstein take an optimistic view about the ability to modify intellectual development we have. Each author stresses the different aspect of this **dynamic** process. Feuerstein emphasises mediated learning experience (which we will refer to later), Sternberg concerns himself with the mechanisms by which various components of behaviour interact that he calls the **'executive functions'**. Increases in knowledge enable more sophisticated forms of acquisition, retention and transfer and possibly improvements in performance components. Higher order, self-monitoring, meta-components enable individuals to learn from their mistakes. Indirect feedback from lower order components to another component alongside it directs feedbacks to the meta-components should result in improved efficiency in performance. (cf. Sternberg 1985). This is Sternberg's basic componential theory, it is less inclusive and more vigorous and experimentally biased than others but he admits that it probably cannot be disproved. He suggests that particular examples of each of five components of his theory have been empirically tested.

Sternberg's argument is that intellectualism can be built up by improvement in any lower or higher order information processing components. His programme therefore, aims to train individuals in meta-componential skills, performance componential skills as well as those skills that involve components of knowledge acquisition, retention and transfer. Each section of his training programme include material that relates the instructions to the general theory, provides training in the

particular process that is of interest, uses real world and research examples of the component skills being developed, illustrates model examples of applications of the component skills, provides multiple exercises that enable independent practice in the use of these skills. Meta - componential training can be broken down into seven areas. (See Sternberg, 1985). Blagg (1991) suggests that Sternberg's (1977) theory of intelligence provides a useful framework within which to analyse and investigate various aspects of intelligent behaviour. His model overlaps with and is complementary to Feuerstein (1979, 1980) theories.

We now move on to a brief overview of the work of Feuerstein as this is the theoretical background and impetus out of which the Somerset Thinking Skills Course arose.



The brain as information processor

"Some psychologists maintain that the one factor unique to human thinking is metacognition, which is the ability we have to reflect on our own thinking processes. Human intelligence, they suggest, derives from the information processing capacity of the brain. Sternberg (Sternberg R J (ed) 1984: Advances in the Psychology of Human Intelligence. Hillsdale, H J, Enlbaum, 1985: Beyond IQ: A Triarchic Theory of Human Intelligence. Cambridge University Press.) identifies three component elements involved in our capacity to process information. They are metacomponents, performance components and knowledge acquisition components."

(From Fisher, R, 1990, p.11, Basil Blackwell Ltd, Oxford)

Figure 1.

CHAPTER 2:

A Review of Feuerstein's Instrumental Enrichment Programme

"So, Socrates, you have made a discovery - that false judgment resides, not in our perceptions among themselves, nor yet in our thoughts, but in the fitting together of perception and thought."

Plato's Theætatus

2.0 Feuerstein's Instrumental Enrichment Programme

The purpose of this chapter will be to explain some of the main aspects of Feuerstein's ideas so that the Instrumental Enrichment (IE) can be understood within its context. A brief description of IE will then be given particularly relating his ideas to the 'mediation' process. A resumé will provide some of the more basic and important research studies into the effects of IE which have been carried out. Some references will be made relating this work to classroom practice and teaching generally.

2.1 The History of the Theory

Reuven Feuerstein is a Rumanian Jew who was one of the founder members of the Zionist State of Israel after the Second World War. He was responsible with others, for the education of young people coming into the country from all parts of the world. He quickly became aware not only of the culturally different backgrounds of the people coming to him, but also that they were being categorised as mentally retarded because of 'cultural deprivation' or other reasons, when he felt they were far more capable than was being revealed on the conventional assessment methods.

Out of this experience and other work in Morocco, Feuerstein began to develop a set of ideas which were quite revolutionary at that time. His definition of cultural deprivation was different from the popular view. It was in marked contrast to the largely discredited notions of Bernstein and the other sociologists of the 1960s, Feuerstein's idea of culture was that it should be seen as a 'process by which the knowledge, beliefs and values of a society were transmitted from one generation to

the next'. This was **not** best measured as a static 'snapshot' of a set of behaviours. He described the lack of this culture or culture deprivation as

> "a state of reduced cognitive modifiability of the individual, in response to a direct exposure to sources of simulation".
> (1980, p.15)

which is a failure on the part of the whole group to transmit or to **mediate** its culture to the new generation. Further elaboration of Feuerstein's ideas can be found in one of his papers, especially Feuerstein and Hoffman (1982). The importance of his view of cultural deprivation is that it dictates the most successful members of society, he goes on to state that 'cultural' defines the most successful societies, as those who have access to their own cultures. Parents and educators are responsible to make this culture available, if parents and educators fail in this task, the children will fail educationally and cultures will change or even die out.

For Feuerstein, the main issue for parents and teachers is **how** to encourage children to learn how to learn. This led him to attack the entrenched beliefs about human development and brought him into conflict with the most respected psychologists of the time, Jean Piaget and Arthur Jensen.

In his pursuit of understanding of how children learn, Feuerstein studied under Piaget where he became impressed with the ideas of a less well known psychologist, Andre Rey, to whom he always acknowledged his debt. At a time when Piaget's writings and ideas were received almost unquestioningly by most scholars in the field, Feuerstein came to understand that far too little emphasis was placed on the social context of learning by the whole Genevan school. Unknowingly to Feuerstein he was in line, with the largely unreported at that time,

ideas of the great Russian psychologist, Vygotsky, and some of the later work of Jerome Bruner and others. [Burden (1987)].

The fashionable views of Jensen and his British colleagues, Burt and Eysenck, about the very fixed and inherited nature of intelligence ran right against Feuerstein's views of the differences between intellectual potential and the measured performance of IQ tests. Feuerstein created a tide of thinking which was optimistic about the possibility of bringing about cognitive changes in the most difficult, and retarded individuals. Feuerstein began to build up a team of like-minded colleagues who sought to find practical ways of breaking some of these established truths/myths. The most outstanding of these collaborators was Jokov Rand, Mildred Hoffman and Mogens Jensen. With funding from basically Western Jewish sources, he set up his research institute on the outskirts of Jerusalem which became a centre for teaching and INSET of teachers, parents and research workers from all over the world. Feuerstein reputation began to grow and was confirmed with the publication of his two key tests, "The Dynamic Assessment of Retarded Performers" in 1979 and "Instrumental Enrichment" in 1980.

2.2 Key Aspects of Feuerstein's Thinking

Feuerstein emphasised that his theories do not grow out of a vacuum but are always based on values and belief systems. He suggests that belief systems are basic to effective action and argues that without a belief in the almost limitless human potential barriers will always remain to prevent change. One of these major hurdles he sees as the traditional IQ tests and uses, perhaps we could say misuse, made of them by this traditional view. Feuerstein's belief is much more positive.

> "except in the most severe instances of genetic and organic impairment the human organism is open to modifiability at all ages and stages of development."
>
> (Feuerstein et al 1980. p.9)

If one takes on board such a belief system, a number of consequences follow logically. Perhaps the key being for Feuerstein is his notion of **"structural cognitive modifiability"** which his way of saying that even the cognitive structure of the brain can be changed by enabling people to learn how to learn. This learning he sees as cumulative and in turn affects performance over ones lifetime. This is of course rather against some traditional dogma that we become less effective learners as we grow older. (Of course, since Feuerstein's initial comments a lot of work has been done on learning with older people which would tend to support his view.)

> "The essential feature of this approach is that it is directed not merely at the remediation of specific behaviours and skills but at changes of a structural nature that alter the course and direction of cognitive development ... **structural changes** ... to the organisms manner of interacting with, that is, acting on and responding to, sources of information thus a structural change, once set in motion will determine the future course of an individuals development."
>
> [Feuerstein (1980), p.9]

The salient feature of learning to learn is his notion of **'mediated learning experience'** which is at the heart of this social interactionist theory of learning.

> "By mediated learning experience (MLE) we refer to the way in which stimuli given out by the environments are transferred by a **mediating agent**, usually a parent, brother or a sister. This agent, guided by his intentions culturally emotionally invests, selects and organises the world of stimulus for the child ... this process of mediation, the cognitive structure of the child is affected."
> [Feuerstein (1980), pp.15-16]

Blagg (1991) suggests this is a subtle process in which these mediating agents size, interpret, extend and embellish the environment so that the young child builds up an internal model of the world in which various experiences are related together meaningfully. In the direct exposure of experience emphasised by the stimulus - organism - response model (S-O-R), advocated by Piaget the impact on the child is in a more haphazard or random fashion, whereas the mediated stimuli cannot escape the child's attention and recognition. Important features of the environment are amplified, transformed, and reorganised while others are blocked out, so that the child is helped to systematically select and appreciate what to ignore and what to take notice of. Therefore Feuerstein emphasises the role of the parent, teacher or significant other (H) in coming between the child and the world of stimuli or the world of the S-O-R model of Piaget can be changed into the S-H-O-H-R model of Feuerstein.

Much of the building of theories at the Jerusalem Research Institute has been geared towards making explicit what is meant by mediation and where and how it happens. This could be considered as the most fundamentally important aspect of his work, only more recently becoming more widely understood and acknowledged. Without the idea of mediation IE becomes just another thinking skills package.

There are three essential aspects of the proper mediation of a learning experience by a significant other (H). Burden (1987) has these as:

1. That the mediator should be aware of, make known and ensure that the learner has understood what is going on. INTENTIONALITY and RECIPROCITY.

2. The mediator should explain why they are going to do what they are going to do. INVESTMENT of MEANING.

3. The act should be conveyed as having value beyond the here and now. TRANSCENDENCE.

Blagg suggests that these

> "... criteria are difficult to operationalise."
>
> (1991, p.90).

Other important and not quite so essential aspects of mediation are as follows:

1. The feeling of competence.

2. Regulation and control of behaviour.

3. Sharing behaviour.

4. Individuation and the psychological differentiation.

5. Goal seeking, goal setting and goal achieving and planning behaviour.

6. Challenge: the search for novelty and complexity.

7. Awareness of the human being as a changing entity or dynamic.

Blagg reports Feuerstein suggesting that when all of these become an integral part of a teacher's repertoire and are used constantly and appropriately can true mediation be said to be taking place.

Feuerstein believes that low attainment is caused essentially by a lack of this mediation. For many reasons a child may not be offered sufficient mediation or there may be factors which have reduced the child's accessibility to this mediation, for example, hearing or emotional problems. Feuerstein's view however ensures that such handicaps need not necessary lead to a impairment of cognitive development providing the adult can ensure that the child does receive sufficient mediation. It becomes clear that the effectiveness of any programme based upon his work IE or latterly the Somerset Thinking Skills Course will be largely dependent on the **quality of mediation** not on the instruments themselves. Although these instruments can be seen as important but, as a means to an end the 'leaders of the learning'. Any proper evaluation of these programmes therefore concentrate much upon the quality of the mediational process as upon a pupil centred outcomes. This also explains why Feuerstein sees as essential that it his work is **not** a freely available package but must be accompanied by intensive training and ongoing teacher support. The British version sold by the Intellectual Development Company Ltd (June 1989) gives details of what is in today's limited education resources base is a very expensive package. However it does seem to be

viable for a few staff with a very small number of children in perhaps a remedial situation.

The final important basic concept which we must take note of in dealing with IE is the idea of **Cognitive Maps**. This identifies the most important elements involved in the completion of a mental act. Seven dimensions are proposed, briefly they are:

1. The universe of content about which the act is centred.

2. The modality or language in which the act is expressed.

3. The phrase of the cognitive functions required by the mental act.

4. The cognitive operations required by the mental act.

5. The level of complexity of the act. (This includes novelty and familiarity).

6. Level of abstraction.

7. The level of efficiency with which the mental act is performed.

The work of IE is directly related to each one of these elements in a step-by-step progression. Particular reference is the **phase element** within which the notion of deficiency is introduced. Feuerstein argues that in order to function effectively any task information has to be gathered in an efficient manner (input), worked upon cognitively (elaboration) and any proposed solutions must be expressed appropriately. A number of important ways have been identified in which these

processes can be disrupted or inefficiently performed. At the input level for example, a person may act impulsively or lack the necessary verbal tools. At the elaboration level a person may not see the need to pursue logical evidence, or lack strategies for hypothesis testing. At the output level they may not be able to communicate in an egocentric manner or again may not possess the necessary verbal tools to communicate their elaborated responses.

Feuerstein and his followers would therefore suggest that in identifying missing or appropriate learning strategies in this way we can also identify the kind of behaviours that will foster learning. The Learning Potential Assessment Device (LPAD), by which the former static assessment procedure is turned into a rather dynamic one. It is the coming together over a number of years of the Israeli teams collection of materials and approaches that are now collectively called LPAD.

Feuerstein et al (1987) described the basic elements of the LPAD model and emphasised the benefits of their particular dynamic approach. They do not accept such a thing as a culturally free intelligence test or cultural specific norms. They also heavily criticise dynamic assessments which are based on a functional approach cf. Budoff and Friedman (1964) or Brown and Ferrara (1985) based on teacher testing and then teaching again paradigm where the aim is to produce quantitative measures as well as qualitative measures of observation on the child's ability to learn effectively. Feuerstein et al (1987) rather referred to their LPAD approach as a structural dynamic assessment. The goal in LPAD goes beyond exploring the changes in the child's immediate levels of functioning but rather on fundamental changes in the basic cognitive processes that underpin many areas of mental activity. Because Feuerstein and his colleagues suggest that to establish a testing base line would undermine a positive relationship between the child and the

examiner, the child's confidence is at risk, as well as the examiner's flexibility to assist the child to perform to the very highest possible level. They rather, make strenuous efforts to facilitate the recurrence and generalisation of these top performances for a child. This gives us a problem, the lack of any baseline data on a child's performance makes it very difficult to quantify the changes that occur and the observations made during assessment. Blagg suggests

> "the LPAD sacrifices the chance of quantitative measures of learning potential in favour of obtaining richer qualitative data".
> (1991, p.16)

In using the LPAD methodology the examiner sensitively interacts with the child, mediating where necessary to bring about a change in the child's cognitive functions. In 1987 Feuerstein claimed that the LPAD materials were chosen because they facilitated four basic functions:

1. They evolve the use of higher mental processes.

2. They had an "optional optimal rather than a minimal level of complexity in order to reflect the complex nature of real life situations, and, by this offer the necessary prerequisites to further learning". (1987, p.45).

3. They offered opportunities for detecting very small changes in a students problem solving behaviour following only limited mediations.

4. They had intrinsic value in motivating the subjects.

Therefore we can see that the LPAD is intended to identify the deficient cognitive strategies and that IE is there to teach appropriate learning strategies and correct deficient cognitive functions. It also aims to teach the concepts, operations and

vocabulary necessary for successful problem solving, to develop motivational aspects, to produce insight into personal reasons for success and failure, also to foster successful work habit that will become automatic and spontaneous as time goes on. Lastly to turn passive recipients into active dynamic generators of their own knowledge and learning.

2.3 Instrumental Enrichment - An Overview of The Programme

The term Instrumental Enrichment (IE) was chosen to represent the instrumental way in which the various activities were going to enrich the cognitive abilities of retarded performers via the intervention of appropriate mediation. The instruments can be seen to be as content limited so that the teacher can introduce 'mediated learning experiences' which can be generalised or in Feuerstein's terms "bridged" into academic or real life situations. There are fourteen instruments in all, which are usually incorporated into a lesson plan involving an introduction which sets out the aims of the lesson, the period of independent work on a particular Instrument and a discussion period aimed at developing insight and principles for generalisation and transfer. The time element of usually 40 to 60 minutes, two or three times a week over two years, ie, 180 minutes a week times by 40 weeks in British school year equals 120 hours over two years is 240 hours which is a very high investment of time. The programme usually begins with the Instrument known as Organisation of Dots which sets the scene for much of what is to follow. This Instrument is most content limited of all and often poses teachers a considerable challenge for this very reason. It is usually taught in conjunction with the first of two Instruments devoted to spatial orientation. These are followed in the first year by Analytic Perception Comparisons, Illustrations, Family Relations and Orientation in Space Two. In the second year the Instruments become increasingly complex and abstract. Categorisation builds upon the work begun in the comparisons instrument and is followed by a Temporal Relations, Instructions, Numerical Progressions, Syllogisms, Transitive Relations and Representational Stencil Designs. Examples of each of these Instruments are given in Howard Sharron's (1988) and are described in Feuerstein's 1980 publication.

As may be guessed from the above brief description the IE Programme is drawn largely from the world of psychometrics, based on a range of task times and presentation methods. Feuerstein suggests that the relatively context free nature of the materials are necessary for this kind of approach. They allow important principles to be exposed without the child being distracted by contextual clutter. He also emphasises that the precise content of each instrument is not important, merely serves as a means of highlighting the need for particular kinds of thinking processes.

Bridging is the attempt to transfer and generalise the cognitive processes used in a lesson into everyday life. Throughout the lesson the teacher should be trying to relate the cognitive processes involved in the instrument to real life tasks and applications. It is envisaged that eventually pupils will spontaneously bridge without prompting or assistance. Unless this bridging can be successfully made transfer and generalisation will not take place and the large point of the programme will be lost.

How then can we judge that the programme works? Is it appropriate in a British setting? These questions are addressed in the next section.

2.4 Does Instrumental Enrichment Work?

In considering the effectiveness of such programmes, we find ourselves in a position very similar to that first posed by Sternberg and Bhana (1986) and quoted again in Blagg (1991). Potential consumers of programmes to teach thinking skills were in a similar predicament to those buying into a new drug programme. We are to imagine ourselves attending a conference on modern developments in research into which a pharmaceuticals sales person is discussing a new drug that their company manufactures, which they claim greatly improves one's general health. This person is persuasive but because they are selling a drug at a research conference, and because they work for the company selling it, you decide to do some research before opting into the programme that could be quite expensive and needs to be used over a fairly long period.

The results of your search are ambiguous. There are few studies of the drugs effect, and most of these have been sponsored or supervised or done in consultation with the manufacturer. The reports you find sketchy and may have inadequate control groups or even none at all. Some amount to little more than testimonials about the effect of the drug has had while others use outcome measures that look as if they have been selected to maximise the favourability of the report. Very few of the reports are published in quality journals but are reported in the company sponsored magazine. Those few studies that indicate better control show mixed results. You are skeptical and rather perplexed. The drug may indeed do everything it is supposed to do, all that the manufacturers claim, but it is hard to tell from the evidence.

Sternberg goes on to suggest that Blagg's (1991) study and Herrnstein, Nickerson, Sanchez and Swets (1986) are the most thorough and carefully planned and

Sternberg goes on to suggest that Blagg's (1991) study and Herrnstein, Nickerson, Sanchez and Swets (1986) are the most thorough and carefully planned and evaluation of intellectual skills training programme that has been carried out. The evaluation is commended for its diversity of measures and what it involves, not only students but teachers as well. Sternberg found this evaluation significant, in that it was dealing with the most widely used intellectual skills training programme in the world.

Feuerstein's work on changing cognitive abilities began in the 1950s, he developed his programme in the 1960s. It was widely disseminated by the Curriculum Development Associates of the USA in the nineteen seventies. Empirical support for the programme came later, firstly with Feuerstein, Rand, Hoffman, and Miller (1979a) who reported the effects of IE on retarded adolescents.

Feuerstein then published his two key books (1979b and 1980) following which there were some well designed studies of IE mostly by Feuerstein's co-workers in the States. (Arbitman-Smith, 1982; Arbitman-Smith and Haywood, 1980; Arbitman-Smith, Haywood, and Bransford, 1985; and Haywood and Arbitman-Smith, 1981). There have also been many small scale studies, a good UK example being Beasley (1984). There have also been numerous, low-key, rather anecdotal studies of IE, which have been poorly designed and lack specificity. Sharron (1987) wrote a eulogy of Feuerstein and his methods and criticised the British Educational Establishment's commitment to out-dated notions of intelligence and learning. He then went on to propose that Feuerstein's programme was the way ahead. The book is an easy to read description of IE but tends to skim and gives a biased account, in our view, of the research literature. Bradley's conclusions remains reasonably valid in the writer's view, as it reads as a partisan account.

> "I would suggest a more appropriate description of the results: at present they are very modest perhaps promising but more likely, at best clouded".
>
> (1983, p.83)

Feuerstein's work is marked by an eclectic overlapping of theoretical models that are useful, particularly heuristically, but are rather difficult to be precise about and therefore difficult to evaluate. As well as these inherent research problems, Bradley (1983) goes on to point out other technical short comings in the published research. He argues that many measures chosen to assess the effectiveness of IE are inappropriate. He is particularly critical that most studies fail to use multi-variant research designs.

Shayer and Beasley (1987) carried out a substantial review of the American and Israeli data. They then went on to report their own study of IE using special school adolescents, very small samples (10 experimental and 10 control subjects). They found that the evidence was sufficient to warrant time and effort involved in the programme but felt that with the very small numbers involved and the optimal conditions under which the study was mounted and supported it is possible to over-generalise their findings.

Burden (1987) suggests that more research need to go into the conditions under which the intervention has been delivered. He goes on to agree with Bradley (1983) that outcome measures that have been used are often inadequate as means of assessing the main IE goals. His solution for this was to develop better laboratory based experimental designs before being applied to complex real world interventions. (cf p.17). He suggests this, it seems, because of the research complexities and impracticality of multi-variant size that require very large samples and use many different measures as well as requiring follow-up studies. (cf Bradley 1983).

Burden advocates a completely different evaluation. He commends the illuminative approach of Hammilton (1976) and suggests that the Context/Input/Process/Product (CIPP) model of Stufflebeam (1961) was a promising framework for examining the complexities of evaluating such programmes as IE. Somerset evaluation of IE utilised Stufflebeam's model and also involved traditional experimental design methodology as well as the illuminative approach. (cf. Blagg, Ballinger and Gardner, 1990 and Blagg 1991). The writer's summary follows.

2.5 Summary of the Somerset Evaluation Experience

The project began in 1983 with the evaluation of IE that was systematically applied to over 1000 14-16 year old's in four Bridgewater Secondary Schools. There were 250 control students and 16 control teachers with 30 teachers of IE. They were carefully monitored over two years using a wide range of formative and summative procedures details of which can be found in Blagg (1991) and Blagg, Ballinger and Gardner (1990) but some of the main features are:

1. There were **significant changes** in IE teacher attitudes and behaviour. They became more committed to their teaching, more optimistic about the potential of low achievers and more aware of the effect they could have in bringing about student change.

2. There was **very slight evidence** of generalisable behavioural changes in the pupils and no evidence of ability or attainment changes.

3. Most pupils and students experienced difficulty in relating the skills and strategies practices in the IE exercises in other curriculum areas and everyday life, that is a **problem of transfer and generalisation**.

4. The kinds of essential skills and strategies that IE began to highlight seemed **essential** to the basic cognitive demands of a changing secondary school curriculum.

5. The team felt that many pupils had been found to be **lacking in these basic concepts**, conventions, procedures and vocabulary necessary to cope with this

kind of work, ie, GCSE, where students were required to study wide ranges of evidence, different comprehensions of information, to extract information, notice gaps and inconsistencies and detect biased information.

6. Teachers from many subject disciplines commented on the pupils' difficulty in using **past experience to help them with a new problem**. It was as though some pupils were unable to recall and analyse previous tasks and compare them with the new problems.

In view of these considerations, in 1985 the Somerset set up a curriculum development group led by Blagg to

> "produce a more contextually appropriate cognitive skills programme that would provide teachers with carefully sequenced range of activities designed to help children become better learners".
> (Blagg, 1989, p.91 in Teaching Thinking M J Coles and W D Robinson eds).

They sought to take account of the apparent failure of IE, which appeared to be its inability to teach for transfer. There was good evidence that working from familiar everyday examples and concrete materials may not necessary lead to transfer and generalisation. Perkins and Salomon (1988) indicated many examples when this more passive knowledge in students was involved in learning different tasks. They quote Barrows and Tamblyn's (1980) experience with student physicians experience of applying technical knowledge to the real life situation. Belmont, Butterfield, and Ferranti (1982) indicated that memory strategies become 'contextually welded' to their acquisition milieu or circumstances.

To overcome this Feuerstein attempts to teach the basics of thinking via a medium that is very neutral and fair, with abstract text, but this also seems to have major problems. Blagg (1991) found that during the time spent on IE students certainly

became more competent in the tasks, but they seem particularly tied to the artificial context. Further, they found that the bridging processes at the end of each lesson did not always work, even with appropriate help and encouragement, some pupils were unable to identify important elements in their learning and consider where they might apply elsewhere. Some teachers were less helpful in prompting the students to think of the transfer situations. Blagg suggests that both students and teachers easily became stuck in dots and triangles, that is in the novel tasks.

Because of these observations and findings and to meet the demands of the changing secondary school curriculum in England and Wales the Somerset team developed their course. An explanation of this course now follows.

CHAPTER 3:

Analysis of the Somerset Thinking Skills Course

"Think! I've got enough to do, and little enough to get for it, without thinking."

Charles Dickens (1812-1870)

3.0 The Somerset Thinking Skills Course

This course was born out of the evaluation and observations of IE, although the full evaluation has only recently been published in Blagg (1991). This was despite finding very **little** evidence of any general behaviour change in the students and no evidence of increases in attainment as well as that both pupils and teachers experienced extreme difficulty in relating strategies and skills of IE to other areas of their everyday and curriculum life.

However, the essential skills and strategies that IE highlighted were essential to the basic cognitive demands of a changing secondary school curriculum. The implications of GCSE were coming through. The National Curriculum was on the horizon. Students were found to be lacking in basic concepts, conventions and procedures, as well as having the necessary vocabulary to cope with this type of work. Blagg (1989) reports that many subject teachers of varying disciplines commented on the students' difficulty in using past experience to help with a new problem. It was as if some pupils were **unable** to think about past tasks and had to given clues in approaching a new task. They did not seem to learn from experience. Students seemed unable to analyse or synthesise to describe and to compare and so were unable to make effective use of past experiences.

In the light of these comments, in 1985 Somerset set up a curriculum development group, led by Blagg, to put together

> "a more contextually appropriate cognitive skills programme that would provide teachers with a carefully sequenced range of activities designed to help children to become better learners".
>
> Blagg and Ballinger (1989, p.91)

3.1 Aims and Objectives

The essential aim of the STSC is to enhance students ability to learn. This is achieved by the following eight specific aims:

1. To enhance self-esteem.

2. To promote positive attitudes and beliefs about being able to learn to learn.

3. To heighten awareness of learning styles and need to adjust them according to differing demands.

4. To enhance ability to communicate ideas accurately and clearly.

5. To teach basic cognitive resources underpinning problem-solving exercise processes.

6. To develop awareness and control over the use of problem-solving processes.

7. To transform passive recipients of information into active searchers and generators of ideas.

8. To facilitate the ability to transfer and generalise across many different contexts. [cf. Blagg, Ballinger, and Gardner (1988), p.33]

3.2 The Interrelation of the Design

The reader will observe that the aims and objectives were not confined to cognitive matters only. The design of the course was a effected by the need for interrelating motivational, social, and communication issues. There were four reasons for this.

1. For their theoretical model the STSC team took the view that students who had experienced repeated failure in their work and were being constantly criticised developed poor self-esteem. This meant that these students saw little point in putting forward their ideas or making any effort. They were concerned with the less able pupil who was not prepared to risk failure and was therefore a passive learner. They were those who saw no relationship between the effort that they put in and the achievement. They were concerned with low achievers and felt that they must address these attitudinal and motivational issues.

2. The team were much influenced by the research evidence pointing out the importance of social aspects of learning, which meant the need, they felt, to shape activities for small group and classwork or in pairs rather than solely independent work. (We have referred to this research previously). Schools reported to them, that this approach was of a practical concern as they in the light of the new curriculum were wanting help in preparing students to work as members of groups, by sharing their ideas, accepting different viewpoints, and negotiation of rôles, tasks, profiles, etc.

3. The significance of language as a mediational tool has also been highlighted and again in a practical level there was a concern in the schools they were in contact with to develop students communication skills. The National Oracy

Project was seeking to encourage ways of developing all communication skills within and across the curriculum as well as the recognised importance of written communication.

4. Within any group of pupils they felt there would be a wide range of skills and competences and that lower achieving students with reading and writing difficulties, were fluent orally, providing they were given a chance to demonstrate their abilities. They found that some students showed very sophisticated reasoning skills when the tasks were presented in their preferred mode. It became important therefore, to produce a course that had a broad appeal and created various opportunities for students of different abilities to benefit from the tasks.

With these points above in mind, STSC tasks were specifically designed for small group and class discussion. All the tasks involved a range of visual and verbal demands. They were consciously trying to design activities that made differentiation by outcome possible. The task could be interpreted at different levels of ability/sophistication.

The teacher guidelines were easily accessible lesson plans, that provided springboards. They found a need to emphasise that a safe democratic environment had to be established in which:

1. Pupils' ideas were considered and valued both by the students and by the teacher.

2. Misunderstandings and errors were handled sensitively and constructively.

3. Pupils are encouraged to challenge ideas, rather than the people giving them.

4. It is safe and acceptable to hold a different view from the majority provided you can justify it.

5. It is good to ask questions, both of yourself and others.

In relation to developing appropriate beliefs and attitudes and self-esteem, there is also need for pupils to consider learning styles. Students often used particular styles of learning whatever the problem or the situation. Keagan, Rosman, Day, Albert and Philips (1964) record how many children with learning problems tend to rush into gathering information, often work in a trial and error manner, and frequently record ideas without sufficient attention to planning or detail. While at the opposite end of the continuum, there are students who are over reflective, constantly checking and rechecking information and plans, so that they take an inordinate amount of time over relatively simple task and often fail to finish. Materials are provided within the STSC to enable teachers to wean students off dependency on an inappropriate style.

There is a marked emphasis on encouraging pupils to talk about their feelings, styles of working and particular problem-solving approaches. In particular, STSC promotes the use of conscious questioning techniques relating to two broad areas of teachable cognitive skills:

1. Cognitive resources - specific skills and techniques.

2. Cognitive strategies - higher level control strategies concerned with selection and coordination of resource skills for a particular purpose.

Nisbit and Shucksmith (1986) clarify the difference between cognitive and resources and strategies by using the football team analogy. The problem the soccer coach has, like the teacher, is to develop flexible, strategic thinkers. While acquiring particular skills and techniques, it is an important part of the educational experience, as the STSC views it, to develop the student ability to select flexibly in the use of these techniques. The cognitive strategies in the STSC represent the higher level general control processes concerned with selecting and coordinating specific cognitive resources for a particular objective. Although there is no agreed taxonomy of these strategies there is a consensus about the important domains which STSC follow. They are:

1. Recognising (a problem exists).

2. Defining (the problem).

3. Generating (alternative approaches).

4. Planning (selecting the most viable approach).

5. Checking (Self-monitoring).

6. Evaluating (solutions and approaches).

7. Communicating (the outcome related to self-esteem).

8. Transferring and generalising (actively reflecting on the applications of skills and procedures learnt in one context to many others, and where possible, deducing general principles or rules that can help the future learning or problem-solving). [Blagg (1991), p.153].

Within each of these areas there are numerous issues to consider, for a discussion of these see Blagg, Ballinger and Gardner (1988). From their experience they felt that many adolescents find difficulty in listening to other people's points of view and engaging in genuine discussion, so that throughout the course, there is demanded a high level of oracy skills and the need to acquire and use precise and sometimes technical vocabulary. In addition, they gave specific purposes in understanding and using language in many forms STSC therefore provides opportunities to address the oral areas as indicated by the English Curriculum Committee: English for Ages 5-16, DES (1989 particularly paragraph 15.17).

3.3 Structure and Organisation of STSC

STSC involves a series of visually based tasks organised into modules and arranged as a spiral of difficulty. Each module builds upon the principles and strategies established previously and continually harks back and checks that the use of the important resources and strategies are in operation. The course contains open-ended and closed tasks, with a deliberate use of ambiguity, so that the need to resolve uncertainties, to come to a definitive agreed problem solution is present. Many of the tasks do not have written instructions and those that do, require careful attention to additional implicit information so that:

1. They develop the ability to break down the familiar pupil expectation that they will be told exactly what to do. The pupils define the tasks for themselves.

2. The use of ambiguity allows for many justifiable interpretations, so prompting debate and discussion.

3. The range of viable interpretation provokes attention to detail and encourages comparative evaluation of the most adequate and consistent definitions of the task.

4. It reduces impulsivity by communicating to the students that the tasks are rarely straightforward and have to be thought through.

5. It encourages all students to risk a contribution in group or classwork discussion, because they know that the teacher is not looking for a set answer to a task.

6. It sharpens the students' awareness of the need for precision and accuracy in everyday communication and the need to avoid ambiguity.

7. It establishes a routine where the students searches for implicit clues and information when presented with a problem. [cf Blagg, Ballinger, and Gardner (1988); pp. 34-35].

The module contains three different types of tasks: artificial, naturalistic and stimulus tasks, before a more detailed explanation see the Handbooks, Blagg, Ballinger and Gardner (1988): Blagg (1991) and alsoColes and Robinson (1989).

3.4 Transfer and Generalisation

The structure and organisation of the course addressed the issue of transfer and generalisation in several important ways.

a.) Transferable and transfer skills are emphasised throughout.

b.) The activities are intentionally ambiguous as a means of promoting discussion, debate and metacognition.

c.) The tasks are very different in their style, format and content, and level of complexity and presentation modes. This variety of examples and contexts enables teachers to assess and, if necessary, heighten awareness of transfer possibilities through sensitive prompts.

d.) At strategic points complex mastery activities are included that extend the range and level of the demands of transfer.

e.) The increasing use of abstraction and the need to use basic cognitive resources for more sophisticated operations as the course progresses, enables the teacher to check the transfer of ideas and understanding of the principles within the modules.

It seems that transfer possibilities have been integrated into each activity and lesson plan, but does not simply rest with the design programme but depends heavily on individual teachers to **mediate effectively** for transfer. This is in tune with the teaching styles advocated by Feuerstein et al (1979) and Glaser (1984). The guidelines in the Handbook [Blagg, Ballinger, Gardner (1988)] and in greater

depth in Blagg and Ballinger (1990) develops the rôle of the teacher as a **mediator and classroom manager**. In this helpful publication Bagg and Ballinger point out that transfer and generalisation is also an outcome of organisational thinking within schools. In an ideal world a whole school approach is required in which everyone is totally committed to enhancing the students' development. This has major in service and organisational implications as well as communication between and within subject departments. The STSC teachers and designers found in discussion with colleagues that they often followed the quotation below of Perkins and Salomon that

> "... disciplinary boundaries discloses not a well defined geography with borders naturally marked by rivers and mountain ranges but, instead, an enormous overlap and interrelation. If knowledge or skills are local, the boundaries surely are not the cleavages of the conventional curriculum. Yet because these cleavages are part of the organisation of schooling, tactics ... are needed to make the numerous opportunities for first trial transfer across the conventional subject ...."
>
> [Perkins and Salomon (1988), p. 30]

It is in this context that the innovation of using theSTSC with whole year groups in an upper secondary school with a detailed evaluation, that the study arose.

CHAPTER 4:

Choosing the Appropriate Paradigms and Frames of Reference

"I keep six honest serving men
(they taught me all I knew)
Their names are What and Why and When
And How and Where and Who!"

Rudyard Kipling (1865-1936)

4.2 The Eclectic Elements of the Research

In seeking to answer the above aim and objectives, several strands had developed.

1. That the research can be essentially described as education research.

2. The research is at the same time quantitative and qualitative in its approaches.

3. It may be described in terms of action research.

4. That its use and purpose dictate evaluative elements. These lead us to using a case study approach that has within it, a major exploitation of the structured interview.

5. Because of the innovatory nature of the programme within the institution, we have sought to exploit the advantages of the illuminative paradigm, please refer to part 4.6.2 following.

4.3 Explanation of the Eclectic Elements

The writer takes this opportunity to give an additional explanation of the threads from different paradigms that have influenced the work. What follows is the writer's perception of the scientific method, with a description of educational and action research. The discussion of the ethnomethodology, evaluative patterns and validity, with the method of reporting educational research gives the reader the opportunity to appreciate the complex nature of this type of project. This discussion is preceded by an explanation of the mixture of the eclectic elements of the project, which is a distinctive feature of the study.

4.3.1 How We Perceive the Scientific Method

The writer perceives the scientific method as resting on a background of empiricism, 'naive realism', hypothetico - deductive methods, positivism, the influence of their scientific communities, and the anti - positivistic new paradigm. The dominant paradigm in educational research can be described as a mixture of methods. The question arises however, "is this science?"

What makes science, science? What are the claims and status of the knowledge that science produces? Both the public and scientific world imply that there is a superior rationality. Before we go further we should examine this assumption. Scheffler (1967) explained it in the following way:

> "Fundamental feature of science is the ideal of objectivity and ideal that subjects all scientific statements to the test of impartial criteria recognising no authority of persons in the realm of science".
>
> (p.1)

The assumption is that the impartiality and objectivity is protected by its willingness to modify scientific statements by empirical evidence. This seems to

assume that both the experienced (the cognitive function) and the sensory inputs are without problems. Shepherd and Johnson (1975) suggest that this alliance of empiricism and "naive realism" has its difficulties but are sufficiently in step to reinforce each other.

Empiricism [after John Locke (1688)] is a coherent philosophy but naive realism with its major tenet that an observer's assumption that other observers will perceive the situation as he does and if they respond differently; this is because of some wilfulness rather than any act of perception. Naive realism is not a coherent philosophy.

Part of the idea of a superior rationality of science depends on the way in which disputes about theory are supposed to be resolved in a decisive fashion. The empiricist assumption is that theories are man made and hence capable of standing in their own, whereas observation gives direct access to reality.

In the different periods of history, different descriptions of what the scientific method is, or should be, have been postulated. This indicates perhaps, that the scientific approach could be a matter of agreement among scientists at any particular time. In our own time, the hypothetico-deductive method seems the dominant paradigm, this was outlined in the important work of Karl Popper (1972) in which he suggests that scientists are basically hypothesis testing. The method of science is concerned with supporting or justifying a specific hypothesis. The most important feature of this, is that it is testable, in other words we must be able to refute the hypothesis by an empirical test.

Popper suggested that we could never prove our hypothesis but we support them to the extent that they survive our attempt to negate them by empirical reality.

> "The methods always consist in offering a deductive causal explanations and by testing them (by way of predictions)".
> [Popper (1972), p.131]

Kuhn (1970) provides a line of criticism of Popper's portrayal of science. He does not accept Popper's characterisation of the open-minded and uncommitted scientist simply testing his hypothesis. He strongly suggests that because of their training in the established scientific community, indeed, specific discipline, they become committed to particular ways of viewing their subject and to various ways of arriving at explanations within their discipline. They are socialised into their academic cultures. They develop their own scientific communities (cf Barnes, 1972). The problem which any scientific researcher faces is to convince his fellows that his findings and explanations are warranted by his reference to the empirical world. The writer agrees that the job of grounding his interpretations in empirical data and showing explicitly to others how we went about it, is the characterisation of doing science. We would further agree with Cuff and Payne (1985) that

> "what is involved in doing science is sufficiently general to allow for a considerable variety of positions within it".
> (p.192)

From the writer's reading, however, it seems that there is a vast amount of discussion and not to say heated argument whether psychology, sociology, educational research and science generally must model their strategies for research on the procedures of the natural scientists.

Positivism is the word used to cover those of the scientific community who believe that to make progress we must seek to follow the methodological paths readily

established by the so-called natural or hard scientists. We must treat the social world as if it were a natural world. That is, everything is excluded from this philosophical position, except natural phenomena and their relations. Some positivists exclude cause and effect from science because it is subjective and therefore unnecessary.

Most of our backgrounds are positivistic in orientation although there has been a paradigm shift towards the anti-positivistic or subjective methods of enquiry. Robert Stake (1978) was an initial advocate of this new paradigm in which he emphasised the case study method. Now we have ethnographic and some historical research methods loosely classified as qualitative methodology. In these methods the personal framework of the researcher determines, to an extent what they will discover about a phenomena. The writer would therefore conclude that knowing about the personal framework is an essential feature of report writing as it is of any interviewee. The qualitative researcher typically goes for an 'in depth' understanding of a single instance of the matter to be investigated. Generalisability to a large population, could be said to have been sacrificed [cf. Eisner (1981)].

The answers to the key questions are that of many educational researchers, in fact it may be seen to be the dominant paradigm, it suggests that both positivistic quantitative and the more subjective qualitative approaches have made major contributions to educational research, and therefore will in the future. The above could be viewed as the two extremes of a continuum. Both these extremes pose problems for the educational research approach. Merton and Kendall (1946) to go even farther back, express the same sort of ideas

"social scientist have come to abandon the spurious choice between qualitative and quantitative data; they are concerned rather with that combination of both which makes up the use of the most valuable features of each. The problem becomes one of determining at which points they should adopt the one, and at which the other approach".
(pp. 541-557)

4.3.2 Education and Research

It therefore follows that part of the research project should be in positivistic terms:

1. Objective. As much as possible we should avoid letting the conduct analysis of interpretation of the investigation be influenced by any bias or prejudice that might influence our conclusions.

2. Orderly. The study should follow a systematic methodology.

3. Repeatable. The study should be reported and explained clearly so that another investigator could duplicate the study.

4. Empirical. Measurement should be employed to help foster repeatability.

5. Public. A study should be public in its conduct and results and generally available with clear conclusions.

6. Problems which had meaning for the participants.

Perhaps our approach could be summed up by Drever (1952)

> "a systematic scientific investigation in the pursuit of knowledge or confirmation in any field".
>
> (p.248)

to define research, but perhaps more appropriately for us in an educational sphere the definition of Lawrence Stenhouse (1980)

> "a systematic enquiry made public"

as he does give this definition in a heavily educational domain. (It was in the Presidential Address to the Annual Conference of the British Educational Research Association, September 1978). This allows us to move away from a quantitative approach, as important as it is, particularly if we accept that

> "educational research is informed by social research more generally and refers to the collection and analysis of information on the world of education".
>
> [Hitchcock and Hughes (1988), p.3]

Further we agree with Stenhouse (1980) when he states that it was his belief that the description of cases and the categorisation of samples are complimentary and a necessary approach in educational research. The superficial stylistic differences between their components should be recognised as impediments to furthering the research community". The writer agrees with the conclusion of Hitchcock and Hughes (1989) for the need for both paradigms, if not their assumption when they suggest;

> "Qualitative as opposed to quantitative research is more amenable and accessible to teachers" but we do agree in the need for both ...to gain the advantages ...."
>
> (p.8)

The writer agrees when Hitchcock and Hughes discuss the qualitative paradigm as

> "Drawing both researcher and subject closer into the activity itself. This research orientation focuses upon investigating social behaviour in natural settings and in terms of school based research ..."
>
> (1989, p.9)

This brings us to a consideration of action research.

4.3.3 Action Research

Our research work needs to be action research as it:

> "... focuses upon a specific situation or problem in a specific setting."
> [Cohen and Manion (1986), p.209]

There are a number of definitions of action research but McNIff (1988) quotes as the most widely accepted, the following from Carr and Kemmis(1986).

Action research is a form of self-reflected enquiry undertaken by participants ... in social ... situations in order to improve the rationality and justice of (a) their own social or educational practices, (b) their understandings of these practices, and (c) the situations (and institutions) in which th practices are carried out. (p. 2).

The changes in emphasis in the 1980's INSET programmes gave birth to Action Research. Previously teachers performance was judged via the theories and the disciplines within which they worked. For sometime there seems to have been a dissatisfaction with the top-down approach and a demand for collaborative enquiry gave birth to what is now known as Action Research. It was initially a methodological approach but has now developed into an epistemology debate into the nature of educational knowledge. [See the forward to Reason et al (eds) (1981)]. It is grounded in a philosophy of **practitioner** research. It is a unified exercise with the teacher in the classroom acting as the primary judge of his total education experience and it is aimed at developing classroom practice. Jean McNiff makes this point forcibly in her book (1988).

She goes further in making a plea for a long-standing educational tradition to be recognised, she suggests that the work rests in that of Corey (1953) and Schwab (1969) as well as Stenhouse in the seventies.

Kurt Lewin back in 1946 suggested that the most effective way of making people move forward is to engage them in their own life enquiries. Not being researched on but involved with it. This distinguishes it from the empiricist view with its epistemology being a theory vindicated by largely statistical evidence. Action Research leans upon the interpretative tradition of the grounded theory of Glasser and Strauss (1967). McNiff (1988) succinctly summed up a spin off that arose from **both** an empiricist and interpretative approach, this is termed the 'disciplines' approach developed, which sought to put educational theory into different traditions. Hurst and Peters focused more on synthesising from disciplines into a common focus, but it still had the ideological basis of a stamp of authority.

This caused concern in three areas to continue with McNiff's analysis.

1. Was the case study a legitimate design? Hamilton (1980) very much said it was. The idea of a case in this context is of a bounded system, the danger is that it may become a very narrowly bounded system.

2. Hurst (1983) when discussing educational concepts changed his mind and agreed that an educational concept was more than the sum of its parts.

3. The methods of interpretive tradition as a whole were thought to be more appropriate to sociological issues than educative ones.

The notion of educational knowledge is perceived as a controlled commodity with the interpretive viewpoint seeing it as qualitative. The empiricists go for the quantitative approach. The control was by the researcher on the researches. The

emphasis was grounded in subjects rather than in educational practice. Although this argument has a lot of force, it does seem that the distinction between sociology/educational knowledge seems to fall into the subject/discipline paradigms that we are seeking to avoid. We do agree with McNiff that the early systems of action research were to do with 'how to do' basis and they did leave out the educational component to turn a research or evaluation projects into really significant schemes to enable teachers to generate their educational theories from their own practice. This style was encouraged by the focus of educational research supported by Jack Whitehead (1984) at Bath University. He reformulated action reflection cycles into the following pack of statements.

1. Problem of educational values denies its practice.

2. I imagine solutions to be the problem.

3. I implement the imagined solutions.

4. I evaluate the outcome of my actions.

5. I reformulate my problem in the light of my evaluations.

To this, a set of questions was tied to the curriculum reforms. These were:

1. What is your concern?

2. Why are you concerned?

3. What do you think you could do about it?

4. What kind of evidence could you collect to help you make some judgment about what is happening?

5. How would you collect such evidence?

6. How would you check that your judgments about what has happened is reasonably fair and accurate (validity)?

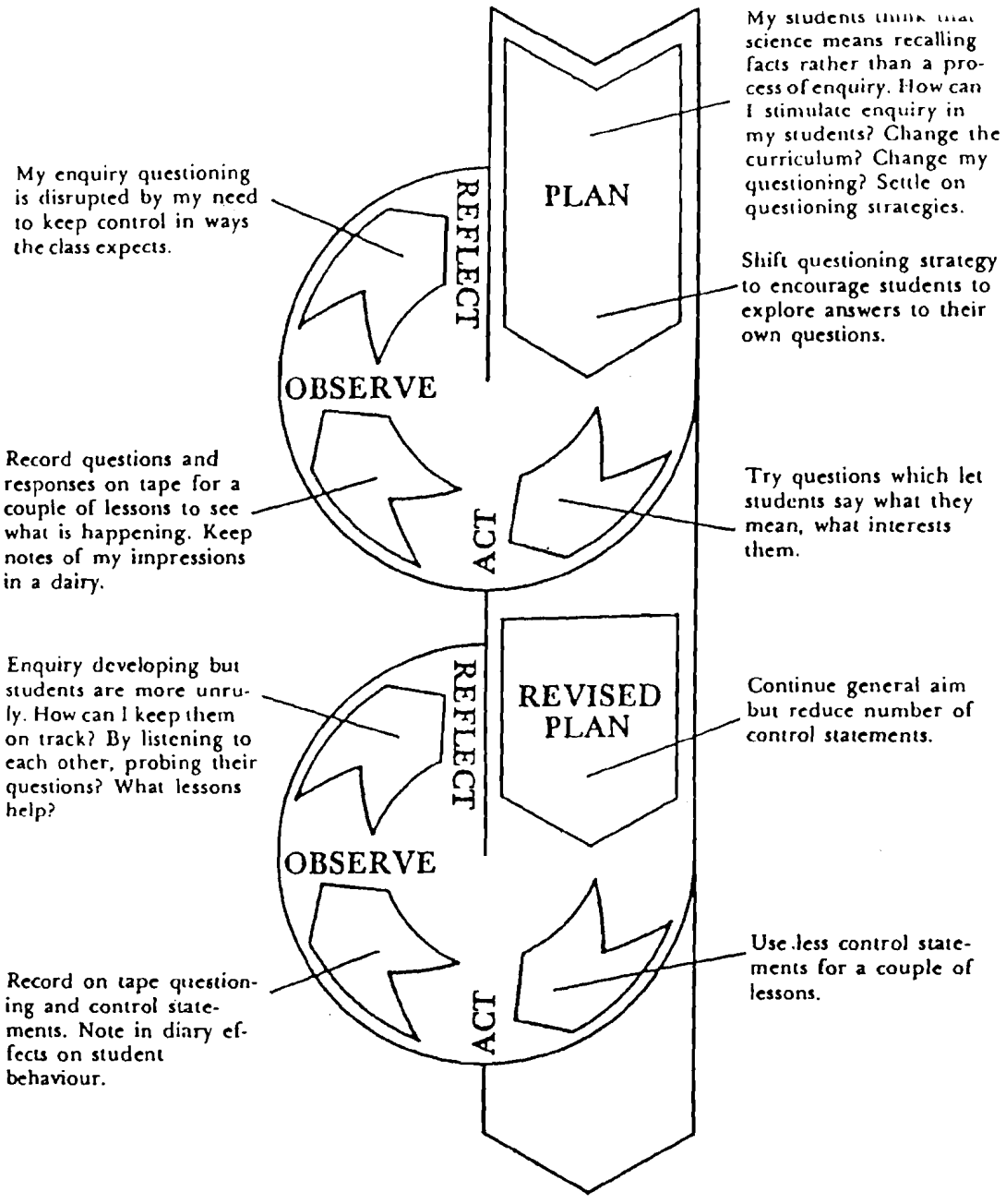
McNiff (1988) goes on to report a further advance by suggesting that the **individual teachers** are the maker of their own grounded theory. She adds to the current trends in research thinking by the addition of reflective planning, observing and action spiral with additional side-shoots as problems coming about as the main focus of the research/evaluation is happening. In other words, it is an attempt to cope with the practical day to day situation. It recognises the dynamic of a situation, in the writers view. McNiff is building on the work of Stephen Kemmiss (1982 a and b). Please consult diagram.

There are many reasons given why teachers engage in action research. These are grouped in political, professional and personal reasons, the argument that was most forceful for us was that the professional teacher centring on pupils self-discovery needs to be able collectively and individually to make independent judgments, develop knowledge of themselves and be committed to a thinking awareness. This complements the heuristic approach of STSC and its basis in IE. The philosophy can be gained from the following quotation:

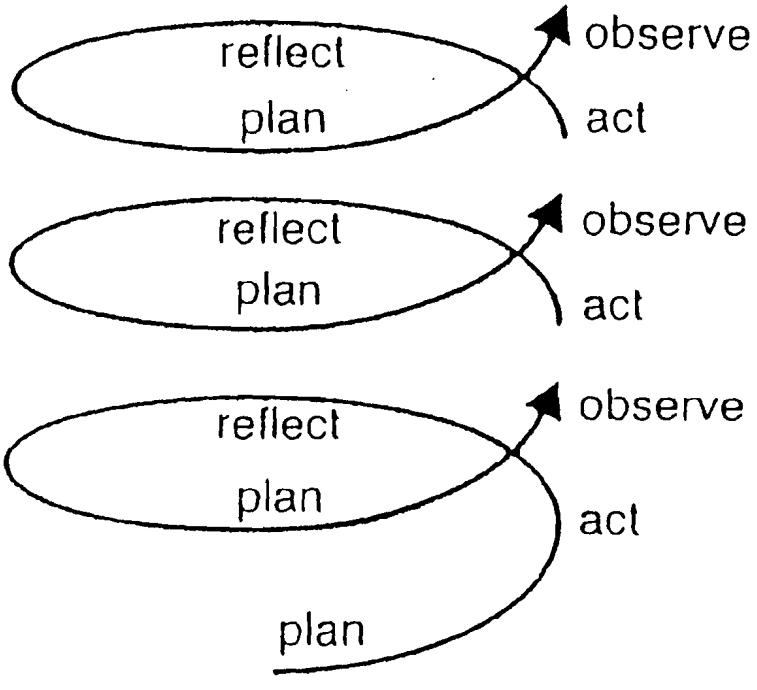
> "It is at least prompting teachers to think about their role in fostering pupils' cognitive development and offers vantage points, novel materials, and teaching strategies to enhance that role. Teaching thinking is both a humbling and yet illuminating experience that transcends subject dogma. Teachers that seriously embark on this, find themselves discussing all manner of curriculum issues..."
>
> [Blagg (1991), p.169]

Action research is moving away from the teacher as a technician externally based assessments and evaluations but seeking to support a "paraxis" mode that is defined as "wise and considered practice". The epistemological support for this is based in Polanyi (1958) who stresses that knowledge is an active experience so that education becomes again something to serve to discover.

Fig.2



McNiff's example of a Kemmis Self Reflective Problem Solving Spiral. In McNiff (1988,p.27).



McNiff's GENERATIVE ACTION RESEARCH In McNiff 1988, p.44.

4.4 The Evaluative Elements of the Research

Stenhouse (1982) sums up action research as:

> "The action research element is based on the close study of individual classrooms involved in the action of the project."
> [Stenhouse (1982), p.213]

His concept of evaluation is about gathering evidence that will enable others to make judgments about the project and its reliability and validity. Stenhouse, of course, is concerned that these judgments are made in a reflective and deliberate sort of way. He also stresses the responsive nature in the sorts of studies he would wish to see. We will refer to this later under the Illuminative Paradigm.

Gitlin and Smyth (1989) advocated a horizontal evaluation for teachers, which were something like the sorts of evaluation and research we have alluded to. They are very much against a centralised, prescriptive and sanction ridden courses of action that have been suggested. They emphasise that this is the teachers very much as a technician, meeting standards and rating schemes that are themselves extremely fixed in their ideas of what good teaching is, as well as making teachers extremely dependent upon others telling them where the strengths and weaknesses of their classroom practice are.

> "Having schools that are inquiring places in which students adopt critically informed view of the world around of them requires, at minimum, a situation in which teachers work with other teachers so that they can clarify what is 'good' teaching, what is happening in the classroom, why and with what effect. In some, we need an approach that encourages change based on dialogue, rather than a monologue delivered by outside experts and received in an unquestioned fashion by those inside the schools".
> [Gitlin and Smyth (1989), p.8]

Personally, the writer and the project team failed to perceive the teaching community being passive, unquestioned receivers of techniques. However, we do agree with them that

> "What is required instead are ways in which teachers can collaborate with one another so as to understand their teaching in its historically embedded context, while engaging in collective change based on a careful examination of an array of taken for granted assumptions which define teaching in a narrow and oppressive ways".
> [Gitlin and Smyth (1989) p.8]

They go on to conclude:

> "That teachers, students and community can converse in some extended sense of the term about educational intentions, aims and means is really the essence of the matter. Analysis has tried to show just what an extended conversation, horizontally conceived, will involve when mutual understanding - 'gaining access to the conceptual world' of others - is paramount".
> [Gitlin and Smyth (1989), p.75]

They are trying to emphasise that one should forcefully and consistently engage in a talking process to understand the links, the choices, the various means and purposes of good teaching and that it is important to see good teaching in that way. Indeed they associate this with making history. We note that Gadamer (1984) stresses

> "Understanding also and above all is a happening and makes history".
> [Gadamer (1984), p.41]

We, however, have to agree with Lee Cronbach (1987) that in this dialogue a person with a scientific viewpoint will prefer replanning, focussing, standardisation, quantification and controls, in contrast to the more humanistically orientated evaluator who will lean more to openness. The writer finds this a rather polarised view but in his article Cronbach does qualify this polarisation. He goes on to say that few individuals would adopt either style for every aspect of the investigation and none would be able to insist on applying such a uniform style to all studies. He stresses that experimental control is not incompatible with attention to qualitative information or subjective interpretation.

Campbell (1975) makes this comment about evaluations that have strong designs

> "... attempt to tap systematically all the qualitative common sense programme critiques and evaluations that have been generated among the programme staff, programme clients from their families, and the community observers ... Where such evaluations are contrary to the quantitative results, the quantitative results should be regarded as suspect until the reasons for the discrepancy are well understood. Neither is infallible. For many of us, what needs to be emphasised is that the quantitative results may be as mistaken as the qualitative".
>
> [Campbell (1975), p.10]

Campbell suggests that an evaluator should **not** see himself as being in one particular category but rather that the choices should differ according to the work being evaluated.

Lawrence Stenhouse would agree and his often quoted comment that research means **doing research.** In our project the team are concerned to bridge the gap between research and actual classroom practice and saw some promise in this Action Research focus for evaluation, coupled with this strand, we agree with John Heron

> "... doing research on persons involves and important educational/commitment; to provide conditions under which subjects can enhance their capacity for self-determination in acquiring knowledge about the human condition".
>
> [Heron (1981), p.35]

Turbert when talking of the collaborative nature of our type of work argued

> "Its intuitive plausibility as means and as an end for educational research and educational practice".
>
> [See Turbert in 'Reason' (1981), pp.141-152]

Where action case studies invite action responses, the evidence gathered to be presented by an evaluation is involved in the decision making by groups or by individuals. This Lawrence Stenhouse (1982) suggests is the general tradition evaluation and has been applied with varying standards of quality. He does suggest though

> "It always involves case study, and I would regard it as a characteristic of evaluation ....".
>
> [Stenhouse (1981), p.214]

He reports at that date; that case studies based on condensed field work are currently being undertaken in a variety of settings in both research and evaluation. He admits the two fields are not always easy to tell apart. It may be how the sponsor actually wants the evidence provided for him. He goes on to describe interpretive case study of the kind we are considering, which he says is deeply concerned with practice. He suggests it has an appeal to the participatory experience in education, rather than to any one technical theory and holds to the everyday language or non-technical language because he recognises and quotes Habermas (1974)

> "... The task of entering into the consciousness and convictions of citizens prepared to act".
>
> (p.75)

He goes on to stress that it strengthens judgments and develops our, in Stenhousian terms, prudence, or in Habermas' terms practical prudence concerned with the probable. One set of answers to this practical problem is now addressed in ethnomethodological terms.

4.5 Ethnomethodology and the Interview

Ethnomethodology was in the 1960s seen as a radical alternative and a challenge to conventional sociology in particular. In reading one finds it is now much less dismissive of other approaches. An emphasis can be found within the psycho-sociological community in analysing how people make sense of or in Kelly's terms construct, their world view and their way of life. This emphasis is included within our research methodology on the grounds that it reflects the way people give meaning and understanding to their everyday lives. Cuff and Payne (1984) describe the centralised idea of ethnomethodology is that the orderliness of social life is not, only the result of people obeying social norms or responding to social pressures. Orderliness is a product of how actors or participants function on every occasion they interact. Garfinkle, the founder of ethnomethodology was interested in not whether a matter was right or wrong but **how** the actors perceived it, and how they came to perceive it in a particular way.

How can the teacher - researcher apply this approach? Wolcot's (1973) description of a college principal and his school developed a range of methods to help our understanding. He had six basic sources of information that he used to supplement his direct observations. It seems to me that an ethnographer 'becomes' involved in a whole range of activities, some of which are not specified at the start of the work. As part of the process the organisation of the field itself will influence the methods used, that is, what is practical and possible to do, and the cost in terms of time and resources.

Hitchcock stresses the unique place of the teacher-researcher in the classroom

> "he will arrive at that especially unique point that the teacher-researcher is placed in. Teachers, unless they look at other schools and other classrooms, are usually already participants in the worlds they wish to describe and undercover by means of fieldwork and ethnography. Even when they do research in other schools they are considerably tuned into the world of schools and classrooms."
>
> [Hitchcock (1989) p.55]

Of the possible techniques, we have chosen to emphasise for the staff input, the use of an interview. It seems a key technique of collecting data. We are drawn to the approach of Wragg (1978), which is concerned with structured interviews whose intention is to gather data so that as Stenhouse observes, that the problem of field research in a case study is to gather evidence in a way that will make it available for critical assessment. Hitchcock (1989) sums up structured interviews as having the advantage of reducing the risk of researcher bias. This we felt was important to take action against as all participants and staff were very familiar with one another, both on a professional and social level. This was so, that in Cicourel's (1967) terms the complex interview would be able to achieve what is intended in research terms, but without losing the rapport, empathy and understanding between the interviewer and interviewee. Yet we were able to specify in advance what questions we thought were appropriate or even important prior to the interview by means of a schedule. We were, of course, influenced by Lofland's (1971) famous passage.

> "I would say that successful interviewing is not unlike carrying on unthreatening, self-control, supportive, polite and cordial interaction in everyday life. If one can do that, one already has the main interpersonal skills necessary to interviewing. It is my personal impression, however, that interactants who practice these skills (even if they possess them) are not overly numerous in our society."
>
> [Lofland (1971), p.19]

The analysis of interviews was done by following the methodology and advice of Sue Jones (1985) in her helpful article linking as it does grounded theory with the analysis and mapping of the data. The enormous influence of Glaser and Strauss' (1967) ideas lies within their stress on the building of understanding about

the world that is firmly grounded in the concept and theories of people inhabiting and taking part in it.

Jones (1985) links her methodology with the work of Diesing (1972). It is recognised that when researchers puts the raw data into categories they are being interpretive. Parlett and Hamilton's (1972 and 1988) explain this in terms of their Illuminative Evaluation of an Innovation.

4.6 Evaluative Patterns

In the 70s and early 80s there has been a growing concern for accountability in Education and many methods have been evolved to investigate the processes involved in teaching and learning. However, two major patterns have dominated the field. The first we shall call the traditional evaluation pattern. The second, which the writer wishes to follow, could be termed the illuminative evaluation pattern. First we will point out some limitations of the traditional patterns of evaluation.

4.6.1 The Traditional Evaluation Pattern

MacDonald and Walker (1974) describe the traditional evaluation that is predominantly quantitative and is very committed to the measurement of three specified behavioural effects. It applies psychometric techniques which can include questionnaires and psychological tests, to the measurement of student attainment and it applies sociometric techniques such as observation schedules, and charting methods, to the measurement of teacher/student interaction.

> "The objectives can usually be set down precisely and clearly in terms of the effects that the course is intended to produce."
> [Wiseman (1970), p.60]

This implies that it is desirable and possible for the evaluation to be concerned with the preordained effects, [Hamilton (1976)]. It has been suggested by Parlett (1972) that tradition pattern regards curriculum evaluation as the comparison of two varieties of compost. He suggests that particularly in the fields in which we are engaging this approach is not totally appropriate. This type of evaluation is essentially one of measurement. These sorts of studies are designed to produce data of one particular type, the objective numerical data that permits

statistical analysis. Although these methods have made major contributions, Parlett and Hamilton question their approach in every field especially those which involve values, beliefs and attitudes.

Parlett [op cit (1972), p.8] indicates that there are several other difficulties connected with this method of evaluation. It is assumed that the programme will undergo no change during the period of the study. He goes on to stress that this is fundamental to the whole research design. This means that we could be tied to the research design and cannot adapt to the changing circumstances, we cannot appreciate outcomes, which may arise. The writer would add that these unanticipated outcomes are of immense value and assumes that they will be produced at some level with any interaction that involves people such as the student/teacher. The more so, when the study is activity based or participatory level or the learning processes being examined. Parlett is critical of this pre-specification. He sees it as a de-personalising impact on evaluation and that no one measurement can capture the complexities of classroom life.

In the second place it is imperative for this type of evaluation to see that all the major variables are strictly controlled. This means that large samples must be used which makes the research expensive and time consuming. The writer would further suggest that it puts the activity for practical possibilities outside the remit of action research. For ethical reasons it may be that we would not wish to manipulate the educational environment for these purposes.

Parlett [op cit (1972)] goes on to suggest that this type of evaluation

> "Often fails to articulate with the varied concerns and questions of participants, sponsors and other interested parties. Since classical evaluators believe in an "objective truth" equally relevant to all parties, their studies merely acknowledge the diversity of questions posed by different interest groups."
>
> (Parlett, 1972, p.9)

Lastly, the methods used by traditional evaluators do tend to impose artificial and arbitrary restrictions on the scope of the study. Parlett and Hamilton point out that the concentration on getting this quantitative information by the above means can lead to the neglect of other, more salient data. Research of this type, they suggest, tends to ignore unusual or atypical results although these may be important or significant for the innovation to the students and teachers.

These sorts of criticisms led to the development of the illuminative approach which is qualitative rather than quantitative.

4.6.2 The Illuminative Evaluation Pattern

We are indebted to Parlett and Hamilton for drawing together the main features of several studies which are outside the traditional mainstream educational research. These studies were descriptive and interpretive rather than trying to measure and predict. The advantage, or the major feature of this type of evaluation is that it is flexible and allows for unforeseen effects.

> "The impact of an innovation is not a set of discreet effects, but an organically related pattern of acts and consequences ... Innovations have many more unanticipated consequences than is normally assumed ... It is often unanticipated outcomes which decide the success or failure of a particular project."
>
> [Parlett and Hamilton (1977), p.7]

So we could say that this style of evaluation sets out to illuminate the full situation. Parlett and Hamilton consider that the adoption of this approach involving not merely a different set of methods but some new suppositions, concepts and terminology is a major shift in the patterns of evaluation.

The Instructional System and the Learning Milieu are two key ideas of this type of evaluation. The instructional system refers to the plan or statement which formally defines the particular teaching. Our study will need to explore how the STSC formalised statements functions in actuality as our practice is carried out.

This reality of educational practice necessitates adding to the instructional system, which is an abstract model, the use of second level concepts within the learning milieu. This refers to the unique environment in which students/teachers work together to produce the interaction of cultural, social, institutional and psychological variables. It embraces the various assumptions and constraints pervading the school and takes on board not only the characteristics of the individual teachers and learners but the whole ethos of the environment.

[Rutter (1979) emphasised these aspects in his detailed study.]

Parlett and Hamilton emphasise that innovations such as we are thinking of cannot be set apart from this learning milieu. So, to assess the success of an innovation it is necessary to trace the impact which extends through this milieu.

The question that now has to be faced, is how to report this mixture, or triangulation approach. In one sentence the CIPP model of Stufflebeam (1971) seems helpful. Before developing this approach we must consider the reliability and validity of quantitative and qualitative research to know that what we want to report is worth reporting.

4.7 Discussion of Reliability and Validity of Quantitative Measures

Kerlinger (1986) suggests there are three ways to approach the question of reliability of our measures, in a quantitative sense.

> "One approach is epitomised by the question: if we measure the same set object again and again with the same or comparable measuring instrument, will we get the same or similar results? This question implies a definition of reliability in stability, dependability, predictability terms."
>
> (p.403)

Secondly he suggests that

> "Are the measures obtained from a measuring instrument 'true' measures of the property measured?"
>
> (p.404)

This is to do more with the accuracy of what is being defined. He goes on to suggest that we should ask a third question:

> "We can enquire how much error of measurement there is in a measuring instrument."
>
> (p.405)

There are, in general, two types of variation. Systematic and random or error variance. The former leads you in one direction giving scores which tend to be positive or negatively high or low. That is with a built in bias. Random or error variance is self-compensating. The scores tend to fluctuate from one side to the other, so they tend to be self-compensating. The reliability coefficient is a measure of consistency obtained by calculating the correlation coefficient between the two repetitions of the same experiment. [Porkess (1988), p.186]..cp9

Wittig (1977) has a simple and useful definition

> " ... reliability refers to the consistency with which a result may be obtained when either or identical or supposedly equivalent forms of a test are used in testing, perfect consistency cannot be expected, but a high degree of reliability is essential. It would be impossible to take accurate or meaningful predictions from the results of an unreliable test."
>
> (p.211)

He goes on to give an equally useful definition of validity.

> "That means a test measures what it claims to measure: that is, a valid test predicts what it intends to predicts. A test may have several validities, for example, a high validity for prediction of scholastic success in literature courses, but a much lower validity for predicting success in mathematics courses. It is very important to identify just what a test does measure. Improper use of test may lead to inaccurate prediction ... "
>
> (p.211)

In other words, our data is valid if it provides a true picture of what is being studied.

Kerlinger (1986) takes us back to our appreciation of what science is.

> "Poor measurement can invalidate any scientific investigations. Most of the criticisms of psychological and educational measurement, by professionals and layman alike, centre on validity . . . Achieving reliability is to a large extent a technical matter. Validity, however, is much more than a technique. It bores into the very essence of science itself. It also bores into philosophy. Construct validity, particularly, since it is concerned with the nature of "reality" and the nature of the properties being measured, is heavily philosophical."
>
> (p.431)

Cohen et al (1980) suggests that "clouding conditions" threaten to jeopardise the validity of experiments have been identified by Campbell and Stanley (1983) and Bracht and Glass (1968). Conditions which Cohen suggests are of greater consequence for validity of what he calls quasi-experiments which are more typical of educational research than the true laboratory experiment. He adapts summaries from both these sources and distinguishes, as does Kerlinger, between internal validity and external validity. The question posed by internal validity is: does the experimental treatment make a difference in the specific experiment under scrutiny? Or as external validity ask the question given these effects, to what

populations or settings can they be generalised? Cohen suggests seven threats to internal validity. We take time to examine them here, as he is writing from an educational research standpoint.

1. History. He suggests that frequently in education research, events other than the independent variable occur between the time of the pre-test and the post-test: which produce effects that can be mistakenly attributed to differences of the variable.

2. Maturation. This problem is more acute in the protracted educational type of studies in brief laboratory experiments.

3. Statistical Regression. Like most maturation effects regression effects can increase between the pre- and post-tests. This is usually based on an unreliable measuring instrument and to extraneous factors which could be unique to the experimental group. Regression means that subjects scoring high on a pre-test are likely to score lower on the post-test. Gains or losses could be wrongly attributed by a researcher just looking at the high and low scores.

4. Testing. Pre-test at the beginning of an experiment can produce an effect other than those due to the experimental variant. Such effects can include "sensitising" subjects to the true purposes of the experiment and so produce high scores on post-test measures.

5. Instrumentation. Unreliable tests or instruments can produce serious errors into experiments. This may be relevant when human observers or judges are being used.

6. Selection. Bias may be introduced as a result of differences in samples.

7. Experimental Morality. Particularly relevant in long-running experiments where the loss of subjects through drop-out may result in compounding the effects of the experimental variables. Those that last the course may be a very different sample from the one started with.

Threats to External Validity

From the same source Cohen (p.166) summarises six threats to external validity.

1. Failure to describe independent variables explicitly. That is, to make the independent variable difficult for replications in the future.

2. Lack of representativeness of available and target populations.

3. The Hawthorn effect. These tend to threaten educational research when the subjects realise their rôle as guinea pigs.

4. Inadequate Operationalising of dependent variables. Dependent variables that the experimenter operationalises must have validity in the non-experimental settings to which he wishes to generalise his findings.

5. Sensitisation to experimental conditions. As with threats of internal validity, pre-tests may cause changes in the subject's sensitivity to the experimental variables and thus cloud the true effects.

6. Interaction effects of extraneous factors and experimental treatments.

The above threats to external validity represent various interrelated interacting factors.

Interaction effects may also arise as a result of any of those factors identified under our threats to internal validity. There is an unequal relationship between internal and external validity. If you have not achieved any internal validity then the experiment cannot possibly be externally valid. It may be an internally valid experiment but it may not have external validity. Also data can be reliable without being valid. Studies can be replicated and produce the same results but these results may not be a reasonable measure of what the researcher intends to measure. A good example quoted by Haralambos (1990, p.721) suggests that statistics on Church attendance may be reliable but they do not necessarily give a true picture of religious commitments.

Qualitative methods are often criticised for being unable to meet rigorous standards of reliability. Such people would stress that the methods are unreliable because the procedures used to collect the data can be unscientific/unsystematic. Results are rarely quantifiable and there is no way of exactly replicating a qualitative study and so checking its reliability.

Haralambos (1990) goes on to suggest, on the other hand, that the qualitative method's supporters

> " ... often argue that quantitative methods lack validity." Statistical research methods may be easy to replicate but they may not provide a true picture of social reality. They are seen to lack depth to describe accurately the meanings and motives which form the basis of social action. They use categories imposed on the social world . . . which may have little meaning or relevance to other members of society. To many . . . only qualitative methods can overcome these problems and provide a valid picture of social reality."
>
> (p.721)

4.8 The Validity and Reliability of Applied Qualitative Research

Roses' (1982) outline directs us to a consideration of four key aspects of validity: descriptive, conceptual, theoretical and external.

1. Descriptive Validity

> Descriptive validity involves asking oneself the question whether each incident or event is really what it is thought to be by the author. Evidence needs to be proffered as to the quality of the data. Walker (1985) states that we should pay serious attention to the perspective from which the author discusses the data.

Runciman (1983) proposed several forms of misdescription: incompleteness, over-simplification, suppression, exaggeration and ethnocentricity. These are seen as major problem areas in any qualitative research concerned with learning, having taken the perspective of the complex ill-understood nature of the learning processes, the vast range of theories and the different types of learning, and particularly relating to our study within a social milieu. We are aware that incompleteness may arise from neglect of other theoretical interest than those of our own, which may be highly significant. Kennedy (1984) suggests that relying on verbal testimony of behaviour than on direct observation of behaviour may be a threat to the natural validity. She then goes on to suggest that oversimplification could consist of lack of understanding of the complex patterns of social interactions that are to diverse to be accurately recorded. Consequentially, she concludes that

> " ... the quality of the investigator's data depends on the quality of the participants' testimony, testimony that is shaped not only by their concern for social desirability but also by things as their insightfulness, their articulateness and their openness."
>
> (Kennedy, 1984, p.367)

We have sought to guard against suppression, exaggeration and ethnocentricity by exposing our assumptions to:

1. The students

2. The involved teaching staff

3. The research supervisors.

However, we are forced to agree with Walker (1985) when he suggests

> " ... in judging authenticity the reader is again forced to rely in part on indirect evidence and, most notably, on his own experience and intuition."
>
> (p.190)

Reason and Rowan (1981) quote Schwartz and Ogilvy (1980) when they argue that we should be moving away from notions of objectivity and subjectivity but develop the notion of perspective.

> " ... this divines a personal view from a distance and suggests that neither the universality or objectivity nor the personal bias of subjectivity."
>
> (p.73, quoted in Reason and Rowan, eds. 1981, p.241)

Descriptive validity is in this case is seen as parallelling measurement validity in quantitative research [Smith (1975)].

4.8.1 Conceptual Validity

Conceptual validity concerns the extent to which the ideas used fit the data. Are the instances included in one category sufficiently similar to be included together? Are the categories, in fact, different? Where do the concepts of the categories come from? Are they used by respondents or are they the tools of the author? We have sought to maintain conceptual validity by using the language and concepts of the respondents to the data.

This problem is reduced by the nature of the Somerset Thinking Skills Course. It is a language based course and the material is considered within its own context. Another vehicle, such as philosophy or history, is not used to transmit the main ideas. Therefore, the students and staff are developing the same language and we can be relatively certain that the key words used in relation to the concepts within the course and in the evaluation mean similar things to both the respondents and the author, the categories were established a posteriori as the reason for the qualitative approach was to try to appreciate some of the subtler changes which may have been missed in the broader categories of the quantitative research.

Therefore, the descriptive validity and the conceptual validity lies to a large extent in the concepts themselves, although derived from the inspection of the data. If the concepts themselves were of suspect validity so then would be our results. To protect this validity we have chosen a course with full major evaluation in existence around the main ideas as well as a widely examined theoretical base much of which was accepted within the paradigm of cognitive psychology. [See Blagg (1988 and 1991), Burden (1987), Beasley (1984), Lake (1987), Mays (1985), Shayer and Beasley (1987), Weller and Craft (1983).]

4.8.2 Theoretical Validity

Theoretical validity refers to the way in which the concepts are formed into a coherent whole. Walker suggests that consideration needs to be given to a number of questions.

1. What is the relationship between data and theory?

2. How are concepts and categories merged?

3. What are the relationships between concepts and how are they defined and determined?

4. How well are empirical relationships established?

5. Which concepts and relationships are least supported in logic or evidence and how significant are these for the work as a whole?

Kennedy (1990) suggests that

> " ... naturalistic investigative procedures are naturally valid, that they enable researchers to come close to the true natural behaviour of their subjects other than procedures allow. But although naturalistic enquiry avoids many of the threats to natural validity that are introduced by artificial devices such as experimental interventions or pre-structured data gathering instruments, it does not avoid all forms of artificiality."
>
> (p.387)

We suggest that the above questions with considerations of external validity will provide the correct perspective.

4.8.3 External Validity

External validity is concerned with the generalisability of the evaluation and Walker (1985), suggests that, for him, it largely depends upon the nature of the samples used. He says that the key question here is

> " ... are the subjects typical of the group as a whole and is the group typical of other groups."
> [Orenstein and Philips (1987) in Walker (1985) p.191]

We do seek to generalise our results to any other institutions. We have confidence in reporting that the subjects are typical, in that the sample was of significant size. The methods of sample selection made within the limits of group institutional convenience. These points are developed in the general discussion of qualitative results.

Liability concerns the extent to which the results are replicated. It is argued that qualitative research is high on reliability and low on validity, while the converse is true of qualitative research. [See Filstead (1970), Haralambos (1990)]

Walker (1985) suggests that

> " ... rigorous, systematic and transparent approaches . . . should in themselves lead to substantial improvement in reliability."
> (p.193)

He continues to follow Smith (1981) and Heron (1981) in suggesting that reliability can be enhanced by involving more than one person in the research process as well as the client to whom the research is addressed. Following Glaser and Strauss (1967) Walker suggests that the reader of the report can also join in this 'discounting'. We have sought to involve informally, many staff as well as the students. Rose (1982) talks of theoretical validity but also goes on to make the important point that the use made of the results is a significant part of reliability.

Reason and Rowan (1981) when talking of validity, suggest that the traditional notion of validity is about methods and not about people. They suggest that with hermeneutics that method itself does not lead to knowledge [Cockelmans (1975); Gadamer (1975)] and rather they follow Rogers (1961) who strongly emphasises that enquiry is a particular human process and should start by looking at our notion of truth, which brings us back to their idea of perspective mentioned above. While talking of action research McNiff (1988) quotes Polanyi (1958) where he suggests that the foolproof idea of the past was often misleading because the analysis and therefore interpretation was by fallible people. He seems to agree with Lomax (1986)

> " ... validity of what we claim would seem to be the degree to which it was useful (relevant) in guiding practice for particular teachers and its power to inform and participate debate about improving practice in the wider professional community."
>
> (p.254)

McNiff suggests that there are three steps towards establishing validity of action research knowledge. The first was self-evaluation, `I know that I improve the process' that in practice leads to the realisation of the specified values. The intentionality and a critical reflection was to be made public and shared so that others could gain an understanding of the practice [Lomax (1986)], we need to explain our own education development and critically reflect and explore it.

Perhaps we need to refine our intuitive understandings of our practice. Our enquiry needs to be disciplined but not underrate the qualities we have as teachers of our intuitive tacit knowledge. Action research, she reminds us, seeks to recognise the potential of the teaching staff's interpretations of their own practice and form these into a dialogue. This we have sought to do in our structured interview methodology as a accumulation of more informal dialogue.

Peer validation is when our research findings are of social value in that they are communicated to others and the detailed procedures are given. The idea is to engage in dialectical dialogue. The theory of social communication of Jurgen Habermas was the underlying theoretical base.

Learner validation for action research was taken to mean looking at the structure of the situation before and after the intervention or hypothesised improvement in teaching. However the tendency was to get evidence of the reaction of clients which was felt to be the strongest support of this sort of research in terms of tape recordings and reports by students, were given as examples. We have sought to use each of the methods in our study. We find ourselves in whole-hearted agreement to the person-centred approach of this action research validity agreeing that the development of autonomous person enhances the students' ability to take on the necessary skills and competencies to function appropriately in society and control their own learning. We feel that the study will illustrate how interpersonal skills committed to caring teachers can develop.

Many teachers [Hitchcock and Hughes (1989)] have been critical of educational research for not taking note of the everyday realities of life in school. We have sought to take some of these realities seriously as we have generated research into our own practice. Interpretative qualitative research the writer agrees with Hitchcock and Hughes.

> " ... holds the greatest promise of teachers in this regard. It is now time to get to grips with a means by which teachers can begin to develop knowledge about their own practice by doing research."
> (p.45)

4.9 Reporting Eclectic Research/Evaluation

To cover the range of techniques we are using, careful consideration needs to be given to the actual mode of reporting. Quantitative assessments making use of correlation studies with a well established control group were being put alongside as sensitive and detailed qualitative data as possible.

1981 saw the publication of Standards For Evaluations of Educational Programmes, Projects and Materials which was an important advance in evaluation research. The publishers The Joint Committee came to the view that a good evaluation study satisfied four criteria.

1. Utility that it was informative, timely and useful.

2. Feasibility that the evaluation design is appropriate to the settings in which the study is conducted and that the design is cost effective.

3. That the propriety and the rights of the persons affected by the evaluation are protected. (Ethical standards).

4. Accuracy: which refers to the extent to which an evaluation study has produced valid, reliable and comprehensive information about what is being evaluated.

Ralph Tyler's (1949) work on curriculum evaluation brought about a first major change in education analysis. This was, that it should be organised around explicit objectives and that the success of the curriculum would be judged on how well students achieved the objectives. In this, Tyler's work marked a shift from

evaluating individual students to evaluating the curriculum. Proveur's (1971) Discrepancy Model, Popham's (1975) Instructional Objectives Model and Stake's (1967) Countenance Model - were designed to evaluate programmes, curriculum and their materials and personnel in terms of explicit objectives. These objective based models tended to look at completed programmes rather after the event and somewhat from a distance. Evaluators began to see that critical decisions needed to be made at each stage of the programme development and they needed to collect evaluated data which would be more useful to programme developers in making these decisions. This led Daniel Stufflebeam (1971) et al to develop their CIPP model. CIPP is an acronym for four types of evaluation strands.

1. Context Evaluation which involves an analysis of problems and needs in a specific educational setting.

2. Input Evaluation which concerns judgment about the resources, strategies that are needed to accomplish the goals of the programme. This requires the evaluator to have a wide knowledge of resources and strategies, as well as knowledge about the research on their effectiveness in achieving outcomes.

3. Process Evaluation is the collection of data once the programme has been put into operation. This process of collecting formative evaluation as the programme progresses means that programme decision-makers can take action based on their appraisal of this data as the programme is in operation.

4. Product evaluation is to determine the extent to which the aims and objectives of the programme have been achieved. This is summative evaluation.

The developers of the model stressed the corroboration between evaluators and the performers within the programme, that is the students or teachers. They assumed, in the best American tradition, that the programme being evaluated was major national or inter-state pieces of work. We have linked this to our smaller action research approach with its collaborative principles linking to Stufflebeam's work and the case study approach after Lawrence Stenhouse.

Our stylistic considerations in writing this report will roughly equate the traditional chapter headings of:

1. Method which would include
   a.) Description of subjects
   b) Research design and procedures
   c) Description of measures employed

2. Findings
   a) Description of statistical procedures
   b) Description of findings relevant to each hypothesis objective and questions
   c) Other findings

3. Summary and Discussion
   a) Summary of research problem, method and findings
   b) Conclusions
   c) Implications

The initial chapters on introduction and the review of literature equate approximately in the CIPP model to the method, findings and summary discussion chapters in the normal write up format.

We will approximate discussion of **method** with the **input and process** parts of the CIPP model putting the **product** part of the model against the **findings.** The context being addressed separately before the methodology.

CHAPTER 5:

Managing the Intervention

"The modes of thought of men, the whole outlook on affairs, the grouping of parties, all have encountered violent and tremendous changes in the deluge of the world, but as the deluge subsides and the water subsides we see order again."

Sir Winston Churchill (1874-1965)

5.0 The Context and The Innovation Process

Stufflebeam (1971), as we have already indicated, has made the important point that any innovation or change should be seen within the general context. To fulfil this aspect of our study, the writer intends to relate this context to structural characteristics and to the famous model of Rogers (1983) by relating his innovation process model to the educational institution within which the research/evaluation has been carried out.

However the environment of the innovation is an important factor in determining what happens. Therefore as a result of indications in the current literature the writer will refer firstly to a series of three features three times. Initially three factors for the success, then three core elements for curriculum change, and three perspectives on viewing schools.

Fullan (1986) in discussing the management of change suggests three

> "Powerful factors related to success"
>
> (p.75)

These three are:

1. In-Service Training

2. The Critical Role of the Principal

3. The Organisational Climates

Previously Fullan had recognised that curriculum change in schools may be

thought of as having three core elements:

1. Learning Materials

2. Practices and Behaviours

3. Beliefs and Understandings

The writer would suggest that our innovation covers all three of these core changes. We may suggest that when a teacher takes on the curriculum change of the Somerset Thinking Skills they are inevitably engaged in using new materials, changing their teaching practices (ie, mediation) and altering their beliefs or understandings such as the **central** belief of Feuerstein's that there is an immense possibility for cognitive modifiability. Looking at our innovation superficially, we could centre on the Somerset Thinking Skills Course of materials. However, Fullan would suggest that the practices and behaviours that these materials, to require to use them adequately as a research treatment, has to do with practices, behaviours, beliefs and understandings. He goes on to suggest that these fundamental changes are problematic in that they involve what teachers **do** and **think**.

The individual difficulties in making these changes are magnified because they take place in an organisational context and/or when the context itself is a target of change. In speaking of good schools, the Inspectorate concluded the schools saw themselves as bases for learning. [HMI, Ten Good Schools (1977) A significant publication in the field]. These schools make their philosophies explicit for

themselves and explain them to parents and students; their work has a foundation of an acceptance of shared values. They emphasise consultation, team work and participation.

See also Peters and Waterman's (1982) and Goldsmith and Clutterbuck's (1984) as examples of surveys that are adding to the growing data bank of good practice run by the Centre For the Comprehensive Schools.

The management of change is anxiety ridden. The personal learning process is therefore difficult for individuals to make operational when they are working within an organisational context. For example, the design of our own evaluation had to consider the learning profile (assessment) policy within the school and had valuable feedback from other members of staff who were collating these materials for their students. Fullan (1982, 1986) suggests that this organisational context is not only not conducive to supporting the processes but may be 'downright unhelpful'. Change may be seen as an individual and organisational learning process.

The study of the organisational climate (Fullan's third powerful factor) has had a poor history in educational administration. Recent researches have provided a more meaningful description of the relationship between climate and improvements. Besides the work referred to above, we can remind ourselves that Rutter et al (1979) used the term "ethos" whereas Dean (1985), Peters and Waterman (1982) use the word "culture" or whether we use the word climate, there is something very dynamic about the shared values, beliefs and expectations that seem to categorise effective organisations and has implications for others within

the institutions. Showers (1985) indicates that change means in the following:

> "The social changes required by coaching in the workplace represent a major departure from the traditional school organisation. The building of collegiate teams that study teaching on a continuous basis forces the restructuring of administrators and supervisory staff."
>
> (p.48)

He goes on to suggest that principals

> "... must work to establish new norms that reward collegiate planning, public teaching, constructive teaching, constructive feedback and experimentation. Professional growth must be seen as valuable and expected"
>
> (p.45)

Little (1982; 1984; 1985) has been examining schools from the following three viewpoints.

1. The school is an environment for learning to teach.

2. The school is an institution organised for its own steady improvement and for the advancement of professional knowledge and practice.

3. The school is a place for pursuing a career [Little (1985) p.1].

The school climate as mentioned above with its three major core factors makes explicit the norms and values as well as the practice of effective innovation or change development and makes it explicit that what is at stake is the nature of the school as an institution. Most commentators would suggest that the majority of schools do not function as organisations designed to support improvement. They would agree with Donald Schon when in the 1971 Reith Lecture he suggested

> "Organisations are dynamically conservative: that is to say, they fight like mad to remain the same. Only when an organisation cannot repel, ignore, contain or transform the threat it responds to it. But the characteristic is that of least change: nominal or token change. Where they do exist and their effectiveness makes practical and conceptual sense."
>
> [Rutter et al (1979), Joyce et al (1983), Little (1984; 1985)].

To enable the reader to make some the above estimations of the innovation within our context we shall relate the model of Rogers (1983) to our educational setting. We have chosen this five stage model as it relates, in our view, to the action research orientation we have indicated previously.

First we will take note of the structural characteristics and organisation innovation before seeking to apply Roger's five stage model.

5.1 Structural Characteristics and Inventiveness

The independent variables related to our organisations innovativeness can be grouped into three areas according to Rogers (1983):

1. Leader Characteristics

2. Internal Organisational Characteristics

3. External Characteristics of the Organisation

We will refer to 1 and 3 above but concentrate on 2, the 'Internal Organisational Characteristics' of the School to provide the reader with a context. What follows must be recognised as a very individual commentary on the institution from a point of view of the writer who has been in the school for over a decade. Literary references all relate to the school dairy, but mainly the minutes of the monthly meeting of the middle management team. This is a relatively large group of twenty to thirty members. Its precursors minutes are also referred to, when the group was known as as the Heads Department Meeting, but served the same basic function. Other minutes have been consulted also. The reference details of the actual minutes have been deliberately omitted from this record for the sake of clarity. The minutes themselves may be viewed at the school, but are not designed for public circulation. The Headmaster has agreed to reference being made to them, but we do not wish for a wider publication as the staff, visitors and parents involved in such meetings over a long period of time, would not be aware of their purpose as part of a research/evaluation document.

Initially, we can set the scene by reference to the previous leadership, which was a

decade of consolidation after merging of two schools on one site. A small rural grammar school was established in 1495 and a larger secondary modern school in the 1950's. The Headmaster of the secondary modern school was appointed to form the Queen Elizabeth School on one site, a major change. The leadership was brought into the school at this time. A decade later, on his retirement the headmaster was described as presiding over a decade of consolidation which left the school with a very high local and county reputation as a 'successful school with excellent results' over the whole ability range. The school organisation was divided into basic department areas of a traditional pattern and a horizontal year pastoral care system. The writer's role as a link between the two made for unique insights into functioning of the whole school.

On the appointment of an acting head, which materialised into a two year period, the school went into a period where any change was limited and the acting head was concerned NOT to jeopardise the future leadership, yet to be appointed. Despite this view the Certificate in Pre-Vocational Education (CPVE) was started. A new head was appointed in 1988. His recorded statements and Governor Minutes hole was intended to bring about change to facilitate learning. From this time the minutes of the middle management meeting record many organisational changes. The CPVE Course rose from 10 to 70 people within 12 months and became 'core' studies in the sixth form. The staff remained relatively stable, there were few changes in the middle management team.

Rogers (1983) delineates the following six areas of the internal characteristics of an organisational structure. He suggests that the inter-connectedness or the features in which the agents in the structure are linked by inter-personal networks as a very positive factor for innovativeness, but at this stage we have little hard evidence to

comment extensively. What we can indicate is that this model in common with many other models seems to looking at a very large curriculum change that has a major organisational effect throughout an institution. The school perceives the present change as effecting the whole student population eventually but taking place from within. The intention was not to undertake major changes in the structures of the school although these were taking place at the same time led by the curriculum change.

1. Centralisation. Power is in the hands of the centralist administration. Under the old arrangements of three deputy heads and headmaster, there is little doubt that the staff consensus was that the power was concentrated at this point. The minutes reflect requests to the executive and information and sometimes directions from the executive without even, on some occasions, preliminary discussion. All three deputies were long-term appointees, not seriously or actively seeking promotion. There was a lot of moral investment and personal pride in 'good administration'. The structure of the timetable was substantially the same from year to year. The changes discussed or indicated in the minutes were relatively minor changes at the margins or in changes in personnel. The major innovation at this time, before the appointment of the present incumbent as head, was an exchange of the roles of the three deputy heads. The strategy was, on the whole, to maintain, a 'successful' school. This emphasised administration and negation of some of the education authorities idea so that the essential nature of the situation continued in the writer's view the picture was one of centralised conservatism. An observer agreeing with the phase referred to above, suggested that a good description was 'dynamically conservative'.

2. Complexity. There would be a high measure of professional expertise and qualification as would be expected of a large 'Upper School' (13-18 years) compared with other 11 - 18 schools. A chemistry teacher led a group of A-Level students into a branch of Cancer Research and was promoted to a lecturer's post in higher education. Quite rare in this field. The favourable points and capitation together with the large size of the sixth form allowed more staff at higher allowances than many similar sized schools, and so attracted applications from highly qualified and experienced staff. In a substantial number of cases department heads have experience of department responsibility before moving to the school. However, this has the effect of not encouraging senior staff to seek promotion as they are proportionally limited opportunities to apply for similar opportunities. One gains the impression on rereading the minutes that such highly competent staff were leading up to or actually putting forward fairly organised ideas to the administration and the administration was not in fact providing the movement towards change.

3. Formalisation. An emphasis on following the rules and procedures. The above makes mention to this and the head of department, head of year, staff meeting minutes contain many references to following the rules, the corporate nature of our decision and the collegiate responsibility. The Staff Handbook began to be quoted more and more as a justification for action or non-action within the minutes. The reprimand or encouraging the support of the staff was on the basis of the School Handbook.

4. Interconnectedness. This was found to be difficult to examine in detail via the minutes of the meetings. In fact, the minutes bring out the departmental

and year group structure as being the formal and informal interconnectedness. There seems to be some transfer across as similar names, for example, a head of year, would also feature in the middle management and department minutes. Department closeness is apparent in the minutes as well as informally grouped round pastoral and departmental interests science versus arts, etc. The writer in terms of subject choice acted as a link between the two and feels uniquely placed to state that the school seemed to be departmentalised. We refer to Rogers' Generalisation 8.15 and 8.16, particularly that the communication of proximity of members within department was a negative factor. As a secondary school there seemed to be a higher number of staff who taught almost exclusively within one department and were closely linked professionally as well as geographically. (cf Generalisation of Rogers 8.17). They had homophily in social characteristics, at least while in school, and to some extent, but to an unspecified degree, outside the institution. This is a negative factor in innovation.

5. Organisational Slack. It would be asking a rather a lot of any member of staff, let alone a department head, to admit to the existence of uncommitted resources in the curriculum climate they were in, and even more so today, but we can point to the pleas recorded in heads of department's minutes to spend departmental allocations. The advent of The General Certificate of Secondary Education did, make a major contribution to flexibility in funding, and proportionally more so in the older age group size, and therefore of the school as a whole. In addition, the Government were now beginning to support innovations by specifing and controlling designated funds for set purposes. For example, TVEI, CPVE and Profiling are good examples of

this. The major resource of staff time seems to depend to some extent on their motivation. Most suggestions within the minutes seem to carry support. This would be expected in a large staff. In addition it is possible for schools to generate outside resources as the school did to provide industrial links. Some slack could develop, but how much before the innovation was in place to encourage the change? How much in the years following could be generate? These are difficult factors to measure or estimate.

6. Size. We have alluded to the size of the school in Dorset and National context. we note that about this time, 1988/1989, only 23.6% comprehensive schools had 1001 pupils and above. At about 1350 students, we were in a minority of schools and within Dorset, the second or third largest. (See Appendix K). Given Rogers description of this type of data being a composite variable, relatively easily measured, we should look at what was happening within this global figure of about 1350. The threat of a falling school role had been around for about 15 - 20 years, but had never materialised due to large numbers of people moving into the area at this time Dorset figured as the fastest growing county in the country for a few months in this period. When these falling roles did actually materialise in about 1985/1986 when the annual discussion about parental requests for students coming into the school and what 'full' actually meant in terms of staffing and accommodation, seemed to have slipped from the minutes. They were replaced with discussions which indeed reflected the very real concerns about staff levels and financing by the county as the threat loomed large. However, Government encouragement coupled with other factors that were discussed in meetings, which indicated what may be described as a general, cultural emphasis on students staying on past the statutory leaving age, this led to an

increase in the size of the sixth form. Many innovations seemed to hinge around the appointment of the current head and the sixth form. The numbers within the sixth form and the demand for courses, led to an increased flexibility. Innovations seemed to stem from the sixth form review and the appointment of the present Sixth Form post-holder. Adoption of these innovations had a `knock on' effect lower down the school.

We now move on to the sequence of the innovative process. The structural variables are related to innovation in one direction during initiation and in the opposite direction during implementation. Rogers (1983, p.361), makes this central feature of his innovative processes in organisation. We now look at this model.

5.2 Innovative Processes in Organisations: The Five Stage Model

The model is the identified sequences of decisions, actions and behaviours in the innovation process. It is an attempt to capture the complex time related nature of the process. We relate this model to our experience of the Somerset Thinking Skills introduced into the school. The model has five stages grouped round two main aspects: firstly, initiation and secondly, implementation.

Stages in the Innovation Process in Organisations

STAGE IN THE INNOVATION PROCESS	MAJOR ACTIVITIES
I. Initiation:	All of the information gathering, conceptualising, and planning for the adoption of an innovation, leading up to the decision to adopt.
1. AGENDA-SETTING	General organisational problems, which may create a perceived need for an innovation, are defined; the environment is searched for innovations of potential value to the organisation.
2. MATCHING	A problem from the organisation's agenda is considered together with an innovation, and the fit between them is planned and designed.
----------The Decision to adopt----------	
II. Implementation	All of the events, actions, and decisions involved in putting an innovation into use.
3. REDEFINING/ RESTRUCTURING	(1) The innovation is modified and re-invented to fit the situation of the particular

organisation and its perceived problem, and (2) organisational structures directly relevant to the innovation are altered to accommodate the innovation.

4. CLARIFYING	The relationship between the innovation and the organisation is defined more clearly as the innovation is put into full and regular use.
5. ROUTINISING	The innovation eventually loses its separate identity and becomes an element in the organisation's ongoing activities.

Rogers (1983, p.363)

Stages in the Innovation Process in Organisations

STAGE IN THE INNOVATION PROCESS	MAJOR ACTIVITIES
I. Initiation:	All of the information gathering, conceptualising, and planning for the adoption of an innovation, leading up to the decision to adopt
1. AGENDA-SETTING	The general organisational problems were really a discussion of the lack of learning or study skills in a discreet personal/social educational course. Various hints and ideas had been tried out with varying degrees of satisfaction and no real feedback or attempt to evaluate what had been happening. The group of staff felt there was need for research into what should be put into a time limited course to achieve the greatest potential for the students. We found it difficult to quantify success because the staff and students were all coming from different bases. Within the course, staff had realised that there was no real clear research base for the messages they were given in response to the question, 'Show us how to revise?' This message had been informally getting to departmental staff who, although having a departmental responsibility, also felt unclear how to respond. The reports to the writer were that they wanted clear, cut and dried, black and white messages in a field where there was no cut and dried research based message. In looking at thinking skills types of courses, we were surprised to find there was a choice, but the Somerset Thinking Skills Course was being advertised by the publishers at this time and Feuerstein was in the news in the United Kingdom. It was felt there was a need for an general school strategy, by some staff. This was encouraged by senior staff.

2. MATCHING

A small group of six staff met to see if they could put this innovation into practice in a small way. They felt quite strongly that unless they started with something new in this area, little would be achieved, other than a long discussion. The problem of study skills was of interest to many staff, the group felt that action was important to a move towards to an overall strategy, but at the same time, they felt not in a position to define the approach. The STSC writers, indicated that they were working from a research base and introduced us to the idea of metacognition. From what the group could find from other published materials, they were only giving good ideas, the best of which the group understood to be the work of Tony Buzan that was available more at a sixth form level. A member of staff was sent on the Introductory STSC Course and discovered the concept of metacognition and the heuristic gap between research and practice in this area.

The cost of the STSC is reasonable compared with other options (at this time was £15 pounds for the Introductory Module with full copying rights within the institution). It particularly compared well with the high initial costs Instrumental Enrichment and the commitment to the high cost of staff training whereas the STSC had not these restrictions. This meant the group could carry out its own in-service training. The group also considered that Instrumental Enrichment, although directly from Feuerstein, would not be so applicable in an all ability range context, which we were hoping to develop the innovations.

----------The Decision to adopt----------

II. Implementation

All of the events, actions, and decisions involved in putting an innovation into use.

3. REDEFINING/ RESTRUCTURING

The small group of staff try out the innovation, really with a degree of ignorance, but enthusiasm. They taught the first part of the Introductory Module for 35 minutes per week for a term with Year 9 (13/14 year olds). The results were mixed. Some staff

were very enthusiastic but others felt that it did not fit in well with their preferred method of working. The initial problem looking for aims and objectives for a lesson was not easily gleaned from the teacher notes. They were appreciative of the group work approach. Although some staff not used to this approach did find it quite difficult given the limited time. In fact, all staff felt that the 35 minute time slot was not suitable. In addition, for a short 15 minute part of a tutorial work programme, one member of staff tried out another module with Year 10 (14/15 year olds). This had some success, but tended to tail off because of pressures of time and other commitments and was not overall very successful. In parallel with this work discussions in the school were taking place regarding a proposed tutorial period of one hour. It seemed that a convincing argument needed to be put forward with a strong research base to include learning skills within this time. It must be appreciated that a large element of uncertainty, not to say fear, and lack of commitment was being experienced by large numbers of staff within the school. The writer explored the possibility of a full evaluation and in 1989 it was negotiated that some time resource would be made available for evaluation in conjunction with a local Higher Education Institution (now the university). The group was able to appreciate that we needed not an evangelical approach but a fuller scientific evaluation taking into account the schools innovation again going on at this time of Learning Profiles. In parallel with this thinking, the new course of Personal and Religious Education had come into being the year previously, and a larger time slot taught as a discreet course for an hour per week, for about 8 weeks was available for our use. This was a commitment by this department as it meant that an element of their course had to be displaced. The reports of this initial work became the Pilot Study.

4. CLARIFYING

Reports from this Pilot Study, on the whole, were quite good. Particularly from the Learning Profiles where the students were extremely complementary. The writer debated at some length with the Media and Communications Department of Bournemouth Polytechnic in their support as Supervisors. There were changes in ideas of

how this evaluation should take place and its emphasis as well as parts of the course being dropped out and a more efficient use of the time available to us took place. Different staff became involved by volunteering and being "volunteered by time table necessity."

The full research evaluation took place over two years. As it was being carried on, the feedback was difficult to give in the quantitative pattern because of our lack of understanding and that by its design one wanted as full a sample as possible before extrapolating the statistical results. We, however, were encouraged to consider the innovation useful by the reports from students and their interpretation of these reports by non involved staff who were acting as tutors and collating the Learning Profiles.

4. CLARIFYING

The full research evaluation study at the time of writing, has not been published. Unfortunately, time resource decisions have to be made before the full report publication date. Decisions about the nature of the course of the next year are therefore not being made in the light of our evaluation, although some indication has been given the way the writer sees the results at this time. The school has an important concern regarding health. Especially in the light of national figures of early sexual behaviour in adolescence, coupled with the schools curriculum health audit. It seems to be that politics suggest that the choice is between Learning Skills and Health Concerns, so that we are in a position of redefining the place of learning skills within the school.

5. ROUTINISING

The current thought is to put learning skills within tutorial time and put a health module in its place in the Personal and Religious Education Course. This gives us a large problem of staff training, but techniques are being considered. The question really being posed is that in the light of the evaluation is it reasonable to pursue a Somerset Thinking Skills Course in whole or chopped up in various parts or to emphasise the essential metacognition and other parts of the learning theory of Feuerstein, especially, his work on mediation. Whatever his outcome, it seems that this evaluation will be the key essential input.

CHAPTER 6:

Establishing the Right Methodologies

"You know my methods. Apply them!"

Sir Arthur Conan Doyle (1859-1930)

6.0 Quantitative Methodology

The objective is to test the hypothesis that the **independent** variable, part of the STSC module will have an effect on the **dependent** variable, the non - verbal IQ tests. The tests applied included a Cross - Tabulation analysis by band and sex. The Analysis of Variance Tests were used to examine gender and compare the two tests. The Univariate F - Tests were used to look for any initial differences by sex. The means of the groups by sex were compared by using the T - Test as was the means of the Control and Experimental group (on IQ measure results). The Paired T - Test compared the means of the two IQ tests used. The subjects and Tests are described below.

a) **Subjects One**

The subjects were thirteen coming up to fourteen year old students in an upper secondary school, a year nine group of 350 in a school population of 1350, with an age group of 13 to 18 years. We took samples of 304 students with a control group of 63 and an experimental group of 247.

Class intervals on the standard age score of Test One (T1)

were 145+/130.

129/115.

114/100.

99/85.

The groups were divided into balanced cells on the basis of their gender.

b) **The Test**

The T1 which was the non-verbal battery of the Cognitive Abilities Test (Level FF): Thorndike - R, and Hagen - E, standardised by France - N, published by Nelson, 1973.

T2 was the Figure Reasoning Test. Daniels - J C, Crosby, Lockwood (1949).

The choice of the test was in part to respond to the convenience of using these existing vehicles within the institution, to encourage direct comparisons of results by the teaching staff as well as to avoid the multiplicity of testing with its attendant methodological drawbacks and ethical considerations. These latter considerations were a major condition of the schools full participation cooperation in this action research. T1 was given by non-participating trained members of staff within a general institutional wide enquiry into "gifted" students. These enquiries were made within the higher ability mathematics and English sets of the year population in question (they are taught and allocated by ability: as part of the pilot study). It was therefore considered feasible to continue this practice to the full study.

c) **The Independent Variable**

The STSC module was then taught by five staff within year 14 curriculum, within the Personal Development Programme. The members of staff had varying backgrounds but all had a positive approach to the innovations. They were all aware of the participatory nature of the STSC course. The course was given over 9 months in the winter and spring terms of 1989/1990. The time allocated was 60 minutes, once a week, for 8 weeks, (the maximum time therefore was 8 hours) less

the time for testing. The groups were mixed ability groups based on the results of Richmond Tests taken at approximately 12 years of age, ie, the year before: but also considering friendship pattern requests as they moved into the upper school.

The staff were only briefly able to familiarise themselves with the course and only had limited training. One member of staff had external courses, one during the pilot, the year before, and one course during this study. They were of three day duration and were aimed at providing him with an introduction and sufficient basis for a cascade effect of training with the assistance of STSC manuals.

d) **The Second Test**

T2 was administered by the staff at the end of the courses. On some occasions the project leader carried out this testing as some staff were unfamiliar with the procedures.

6.1 Methodology - Qualitative Procedures

6.1.1 Learning Profiles

These were used as a record of both the ongoing process and as a summative profile. They were results of the materials and the working notes of the students.

a) The profiles were sorted into male and female. Categories for analysis of student's comments were formed after the profile was written up by the students. They were given five major areas in which they could suggest working skills they considered they had covered with some indication of level of achievement from 'I made a little progress' to 'I understand this and developed my ideas' by shading boxes 1 - 6, with an additional area for comment. A small area for general comment was designed into the sheet. On the second side some assessment of cross-curricular skills were indicated with some suggested headings. Staff assessments and comments on the student and the sheet, was negotiated and signed by both student and teacher.

b) On a second round of the course, a more summative profile was tried. This indicated what we were going to do.

> "You will consider positive attitudes and beliefs about being able to learn (Metacognition)".
>
> "You will develop more awareness and control over the use of problem-solving or thinking processes as well as transfer and generalise these ideas to different areas".

Then four main questions were addressed.

1 The student was asked to consider how far they thought they had succeeded in the module.

2. What, if anything, especially interested them?

3. What, if anything, they had found difficult?

4. Intentions in the future?

A small area for a staff response and student/staff negotiation was made. (cf Appendix).

At least 12 months after the course, we began to ask students to review their thinking on the course. We did this by using the first side of the original learning profile. Students were asked to recall what they could of the course and make comments 1 - 5 on the main concept as they could remember them and then indicate by level of achievement with reference to particularly transfer and generalisation, wherever possible. Whether little progress was made or how their ideas had developed. An area for comment on each of the five main concepts they stated was built into the design with a small area for general comment.

6.1.2 Staff Interviews

The data gathered from staff interviews was by a structured interview. These were carried out after a series of informal interviews and reference to the course in regular staff meetings about the curriculum generally. The interview schedule was developed around five aspects:

1. Personal background, which included their personal philosophy of teaching, previous experience and their preparations for the lessons, preconceptions of the course and problems they came across.

2. The lessons. An attempt to find out how they structured the lessons, the atmosphere of the group, whether they thought they had achieved their objectives for each lesson, whether the students shared the objectives and the transfer generalisation of the work as well as the look at the individual lesson materials and student recording or self-assessment.

3. A more general discussion of the course under the roles they and the students had to undertake, their interactions, and something about small group and the shared work.

4. Mediation was covered by looking at the distinct areas from Blagg (1988).

5. A consideration of the future under headings of education and social value of the course, validity and the use of time and resources, generally, and a place in the curriculum. (cf Appendix).

This interview schedule was thought of in terms of evaluation and was developed from the work of Blagg (1988) and Powney et al (1987). Within this structure we were able to establish the CIPP (Stufflebeam)model of evaluation. That is Context , Input, Process and Product. The **context** being largely item one, personal background, the **input** being two, the lessons (less section (d) on recording and self-assessment), the **process** taking up three discussions of the course, four, mediation, with the **product** being five, the future. We expected some overlap between these areas and the CIPP reporting.

CHAPTER 7:

Presentation of Results

"Of facts there is already too much in psychology, of evidence too little"

J.A. Deutsch (1960)

7.1 Quantitative Results

THE STATISTICS.

The data was examined by being subjected to two main groups of statistical proceedures. The **Cross-Tabulation** or Cross-Classification and the **Analysis of Variance.**

A cross-tabulation shows the number of cases that have a particular response combination. The number of cases in each cell of a cross tabulation can be expressed as the percentage of cases in that row (the row percentage) or the percentage of cases in that column (the column percentage). The variable that is thought to influence the values of another variable is called the independent variable. The variable that is influenced is called the dependent variable. Percentages are calculated so that they sum to 100 for each category of the variable. The writer uses this technique to examine the original ability levels of the population as indicated by the results of test one for the bands, the teaching groups, the genders and to test for differences between the experimental and the control groups. The use of the row and column percentages does not allow for the quantification of testing of the relationship between the variables. Therefore it is useful to consider various indexes that measure the extent of association as well as statistical tests of the hypothesis that there is an association.

The hypothesis that two variables are independent is often useful. Two variables are by definition independent of each other if the probability that a case falls into a given cell is simply the produce of the marginal probabilities of the defining categories of the cell. This is the basis of the **Chi-Square** test of independence.

A statistic that is often used to test the hypothesis that the row and column variables are independent is the **Pearson Chi-Square.** It is calculated by summing over all cells the squared residuals divided by the expected frequencies.

The calculated chi-square is compared to the theoretical distribution to produce an estimated independence or not. Since the value of the chi-square depends upon th number and rows and columns in the table so one must know the degrees of freedom for the table. The chi-square is a test of independence; it provides little information about the strength or form of the association. The chi-square size is a reflection of the size of the table. Thus, in our example large chi-squared values can arise even when residuals are small relative to expected frequencies because of the size of the table.

The chi-square statistic is not of itself a good measure of the degree of association of between two variables. However its widespread use in tests of independence has led to the development of measures of association based upon it. Each of these seeks to modify the chi-square to minimise the influence of sample size and degrees of freedom as well as restrict the range of values of the measures to those between 0 and 1. This makes comparisons more meaningful between tables of various size and dimensions. **Pearson** suggested the use of the coefficient of contingency. This does not usually reach an upper limit. **Cramer's V** on the other hand can attain the maximum of 1 for tables of any dimension.

Lambda always ranges between 0 and 1. A value of 0 means the independent variable is of no help in predicting the dependent variable. A value of 1 means that the independent variable perfectly specifies the categories of the dependent variable. When two variables are independent, lambda is 0; but a lambda of 0 need

not imply statistical independence. In particular, lambda reflects the reduction in error when values of one variable are used to predict values of the other. If this is absent, lambda is 0. For a particular table two lambdas can be computed, one using the row variable as the predictor and the other using the column. Dependent and independent variables are not clearly distinguished. Then, a symmetric version of lambda, which predicts the row and column variable with equal frequency, can be computed. So we can obtain the symmetric lambda as well as two asymmetric lambdas.

Several measures of association for a table of two ordered variables are based upon the comparison of the values of both variables for all possible pairs of cases. A pair of cases is concordant if the values of both variables for one case are higher (or both lower) than the corresponding values of for the other case. The pair are discordant if the value of one variable for a case is larger than the corresponding value, and the direction is reversed for the second variable. If the preponderance of pairs is concordant, the association is positive.

Kendall's Coefficient of Concordance is another measure of level of agreement. It takes a value between 0 and 1. The nearer 0 the value the greater the disagreement between. **Gamma** is closely related to tau statistics and can be thought of as the probability that the pair is discordant, assuming the absence of ties. The absolute value of gamma is the proportional reduction in error between guessing concordant and discordant ranking of each pair depending on which occurs more often and guessing the ranking according to the outcome of the toss of a fair coin.

In the computation of gamma, no distinction is made between the independent and dependent variable; the variables are treated symmetrically. **Somers** proposed an

asymmetric extension of gamma that differs only in the inclusion of the number of pairs not tied on the independent variable in the denominator.

The **Eta Coefficient** is appropriate for data in which the dependent variable is measured on an interval scale and the independent variable on a nominal or ordinal scale. Eta can be interpreted as the proportion of the total variability in the dependent that can be accounted for by knowing the values of the independent variable. The measure is asymmetric and does not assume a linear relationship between the variables.

The second main area of statistical analysis that was used is the **Analysis of Variance (ANOVA)**. These were used to test the null hypothesis that the populations' means are equal. To use ANOVA the observed variability is subdivided into two parts - variability of observations within a group about the group mean (within groups variation), and the variability of the group means (between groups variation). The **F-statistic** is calculated as the ratio of the between-groups estimate of variance to the within-groups estimate of variance. The analysis of variance F-test does not pinpoint which means are significantly different from each other. Multiple comparison procedures, which protect you against calling too many differences significant, but are used to identify pairs of means that appear to be different from each other.

There are a variety of test statistics for evaluating **multivariate differences** based on the eigenvalues of HE-1. Four of the most common are displayed in **SPSS/PC+ MANOVA**. They are **Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root.**

Although the exact distributions of the for criteria differ, they can be transformed into statistics that have an approximately an F distribution. When there is a single variable, all four criteria are equal the ordinary ANOVA F statistic. When there is a single sample or two independent samples with multiple dependent variables, they are all equivalent to Hotelling's T2. In both situations, the transformed statistics are distributed exactly as F's.

Two concerns dictate the choice of the multivariate criterion these are power and robustness. That is, the test statistic should detect differences when they exist and not be much affected by departures from the assumptions. For the most practical situations, when differences among groups are spread along several dimensions, the ordering of the test criteria in terms of decreasing power is Pillai's, Wilk's, Hotelling's, and Roy's. Pillai's trace is also the most robust criterion. That is, the significance level based on it is reasonably correct even when the assumptions are violated. This is important since a test that results on distorted significance levels in the presence of mild violations of homogeneity of covariance matrices or multivariate normality is of limited use.

In looking at our Multivariant tests of significance the analysis is presented in the following way. The **first line** contains the values of the **parameters (S,M,N)** which is used to find significance levels in tables. For the first three tests, the value of the statistic is given followed by its transformation to a statistic that has approximately an F distribution. The next two columns contain the **hypothesis** and the **error degrees of freedom** for the F statistic. The **observed significance level** is given in the last column. This could be described as the probability of observing a difference at least as large as the one found in the sample when there is no difference in the populations. There is no simple way to transform Roy's largest

root criterion to a statistic with a known distribution therefore only the value of the largest root is displayed.

As in the univariant analysis of variance, the terms are tested in reverse order. That is, higher-order effects are tested first, since it is difficult to interpret lower-order effects in the presence of higher order interactions and not be misleading.

Before examining our analysis we should note how the bands of data was established. The four bands were selected on the scores of the non-verbal reasoning test of the Cognitive Abilities Test (Test 1) were:

BAND

4: 130 - 145

3: 115 - 129

2: 100 - 114

1: 85 - 99

On a cross-tabulation analysis by band on the above basis we have reason to reject the Null Hypothesis that there is no difference between them as the results indicate a significance level below 0.05 of .0000 with a high Chi-Square of 950.2161 suggesting that the band means are not fluctuating around a common mean.

Cross-Tabulation:

COGABILS By BAND	Test One the Cognitive Abilities Test. The ability band of four.				
Column	69	91	128	34	322
Total	21.4	28.3	39.8	10.6	100

Chi-Square	DF	Significance	Min EF	Cells with EF<5
950.21614	177	.0000	.106	235 of 240 (97.9%)

Statistic	Symmetric	COGABILS Dependent	BAND Dependent
Lambda	.44266	.09571	.98454
Uncertainty Coefficient	.49154	.32820	.97860
Somers' D	.83545	.99513	.71993
Eta		.94798	.99538

Statistic	Value	Significance
Cramer's V	.99180	
Contingency Coefficient	.86423	
Kendall's Tau B	.84642	.0000
Kendall's Tau C	.93548	.0000
Pearson's R	.94741	.0000
Gamma	.99567	

Number of missing observations = 0

In answer to the question: does the Cognitive Abilities Test (Test 1) indicate any difference by gender? With some confidence we can state that as the results are **not** near significance level on the cross-tabulation so we accept the Null Hypothesis. We also note that Kendall's Tau (Band C) indicates some concordance 0.84 and 0.93 with a high significance level of 0.0000.

Cross-Tabulation:

COGABILS	Test One the Cognitive Abilities Test.
By SEX	The sex of the subject

	Female	Male	Total
Column Total	160 49.7	162 50.3	322 100

Chi-Square	DF	Significance	Min EF	Cells with EF<5
52.71016	59	.7051	.497	109 of 120 (90.8%)

Statistic	Symmetric	COGABILS Dependent	SEX Dependent
Lambda	.10151	.00000	.29375
Uncertainty Coefficient	.04382	.02585	.14361
Somers' D	-.04199	-.6192	-.03177
Eta		.04429	.40459

Statistic	Value	Significance
Cramer's V	.40459	
Contingency Coefficient	.37506	
Kendall's Tau B	-.04435	.1682
Kendall's Tau C	-.06192	.1682
Pearson's R	-.04429	.2142
Gamma	-.06336	

ANALYSIS OF VARIANCE DESIGN

EFFECT .. SEX

Multivariate Tests of Significance (S = 1, M = 0, N = 157)

Test Name	Value	Approx F	Hypoth DF	Error DF	Sig of F
Pillais	.01065	1.70606	2.00	317.00	.183
Hotellings	.01076	1.70606	2.00	317.00	.183
Wilks	.98935	1.70606	2.00	317.00	.183
Roys	.01065				

Univariate F-Tests with (1.318) DF

Variable	Hypoth SS	Error SS	Hypoth MS	Error MS	F	Sig of F
COGABILS	682.37	64390.22	682.37	202.48	3.37	.067
FIGREAS	66.69	28179.83	66.69	88.62	.75261	.386

In the T-Test to look at differences between means by gender for the variables of the Cognitive Abilities Test and the second test the Figure Reasoning indicated strongly that there was no difference.

T-Test/Groups Sex (0,1)/Variables COGABILS FIGREAS

Independent samples of SEX The sex of the subject

Group 1: SEX EQ 0 Group 2: SEX EQ 1

T-Test for: COGABILS Test One the Cognitive Abilities Test

	Number Cases	Mean	Standard Deviation	Standard Error
Group 1	160	113.2063	13.755	1.087
Group 2	162	111.9074	15.565	1.223

Pooled Variance Estimate

F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.28	.119	.79	320	.428

Separate Variance Estimate

t Value	Degrees of Freedom	2-Tail Prob.
.79	316.13	.428

In comparing the experimental with the Control Group by Cross-Tabulation on the initial test (Cognitive Abilities) we find that we cannot reject the Null Hypothesis, therefore we can conclude, with a high degree of overall certainty that the Control and Experimental Groups at the start were similar in their results on these tests.

Cross-Tabulation:

COGABILS By EXPCON	Test One the Cognitive Abilities Test. The Experimental or Control Group.			
EXPCON	**Count**	**0**	**1**	**Row Total**
	Column Total	75 23.3	247 76.7	322 100

Chi-Square	**DF**	**Significance**	**Min. E.F.**	**Cells with EF<5**
71.41586	59	.1289	.233	102 of 120 (85%)

Statistic	**Symmetric**	**COGABILS Dependent**	**EXPCON Dependent**
Lambda	.02646	.00330	.12000
Uncertainty Coefficient	.05947	.03393	.24067
Somers' D	-.16936	-.31563	-.11573
Eta		.23778	.47094

Statistic	**Value**	**Significance**
Cramer's V	.47094	
Contingency Coefficient	.42606	
Kendall's Tau B	-.19112	.0000
Kendall's Tau C	-.22557	.0000
Pearson's R	-.23778	.0000
Gamma	-.32281	

Number of Missing Observations = 0

On the Analysis of Variance Tests in comparing the two tests of the Experimental Design by the Control and Experimental Groups we can conclude with a high degree of certainty - The Multivariate Tests of Significance were at the absolute 0.000. The Univariate F-Tests were 0.000 and 0.004 respectively. Our conclusions are **there is a difference between the two tests and the Experimental and Control Groups.**

Analysis of Variance - Design 1

Effect - EXPCON

Multivariate Test of Significance (S = 1, M = 0, N = 157)

Test Name	Value	Approx F	Hypoth DF	Error DF	Sig of F
Pillais	.06051	10.20813	2.00	317.00	.000
Hotellings	.06440	10.20813	2.00	317.00	.000
Wilks	.93949	10.20813	2.00	317.00	.000
Roys	.06051				

Univariate F-Tests with (1.318) DF

Variable	Hypoth SS	Error SS	Hypoth MS	Error MS	F	Sig of F
COGABILS	4124.69	64390.22	4124.69	202.48	20.37	.000
FIGREAS	728.47	28179.82	728.47	88.62	8.22	.004

In looking at the Experimental and Control Groups by the T-Test we note that the **means** of the groups on the Cognitive Abilities Test indicate that the Control Group had a score of 8.25 points higher, reflecting higher non-verbal ability.

T-Test/Groups EXPCON (0,1)/Variables COGABILS FIGREAS

Independent samples of EXPCON The Experimental or Control Group

Group 1: EXPCON EQ 0 Group 2: EXPCON EQ 1

T-Test for: COGABILS Test One the Cognitive Abilities Test

	Number Cases	Mean	Standard Deviation	Standard Error
Group 1	75	118.8800	13.378	1.545
Group 2	247	110.6316	14.549	.926

Pooled Variance Estimate

F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.18	.398	4.38	320	.000

Separate Variance Estimate

t Value	Degrees of Freedom	2-Tail Prob.
4.58	131.59	.000

Importantly we note on the same Analysis that the Second test Daniel's Figure Reasoning indicated that the Control Group although still scoring higher than the Experimental Group had fallen in their mean score. The difference in the score was only 3.54 points. The difference achieved by the treatment on the Experimental Group was therefore in the order of 4.71 points. That is 8.25 - 3.54 which equals 4.71. Given the short nature of the treatment, with its relatively poor reflection of the work of Feuerstein and the use of only part of the first introductory Module of the Somerset Thinking Skills Course taken together with the relative lack of staff training, this is a **highly impressive result**.

Independent samples of EXPCON The Experimental or Control Group

Group 1: EXPCON EQ 0 Group 2: EXPCON EQ 1

T-Test for: FIGREAS Test Two

	Number Cases	Mean	Standard Deviation	Standard Error
Group 1	75	116.4800	8.878	1.025
Group 2	247	112.9595	9.550	.608

Pooled Variance Estimate

F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.16	.464	2.84	320	.005

Separate Variance Estimate

t Value	Degrees of Freedom	2-Tail Prob.
2.95	130.29	.004

In using the Cross-Tabulation analysis of teaching groups which were described as mixed ability or all ability groups within the school population, we find high significance of 0.0075 with a high Chi-Square of 865.48591 (cf. following table) which enable us to reject the Null Hypothesis with some certainty and therefore conclude that the ability levels of the groups on the initial Cognitive Abilities test, were very different. That is, there is little commonality of means.

Cross-Tabulation:

COGABILS Test One the Cognitive Abilities Test.

By TEACHGP The group in which taught.

Chi-Square	DF	Significance	Min EF	Cells with EF<5
865.48591	767	.0075	.003	840 of 840 (100%)

Statistic	Symmetric	COGABILS Dependent	TEACHGP Dependent
Lambda	.15061	.06601	.246727
Uncertainty Coefficient	.32925	.27194	.41718
Somers' D	.11030	.11417	.10668
Eta		.36625	.50815

Statistic	Value	Significance
Cramer's V	.45471	
Contingency Coefficient	.85372	
Kendall's Tau B	.11036	.0025
Kendall's Tau C	.11197	.0025
Pearson's R	.22035	.0000
Gamma	.11668	

Number of Missing Observations = 0

The Paired T-Test on the Cognitive Abilities and the Daniel's Figure Reasoning indicated that the means of the scores were approximately the same 12.5528/113.7795. That is, the difference is only 1.3 points. The first test having a larger spread (standard deviation of 14.7 against 9.5) and a slightly larger standard error of 0.8, that is 0.3 larger (as in the following table).

T-Test/Pairs COGABILS FIGREAS

Paired Samples T-Test:

COGABILS Test One The Cognitive Abilities Test

FIGREAS Test Two

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
COGABILS	322	112.5528	14.685	.818
FIGREAS	322	113.7795	9.502	.530

Mean (Difference)	Standard Deviation	Standard Error	2-Tail Corr Prob	t Value	Degrees Freedom	2-Tail Prob.
-1.2267	11.918	.664	.587 .000	-1.85	321	.066

Using the Paired T-Test to compare the means of the Cognitive Abilities and Daniel's Figure Reasoning for the **Experimental Group** we are able to reject the Null Hypothesis with a high degree of confidence, as the Two Tailed Probabilities are 0.000 and 0.003. The difference of the means being + 2.33.

Paired Samples T-Test:

COGABILS Test One The Cognitive Abilities Test

FIGREAS Test Two

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
FIGREAS	247	112.9595	9.550	.608
COGABILS	247	110.6316	14.549	.926

Mean difference	Standard Deviation	Standard Error	2-Tail Corr Prob	t Value	Degrees Freedom	2-Tail Prob.
+2.379	12.093	.769	.564 .000	–3.03	246	.003

In the **Control Group** however we see **a fall** in the mean IQ of 2.4 as measured in Test 1 and 2. We have less confidence in setting this in our results as the Two-Tailed Probability are 0.000 and **0.054**. We can speculate in several areas, for the reasons to account for this suspected fall. It may be that the motivation of the Control Group in this second test was **not** as high, as in the first novel experience. The students had been encouraged to understand the real contribution they were making to the project. This was **not** shared with the Experimental Group to attempt to avoid any Hawthorne Effect. We also suspect that in a stressful situation with type of testing, unfamiliar in the school context; some students may not make that final effort during the second test that could account for this fall in scores.

Paired Samples T-Test:

COGABILS Test One The Cognitive Abilities Test

FIGREAS Test Two

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
COGABILS	75	118.8800	13.378	1.545
FIGREAS	75	116.4800	8.878	1.025

Mean Difference	Standard Deviation	Standard Error	2-Tail Corr Prob	t Value	Degrees Freedom	2-Tail Prob.
-2.4000	10.611	1.225	.611 .000	1.96	74	.054

In addition the Analysis of Variance, Tests of Between Subjects Effects using the Unique Sum of Squares indicates very highly that there was a difference between the Experimental and Control Groups. Tests involving the 'Improve'; that is, the difference defined inside the MANOVA and designated for this purpose only, as 'Improve'.

The Within-Subject Effect suggest there was an improvement (Significance of F is 0.002). Further the 'improvement' looked at by gender indicated (Significance of F is 0.023) that the males improved more.

Analysis of Variance - Design 1

Tests of Between - Subjects Effects.

Tests of Significance for T1 using UNIQUE sums of squares.

Sources of Variation	SS	DF	MS	F	Sig of F
Within Cells	70780.77	318	22.58		
Constant	6045194.03		6045194.00	27159.52	.000
EXPCON	4159.99		4159.99	18.69	.000
SEX	587.86		587.86	2.64	.105
EXPCON by SEX	378.95		378.95	1.70	.193

Tests Involving 'IMPROVE' Within - Subject Effect
Tests of Significance for T2 using UNIQUE SUMS OF SQUARES.

Source of Variation	SS	DF	MS	F	Sig of F
Within Cells	21789.28	318	68.52		
IMPROVE	2.18		2.18	.03	.859
EXPCON by IMPROVE	693.17		693.17	10.12	.002
SEX by IMPROVE	161.20		161.20	2.35	.126
EXPCON by SEX by IMPROVE	355.49		355.49	5.19	.023

7.2 Conclusions

We can therefore conservatively conclude that the bands were initially different, that both the Experimental and Control Groups were from the same population. Any differences by gender were not statistically significant at the 0.05 level on either the Cross-Tabulation and the Analysis of Variance. The T-Test indicated strongly that there was **no gender difference** in either Test 1 or 2.

The Analysis of Variance indicated, with a high degree of confidence, that there was a difference between the Test 1 and 2. The experimental treatment had an effect. This was confirmed by the T-Test in the Experimental and Control Groups, despite the limited nature of the treatment. The limits of time, resources and staff expertise were most obvious. The achievement within an eight week course, of which approximately six to seven hours was the time spent on an introductory course material, the other time being concerned with the necessary testing. These results are interesting enough to merit further enquiry.

The Cross-Tabulation indicated the differing ability levels of the teaching groups. We noted that the means of the two tests were close. The Paired T-Test strongly indicated that the mean IQ of the Experimental Group had increased whereas the Control Group had fallen. We can only guess at motivational reasons for this unexpected fall, despite a design feature against this in the experiment. Further Analysis of Variance confirmed that there was a difference by gender and that males seem to have improved more.

The question now facing us seemed to be -' is this sufficient evidence to establish the innovation, in general terms, in the context of the school in which it was carried out?' We considered that we had a sufficient case to claim to be making some

improvement. However we could not assume that any change in the discreet teaching groups of the course classrooms would or could be transferred to the everyday learning environment. We had no convenient performance indicators such as GCSE results after Adey and Shayer (1991) to enable us to quantify the thinking skills variables among all the other suspected influences on students and their learning. However we were able to develop a range of **Qualitative Measures.**

7.3 Discussion of Qualitative Results

Learning Profile Comments at the Time of the Course.

1. Comments seem to fall into five main areas clustering around what could be considered the five main concepts in the first part of the introductory module of the course.

   Not all fitted exactly into this format but a very high number did. Interpretation by the context and the additional General Comment helped allocate ambiguous comments, especially if they were not obviously positive or negative.

   Students had developed some sophistication in both formative and summative profiles as the innovation were established within the school. A senior person of the Assessment Committee suggests that

   > " ... the innovation was well established within the school, as we had always taken a whole school approach and was our interpretation of what the Law required. The problems, however, lay in the administration and the cost of our systems."

2. The sample of 100 was not completely random as it was not drawn from the entire group as a small number of the returns were not offered at the time. However, the sample of 50 males and 50 females were thought not to exclude any group or section of the students.

3. There were 282 comments out of a possible 465 giving a 60.65% figure, is high suggesting that the five main areas were a positive help. Giving a 60.65% figure, which is high. Readers will note that not all students

commented on all aspects. Such comments as

"I have enjoyed this bit of work and understood it well."

or

"I enjoyed this topic, because it was interesting. I learnt about metacognition."

were classed as helpful. Whereas,

"I have quite enjoyed it but found it a just a little hard to understand."

This was classed as a problem comment.

4. 91 or 19.57% reported that work or idea gave them a problem. This did not logically preclude them from the HELPED category in reality. It includes indications that the respondent struggled with some aspect of the work - it may have helped in learning.

"I enjoyed this bit of work, but didn't really understand it very well."

Together with the following was classified as a problem.

"I didn't like this one so I tried my best to pay attention."

"I'm not good at comparing."

5. Over all the categories, the same amount (91 statements 19.78%) felt that some aspect of the work was of little help or they stated that they were already familiar with the concept. In the writer's view this is a particular problem with such a course and indeed, may be of the metacognition theory as a whole. As we seek to facilitate the students making often familiar mental processes explicit and more considered, we may well expect students to dismiss valuable ideas to their learning as of little value, because of this

familiarity. So, classified as little help were the following comments.

"I found it easy, but because I didn't learn anything it was a bit boring".

"I don't think I do this much. Though I probably do without knowing it."

6. If we take those comments, which reported little help with those comments that indicated a problem, we have the surprisingly low figure of 183 or 36.35%. Of these 36 or 7.74% suggested that the work/idea was inappropriately "easy".

7. Of the 465 comments approximately 50% for each gender, 36 more males suggested they were helped than females. It is difficult to assess the reason for this as it could be a reflection of the interpretative analysis.

8. Of the five categories the order of magnitude of comments was INSTRUCTIONS (123) followed by ANALYSING and SYNTHESISING (91) by contrast the order of HELPED category was COMPARING (66), CLEAR MENTAL LABEL (63) and ALTERNATIVES (62) were 12 points at least ahead of INSTRUCTIONS and ANALYSING and SYNTHESISING (48 and 43). Instructions seem to be criticised as very easy, whereas Analysing and Synthesising seems to have caused a difficulty. This is confirmed by the reported experience of some staff. The implications for the teaching process are to stress the latter by examples and learning experiences and perhaps lead into the whole area with the Instructions concepts.

9. All the above comments were made in the context of achievement, which the writer has attempted to quantify. Please consult the Graphs that show a high

degree of success being reported with least achievement being in the Analysing/Synthesising area. However, even this area had an overall 264 in weighted scores. This was a high percentage of 44% of the total possible score.

(The weighted score is simply the achievement shaded area on the profile scored from the least - one to six, the highest multiplied by the number of times selected.)

What the project found difficult to do for such a limited input was to comment on transfer and generalisation of the learning into other areas of heuristic problem solving at this time. Therefore students who had experienced the first pilot stages of the action research aspects of the project were asked to indicate the level of transfer they had experienced one year (plus) after the course.

Figure 4.

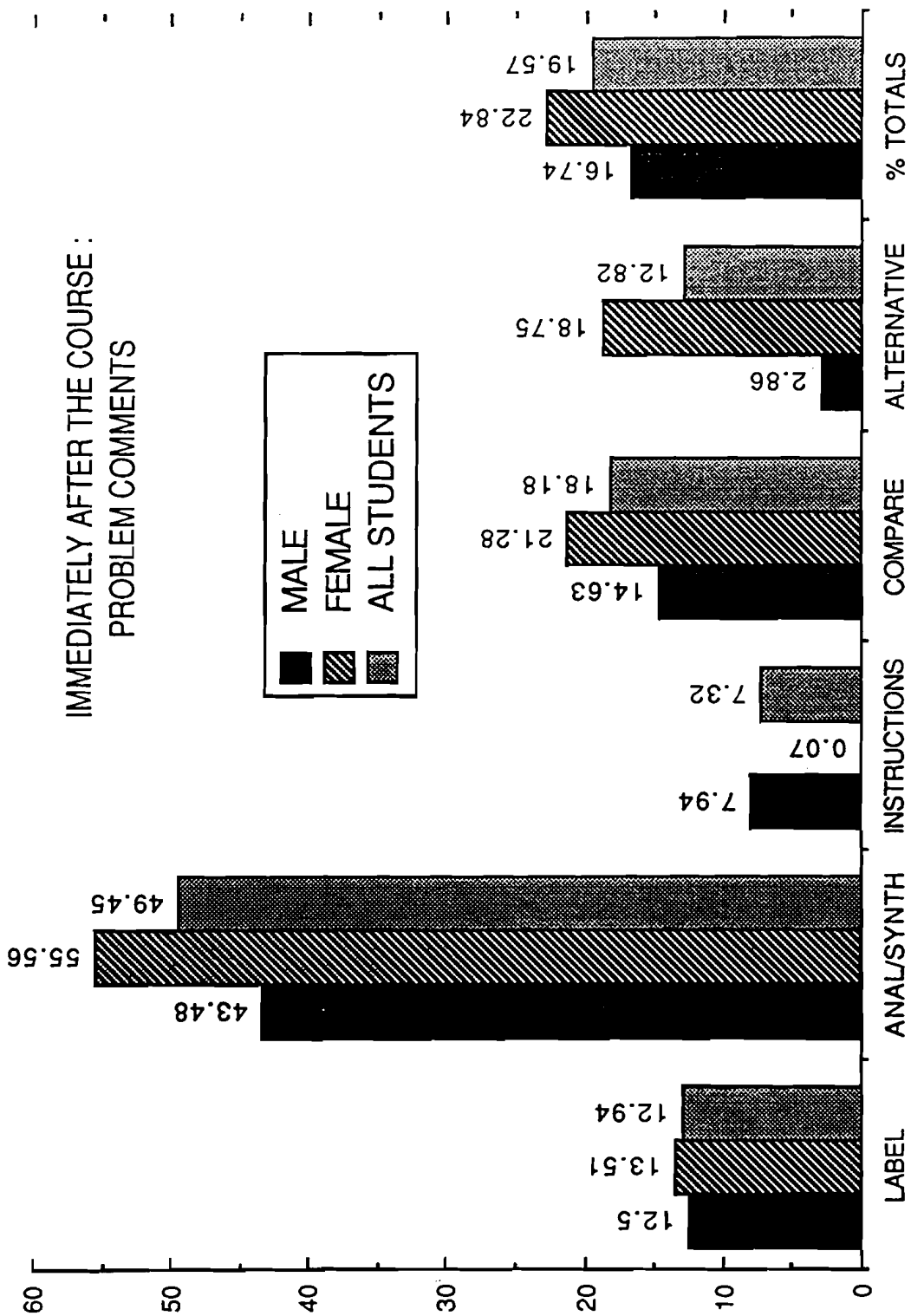
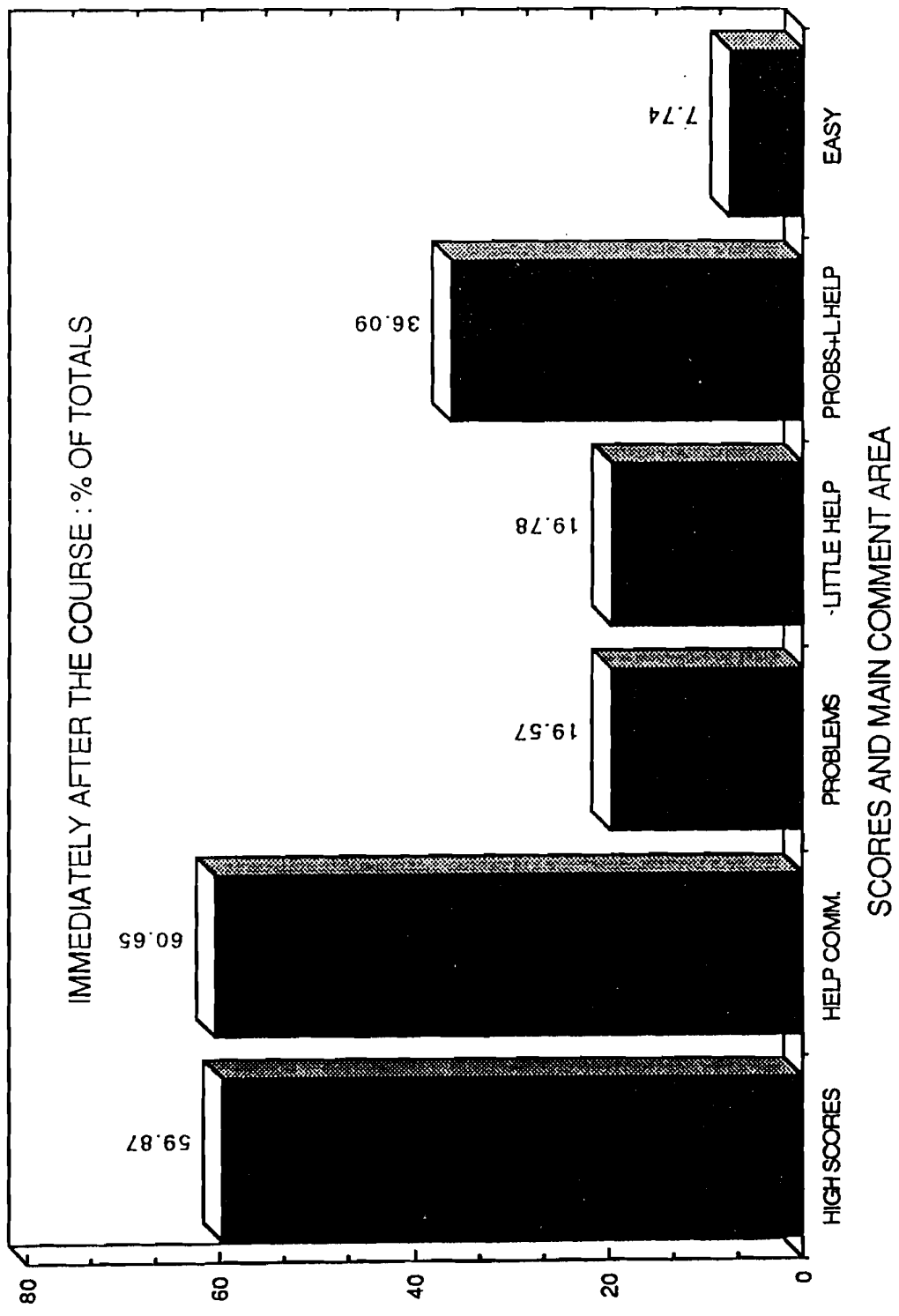

IMMEDIATELY AFTER THE COURSE :
PROBLEM COMMENTS
MALE
FEMALE
ALL STUDENTS
0
10
20
30
40
50
60
LABEL
ANAL/SYNTH
INSTRUCTIONS
COMPARE
ALTERNATIVE
% TOTALS
12.5
13.51
12.94
43.48
55.56
49.45
7.94
0.07
7.32
14.63
21.28
18.18
2.86
18.75
12.82
16.74
22.84
19.57

Figure 5.


IMMEDIATELY AFTER THE COURSE : % OF TOTALS
80
60
40
20
0
59.87
60.65
19.57
19.78
36.09
7.74
HIGH SCORES
HELP COMM.
PROBLEMS
-LITTLE HELP
PROBS+L HELP
EASY
SCORES AND MAIN COMMENT AREA

IMMEDIATELY AFTER THE COURSE :
% OF ALL COMMENT TOTALS
80
60
40
20
0
70.04
53.02
60.65
16.74
22.84
19.57
14.98
24.14
19.78
31.72
46.98
36.35
MALE
FEMALE
ALL
PROBLEM
LITTLE/REP.
ALL DIFFICULT

Figure 6.

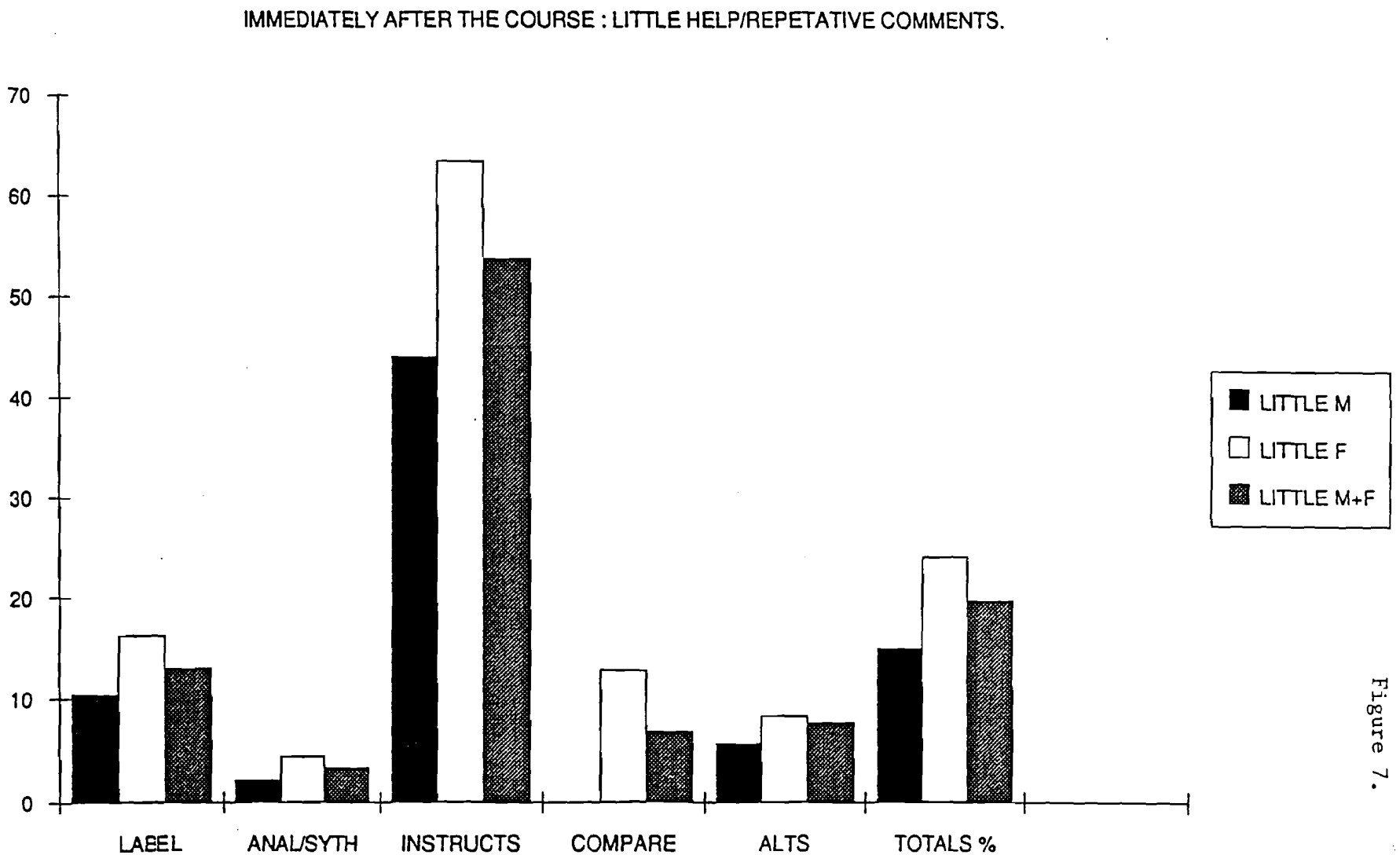

IMMEDIATELY AFTER THE COURSE : LITTLE HELP/REPETATIVE COMMENTS.
70
60
50
40
30
20
10
0
LABEL
ANAL/SYTH
INSTRUCTS
COMPARE
ALTS
TOTALS %
LITTLE M
LITTLE F
LITTLE M+F

Figure 7.

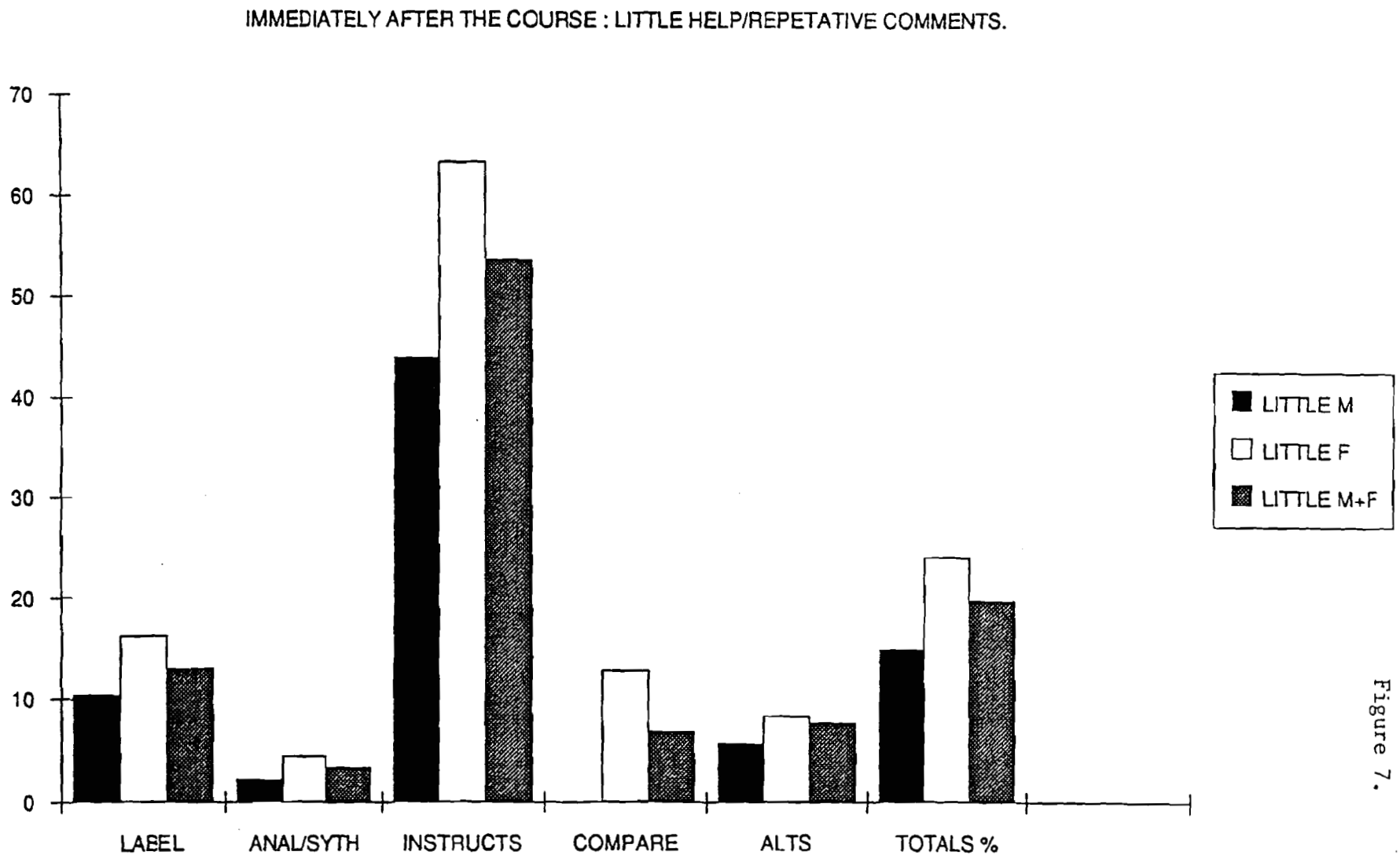
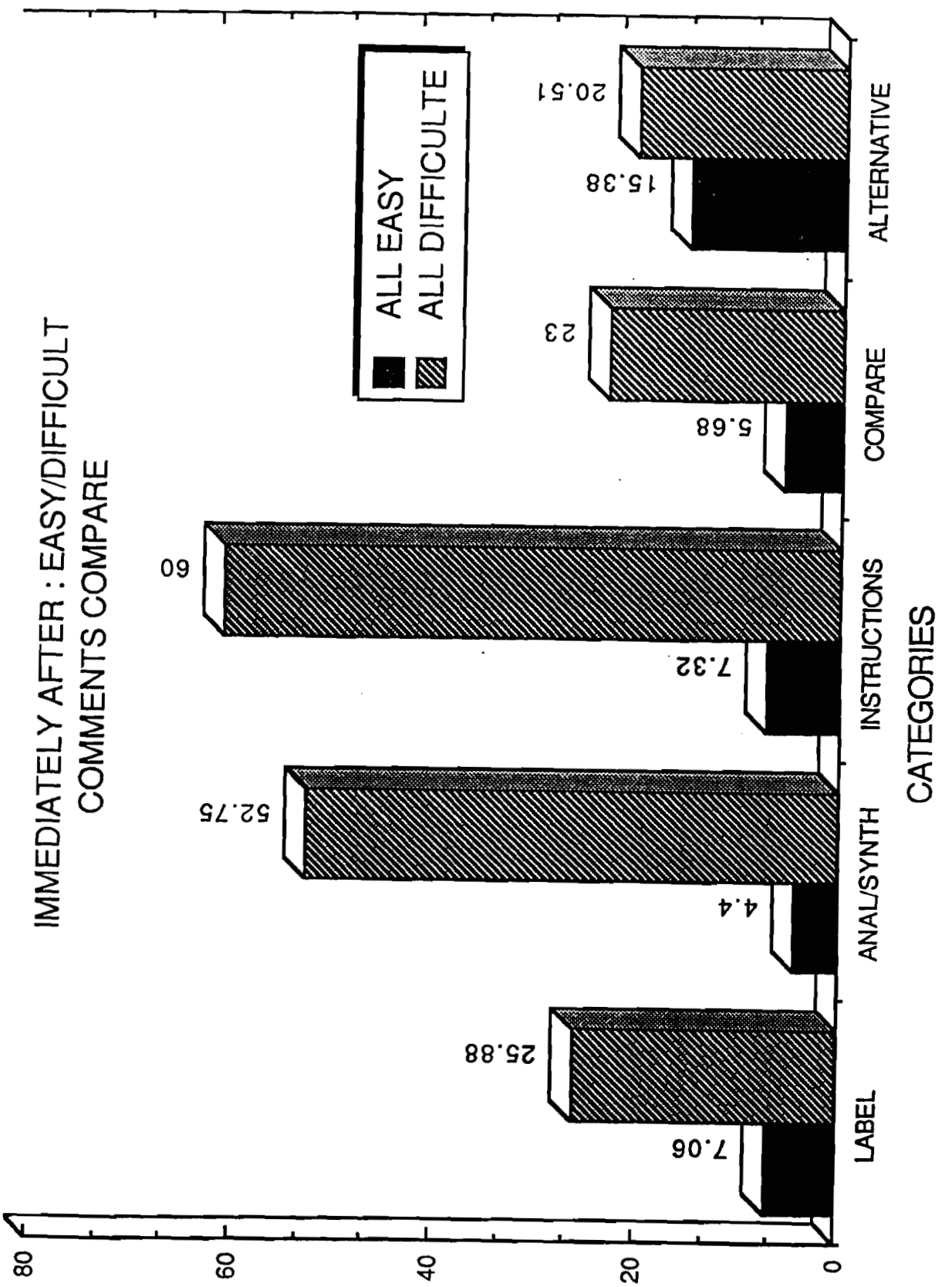

IMMEDIATELY AFTER THE COURSE : LITTLE HELP/REPETATIVE COMMENTS.
70
60
50
40
30
20
10
0
LABEL
ANAL/SYTH
INSTRUCTS
COMPARE
ALTS
TOTALS %
LITTLE M
LITTLE F
LITTLE M+F

Figure 7.

Figure 9.


IMMEDIATELY AFTER : EASY/DIFFICULT
COMMENTS COMPARE
ALL EASY
ALL DIFFICULTE
0
20
40
60
80
7.06
25.88
4.4
52.75
7.32
60
5.68
23
15.38
20.51
LABEL
ANAL/SYNTH
INSTRUCTIONS
COMPARE
ALTERNATIVE
CATEGORIES

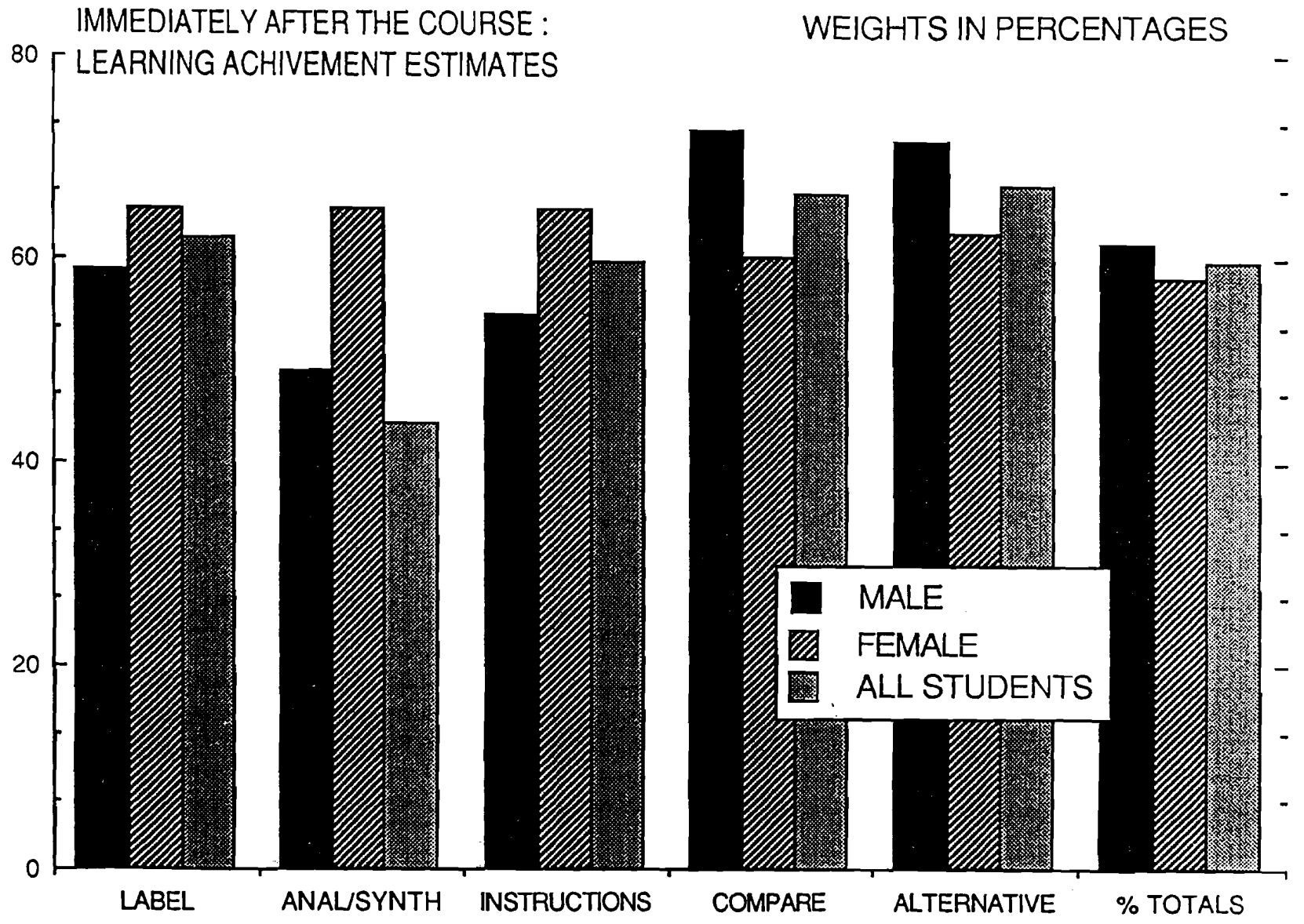

IMMEDIATELY AFTER THE COURSE :
LEARNING ACHIVEMENT ESTIMATES
WEIGHTS IN PERCENTAGES
80
60
40
20
0
MALE
FEMALE
ALL STUDENTS
LABEL
ANAL/SYNTH
INSTRUCTIONS
COMPARE
ALTERNATIVE
% TOTALS

Figure 1.

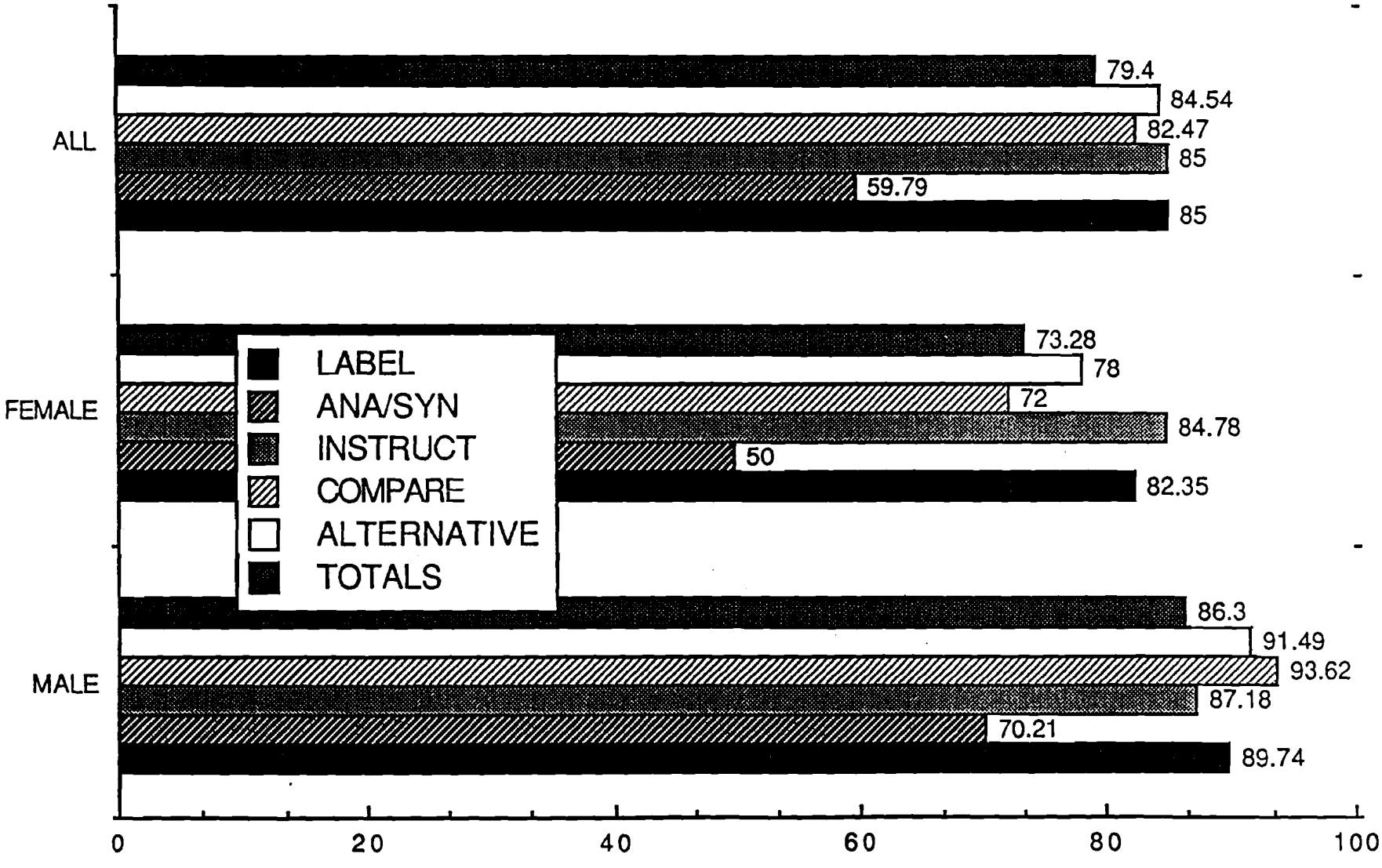

IMMEDIATELY AFTER THE COURSE : % OF 4-6 SCORES OF EACH CATEGEORY.
ALL
FEMALE
MALE
LABEL
ANA/SYN
INSTRUCT
COMPARE
ALTERNATIVE
TOTALS
79.4
84.54
82.47
85
59.79
85
73.28
78
72
84.78
50
82.35
86.3
91.49
93.62
87.18
70.21
89.74
0
20
40
60
80
100

Figure 11.

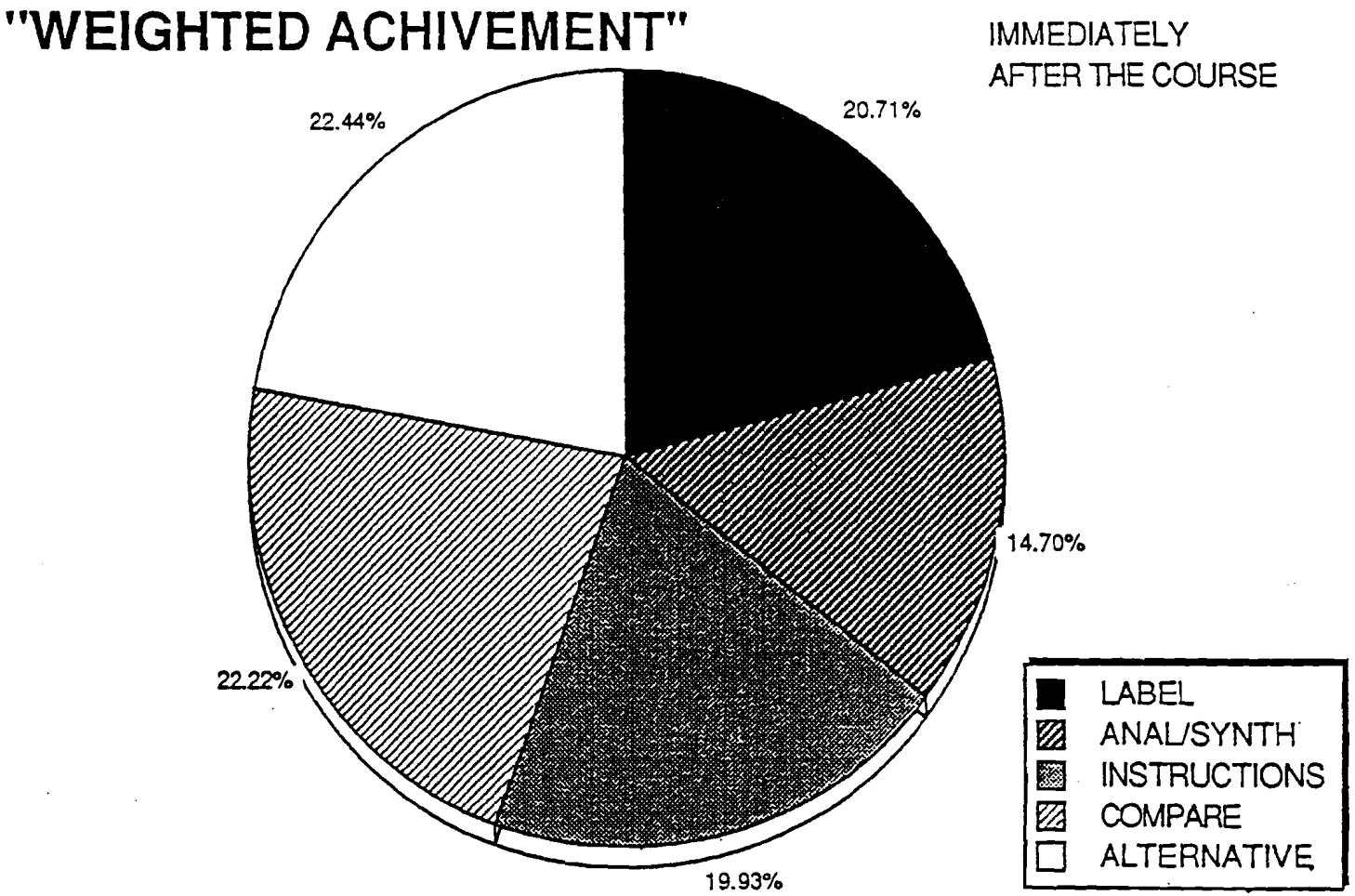

"WEIGHTED ACHIVEMENT"
IMMEDIATELY
AFTER THE COURSE
20.71%
14.70%
19.93%
22.22%
22.44%
LABEL
ANAL/SYNTH
INSTRUCTIONS
COMPARE
ALTERNATIVE

Figure 12.

7.4 Learning Profile Format Reports - One Year Plus, After the Course

A sample of forty was taken after one year (plus) after completing the course. Twenty responses for each gender. Please consult data and graphs in the appendix.

1. To get some insight into the level of transfer and generalisation the students were asked to indicate by shading in an area from the lowest - one, to the highest - six. They had little guidance in which headings to use.

2. They tended to recall the course in terms of the five basic areas with an additional smaller area of 'scenes', which had ten comments. These these seemed to refer to the introductory first group activity on comparing the senses within the living room picture. So we had such comments as

   "I remember doing something about our six senses, plus an extra one."

3. The reported levels of transfer into use in their general problem solving were high, the highest being for INSTRUCTIONS. Both gender groups were well above 70%, with a combined percentage of 74.58%.

   This was the area reported straight after the event as rather easy and obvious. It was one of the two lower rated areas for achievement in learning - 40.33% rated their achievement in the lower categories.

   " ... using a computer programme."

   " ... understanding certain instructions."

4. The other lower rated area for achievement, Analysis/Synthesis, was 24% points **lower** than Instructions. The only other lower group of comments was

the small number of references to the senses. This was a more expected result as this had the lowest level of achievement of 44% of the weighted scores at the end of the course compared with 59% for Instructions referred to above. It also had the least number of Helpful comments (43%) with a high percentage of comments - 52.75% suggesting they had a problem or little was learned when indicating immediately at the end of the course. Such comments as

> "I didn't understand this much as the others but I think . . .[I] got the hang of it."

The comments on analysing and Synthesising one year plus after the course, such as

> " ... working out circuits in design and technology."

These did indicate an encouraging degree of specificity. However, there were some comments such as

> "Problem solving in maths."

> " ... sorting problems out."

These were perceived as general comments.

5. However, in the comments response area of the form, the Analysing/Synthesising responses were surprisingly high, both gender groups having some evidence in their comments of being able to apply the concept. The comments responses for Analysing/Synthesizing within the same approximate range as Instructions, Comparing and Alternatives only Label being 15 percentage points higher. Compare was slightly lower.

6. The Compare comments had a difference of about 25 percentage points between the genders. Why the female comments should be so much lower is difficult to speculate upon. However, as we are in an action research paradigm it will be an area to plan, to observe the results of the next experience, of course.

   The compare comments seemed to be more specific to the concept, we had such comments as

   "Matching my circuit diagram with someone else's."

   or

   "Identifying objects which are similar."

7. What is most marked in the results are the low figures in all the areas of students being UNABLE to apply or explain.

8. Several students were able to give for alternatives and possibilities the same example: choosing GCSE Options and other comments such as

   "My choice of subjects in line five."

   This led to the impression that they were conscious, after the course, of thinking about their thinking in a detailed way.

9. It is interesting to note that the scores for examples under CLEAR MENTAL LABEL did not include any shaded area in the second and third columns. That is, these indications by the students were not counted as positive or as transfer in our quantitative results. Although some had in the comment box

such positive comments as follows.

"Maths: making mental pictures of rotations."

This may perhaps lead us to suspect that there was more transfer than indicated by the weighted scores.

10. Most general comments were positive with a high number of

" ... when we did the thinking skills course, I didn't think it applied to me that much - but now realise that it applies to a lot of learning aspects, and think it has helped quite a lot."

However, we did have a small percentage of comments, such as

"Project can be interesting you can learn something from it. It's a little bit boring to do."

Such comments lead us into an action research paradigm to answer the improvement of learning types of questions, to eliminate some of the exercises, The pilot teaching staff "sensed" students felt some aspects were repetitive, so that the full study had a reduction in the repetition of some exercises. These were the ruler and pencil exercises in joining up dots and ends of lines and sections, which although useful, we felt in the limited time available, needed reducing in the light of our pilot experience.

11. Weighted Achievement Scores estimated at the time compared with the transfer indications we had one year plus after the course. The percentage complete totals for the achievement weighting was 60% approximately, against a transfer of 89%. A difference of 29% points. There was also major differences in the instructions scoring, labelling and analysing and synthesising. This was particularly marked as the achievement weight was only 44, the lowest of all the estimates, and yet the actual transfer, students

felt, was high at 85%. We offer these only as general indications of a trend because we are not comparing like with like. However, the writer was encourage to speculate within the aspect of analysing and Synthesising as it has been a problem area for students and staff all the way through the project that it could be that this aspect made more constructive sense in the light of the learning experience after the course, than during it.

The students were asked in the same context, one year plus after the course, to comment on cross curricular issues.

7.5 Comments on Cross Curricula Issues.

The students were asked to make some comment looking at the course related to cross-curricula issues with which they had been dealing under GCSE and National Curriculum influenced school concerns. The areas that they wanted to consider were deliberately left very wide and the comments looking at the data show a whole range of positive and negative comments.

To an extent these broad categories of positive and negative were more interpretative than our other categories as they did not fall neatly into the five made areas as our previous experience had been. The results were heavily skewed towards the positive side.

We also note that in comparing the genders, it seems that males tended to score lower in both areas than the female responses. It should be pointed out that not all students made responses and the amount of responses were able to be varied. Therefore, although we have a smaller sample, we were able to get some feeling for the enjoyment or success of the course.

One feature of thses comments was those made, usually positive, about the group work. The comments on transfer, which were few, although this was an emphasis of the course, were equally balanced between difficult and easy. The most difficult part of the course, that gave rise to the highest scores for difficulty was analysis and synthesis. This confirms the previous results.

The worst points reported for 'the test' were a result of staff seeking to answer the action research question 'How can we improve our teaching and learning in this

situation?' A greater emphasis on remembering the categories and meanings of the main parts of the Somerset Thinking Skills Course Introductory Module was made. This was a very short test and involved only rote memory. It related well, the staff felt, to the rest of the course, it was one means by which staff were searching for ways to enable students to feel familiar and confident with the very key aspects of a different type of course.

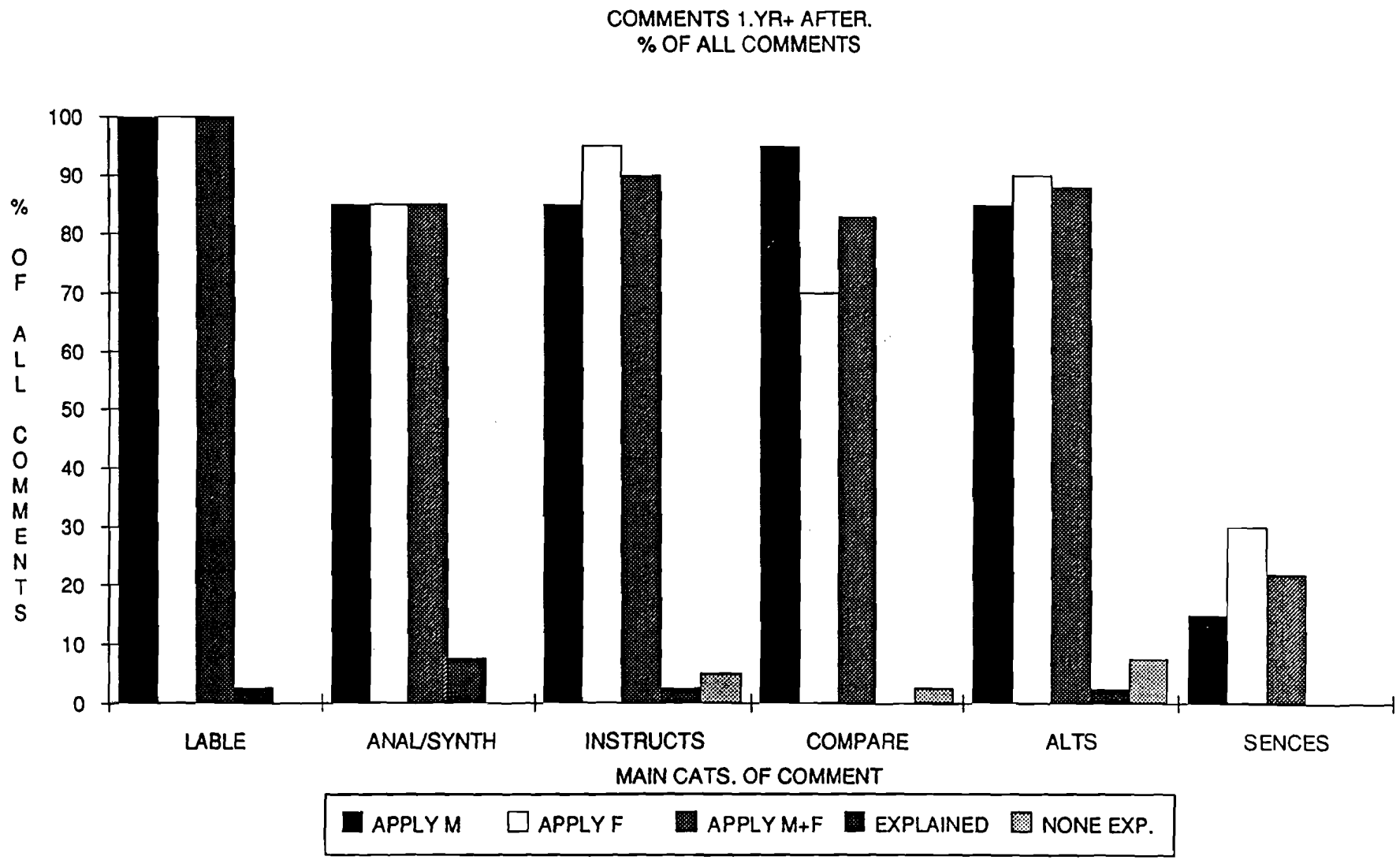

COMMENTS 1.YR+ AFTER.
% OF ALL COMMENTS
% OF ALL COMMENTS
100
90
80
70
60
50
40
30
20
10
0
LABLE
ANAL/SYNTH
INSTRUCTS
COMPARE
ALTS
SENCES
MAIN CATS. OF COMMENT
APPLY M
APPLY F
APPLY M+F
EXPLAINED
NONE EXP.

Figure 13.

Figure 14.

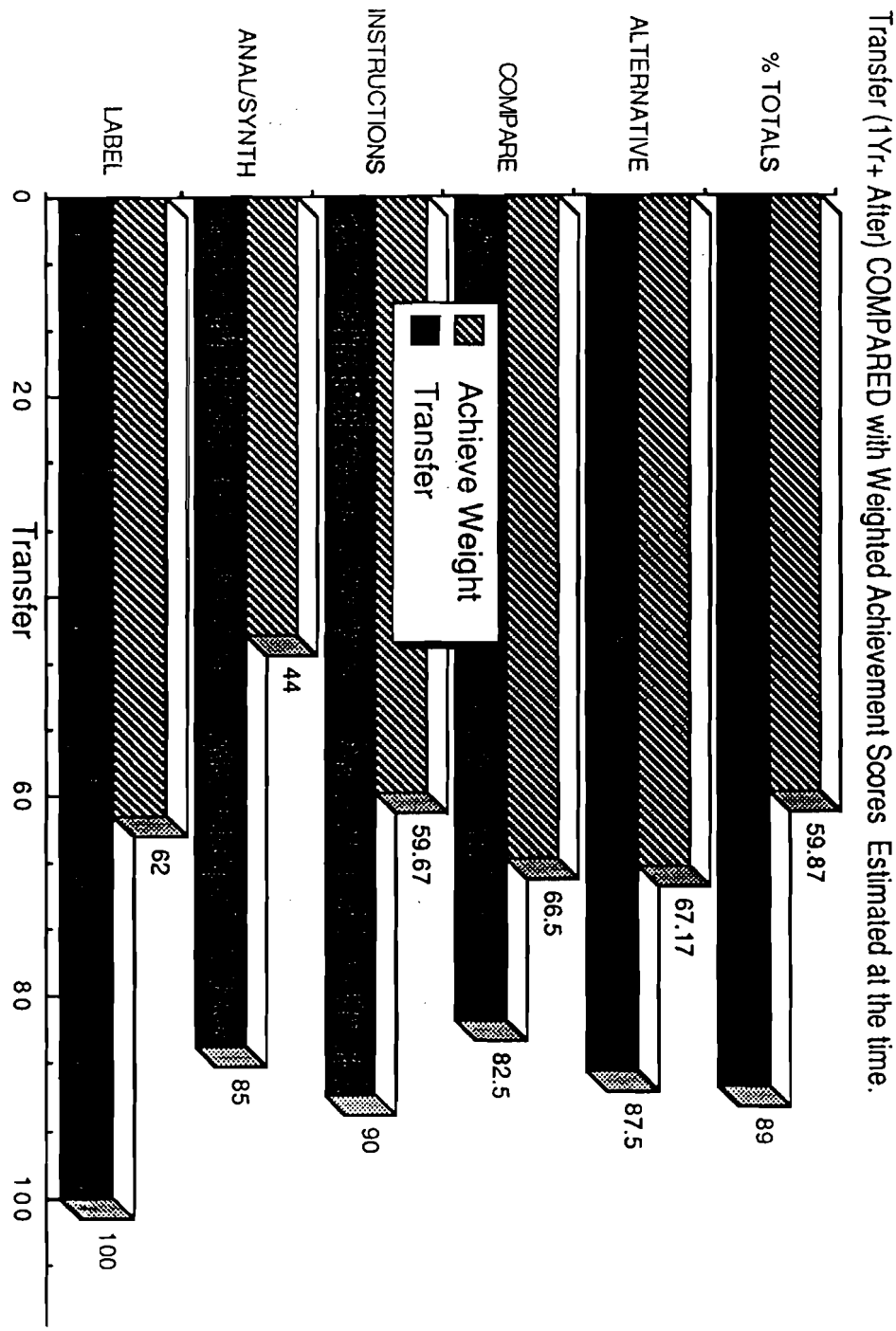
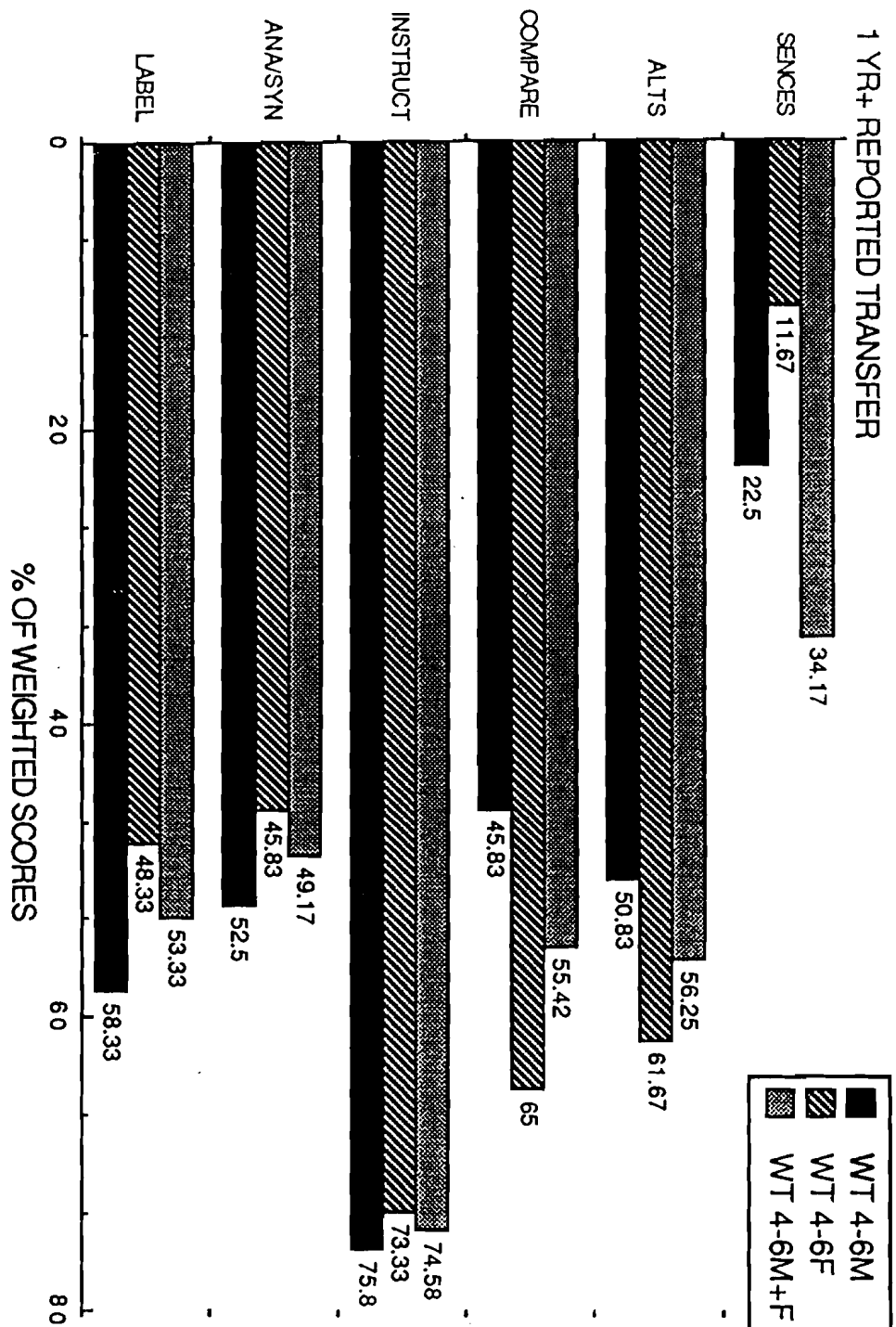

Transfer (1Yr+ After) COMPARED with Weighted Achievement Scores Estimated at the time.
% TOTALS
ALTERNATIVE
COMPARE
INSTRUCTIONS
ANALYSYNTH
LABEL
59.87
89
67.17
87.5
66.5
82.5
59.67
90
44
85
62
100
Achieve Weight
Transfer
0
20
60
80
100
Transfer

Figure 1


1 YR+ REPORTED TRANSFER
WT 4-6M
WT 4-6F
WT 4-6M+F
SENCES
11.67
22.5
34.17
ALTS
50.83
56.25
61.67
COMPARE
45.83
55.42
65
INSTRUCT
73.33
75.8
74.58
ANA/SYN
45.83
52.5
49.17
LABEL
48.33
58.33
53.33
0
20
40
60
80
% OF WEIGHTED SCORES

One Year and After the Course Figure 16

Comments: Asked to look at cross-curricular issues.

	Area of Comment	Female	%	Male	%	Total Comments	%
1.	Simple and Easy	5	4.67	7	9.33	11	6.04
2.	Different	4	3.74	6	8.00	10	5.49
3.	Difficult: Analysis/Synthesis	8	7.48	4	5.33	12	6.59
4.	Worst Points: Test	1	0.93	0	0	1	0.55
5.	Boring	2	1.87	2	2.67	4	2.20
6.	Own Examples: Trans in General - Difficult	4	3.74	1	1.33	5	2.75
7.	Own Examples: Trans in General - Easy	6	5.61	0	0	6	3.30
8	Good Effort Put In	10	9.35	0	0	10	5.49
9.	Enjoy	7	6.54	11	14.67	18	9.89
10.	Success	11	10.28	13	17.33	24	13.19
11.	Groups	33	30.84	18	24.00	52	28.57
12.	Metacognit on	7	6.54	7	9.33	14	7.69
13.	Better Than Anticipated	3	2.80	0	0	3	1.65
14.	Transfer	3	2.80	1	1.33	4	2.20
15.	Talk	3	2.80	0	0	3	1.65
16.	Listening	0	0	3	4.00	3	1.65
17.	Did Not Learn	0	0	2	2.67	2	1.10
		n = 107		n = 75		n = 182	

One Year and After the Course

Comments: Asked to look at cross-curricular issues.

Quotations

1. "I think that although I have never heard of metacognition, I think I have always used it, and knowing about it did not make a lot of difference."
2. "I have never done lessons quite like this. This module was different to any other lesson we have because of the things we did. "A bit weird" totally different."
3. "I found analysing pretty hard but the others were a lot easier."
4. "We also shouldn't have had tests, tests which I found exceedingly boring."
5. "Sometimes it got boring"
6. ("Metacognition - thinking about thinking - I think this helps when making decisions but not really anywhere else."
7. ("Most of the examples were easy to find except analysing and synthesising."
8. "In group work we get things done and manage to do my work. I feel I have made all the effort needed to gain the most of the work covered."
9. "I found the STSC quite easy and fun to do. The course has been interesting and fun to do I enjoyed it a lot."
10. "Attitude to others is okay as well. For learning I think I've been learning quite well and w uld give myself above 8/10 or maybe 7/10."
11. "I worked in groups fairly well, and the cooperation needed in the groups was there."
    "I can work with other people reasonably well but I don't like learning in bigger groups than 2 or 3."
12. "Metacognition is important." "You need metacognition in your work because you are thinking about thinking with your classwork and homework."
13. "Better than P.R.E. in my last school."
14. "These were quite hard." "It has been fairly difficult to find my own examples of the STSC until I was familiar with what I was doing."
15. ".. you different ideas of your own and when your in groups you combine everybody's ideas to form one."
16. "Most of the time I listened well ..... but sometimes I was distracted."
17. "I felt lazy".

Figure 16a.

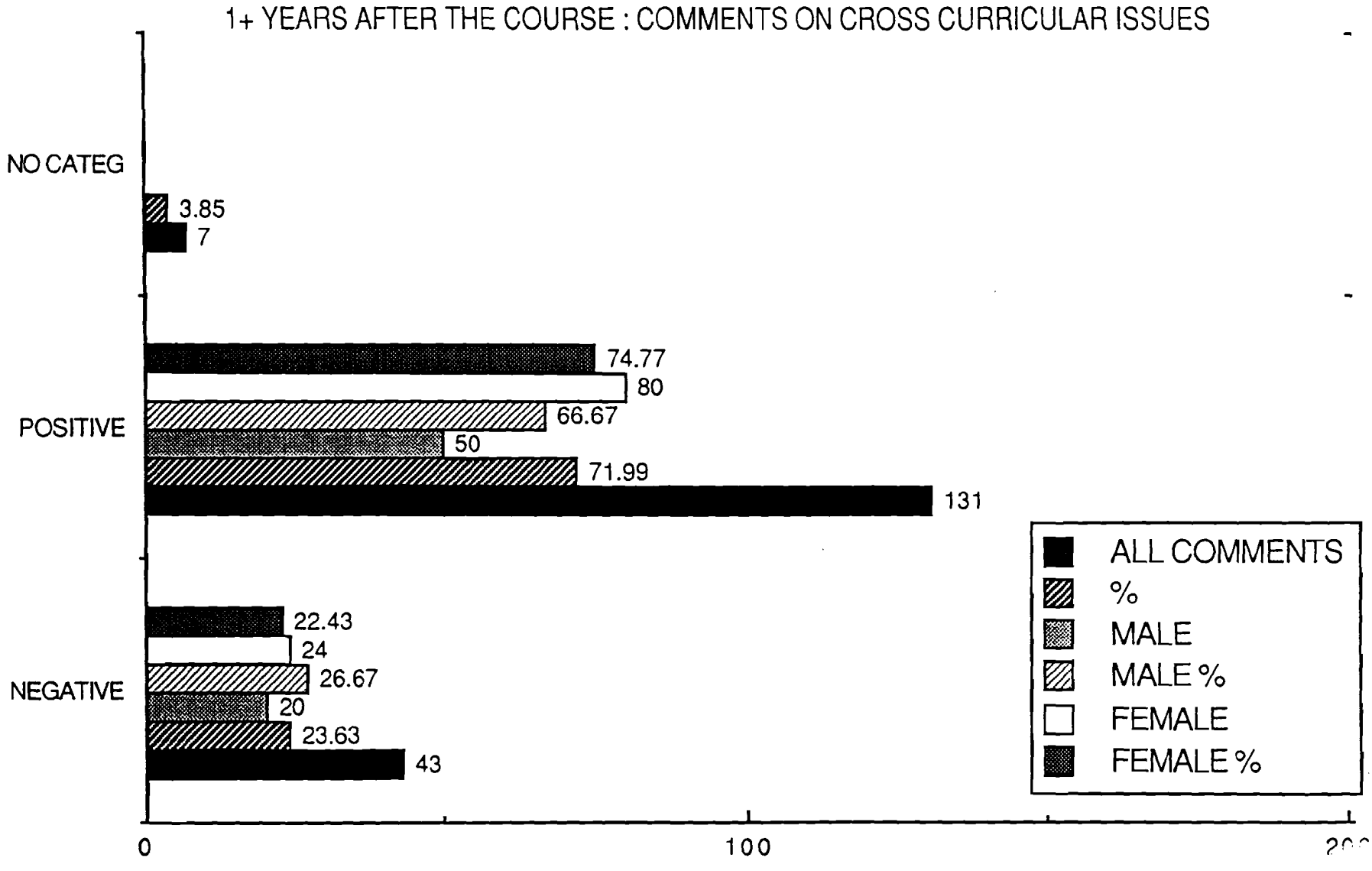

1+ YEARS AFTER THE COURSE : COMMENTS ON CROSS CURRICULAR ISSUES
NO CATEG
3.85
7
POSITIVE
74.77
80
66.67
50
71.99
131
NEGATIVE
22.43
24
26.67
20
23.63
43
ALL COMMENTS
%
MALE
MALE %
FEMALE
FEMALE %
0
100

Figure 17.

7.6 The Questionnaire: The Curriculum Area Comparisons

Given the comparison of the reports from the students, directly after the event, and the results of their estimations of learning one or more years after the course, we are left with a pertinent question. How can we relate this evidence to what is good or bad or make any estimation of the validity of this data?

We were not able to build in additional testing or evaluation techniques due, mainly to the pressure of time. The writer has referred previously to the high percentage of student time, this assessment/ evaluation involved within the course. In addition, the context was changing within which the learning took place. These changes included, staffing, time-tabling slots, the rooms and the formation of the teaching groups. Some of the students in the one year plus sample were taught in ability groups set against English or Mathematics, whereas others were within tutor groups as was the main sample in the study. This real world problem of research design was supported in our view by attempting to follow an action research paradigm.

It was decided to offer the reader a comparison by taking some of the results of a questionnaire, which was a review of the whole curriculum area. The students' reporting were year 11 students (16+ years). They had not however, experienced as year 9 students (13+ years) the innovation of the treatment (Somerset Thinking Skills Course). Given the reservations stressed above, we suggest that these results of a large sample of 166 students about 55% of that population, may give the reader a rough measure with which to make comparisons. Perhaps we could illustrate this as like a ruler in a photograph of an archaeological dig.

It helps the viewer make a size estimation. It is not a precise instrument but a reference point to help make a tentative comparison.

1. The module percentage of those who scored high scores in the questionnaire, this would be 3 and 4, have the highest scores around the 48.80% for the interest category and the helpful category was 46.99%. The former was for a module on Personal Relationships and the latter on the Wider World 1 module. The lowest percentage score was 24.70% on an interest category and 21.69% on the help category. Both are in the Wider World 3 module. This gives us a range of about 24% and 25% points respectively.

   Comparing the results immediately after the course (that is the Somerset Thinking Skills Course) with the Learning Profiles' high scores, these were 4 - 6 giving for all students a high of 85% for the Instruction Category and a low of 59.79% for Analysing/Synthesising. This gave a similar range of 25% points. The students were considering the level of achievement/learning. Although the range on both sets of scores were similar, the Somerset Thinking Skills results immediately after the course were of a much higher order than the percentage totals on the Questionnaire.

2. One year plus after the intervention of the independent variable, the data indicates a fall from the high of immediately after the course. If we compare the scores of the reported transfer, although the students are not now trying to quantify the level of achievement/learning but an application of this learning in their lives (Problem Solving) after the course. The highest score was 74.58% with a lowest score of 34.17% giving a range of over 40% points.

Much greater than the other scores recorded, although the high point was not quite as high as that of the reported score immediately after the course.

3. If we compare the weighted scores directly after the course/treatment with the transfer one year plus after, we can see a marked difference in totals, the percentage totals are 59.90% compared with the high percentage of 89% giving a difference of 29% points. These are, of course, of a much higher order than the yardstick of the Questionnaires.

4. If we look at the high scores of 3 and 4 on the Questionnaire two years after the course, we can note the relatively low profile. Interest percentages from 52.63% to 25%. Helpful percentages from 45.26% to 18.13% giving a range of 27% points between the Interest and Helpful Categories. Perhaps the graph comparison of sources following give some indication of the order of the differences.

5. In figure 19 that indicates the percentage of high scores two years, at least after the course modules in the same curriculum area. If we take the module with the highest scores (Personal Relationships 1) the percentages are, Males 25% for interest; 24% for Help. Females 31% for Interest; 27% for help. In figure 5 we get an overall score of 60% for high scores of 'Help' category. In figure 6, a more direct comparison. Looking at the percentage of helped comment. Males gave a 70% response, Females 53%; with a total figure of 60% approximately. These scores are higher than for those modules in the same curriculum area. They would have had the same rooms and times and some of the same teaching staff, who were experienced in their own modules and the curriculum area.

6. The above trend is confirmed if we compare figure 10 and 11, with figures 18, 19, 20 and 21. Although they are not direct comparisons they do confirm the trend. For example the percentage of high scores for the modules' two years after the courses on help and interest are as follows.

Module	Help %	Interest %
PR 1.	45	49
WW 1.	47	47
WW 2.	28	33
PR 2.	28	33
WW 3.	22	25

(from Appendix D2). This is out of a grade of 1 -4, a designation as high scores all 3 and 4 ratings.

The scores for the Teaching Group Comparisons show the same trend except the small group labelled group 76 were all the scores are high and look abnormal results.

We note the positive comments of the students, as compared with the responses of other students in reporting in the same curriculum area although not having experience of the STSC. This rough yardstick does indicate the robust nature of the intervention and the feeling of help, interest and success that had been initially indicated did persist two years after the course. It may encourage us to hope for transfer and generalisation. The criticism of this data would be around its design. Having gone for an unstructured and open approach to facilitate the students' real expression. It does however, leave a problem of analysis. Given the Action Research approach of changing the structure as in the light of the feedback this questionnaire would have benefited in our view of a more direct comparison of a similar questionnaire, of two years previously. As an alternative we need to wait

for a further two years to compare with another year group of students in a further Action Research cycle.

The writer suggests more use could have been made of the data in evaluation and research terms had there been more structure at the being of the data collection. If there is a lack is not in material but structure. A repeat design should cover these objectives more closely but without the complete loss of the undirected response. However with such data, we cannot create good designs at the start as we could with hindsight. We have established that there was an improvement in thinking, that there was some transfer and generalisation and this was appreciated by the participants at the time and up to two years later.

A different perspective is reported in the following section. The teaching staff fed back there experiences not through a questionnaire, but by informal discussions and a formal structured interview.

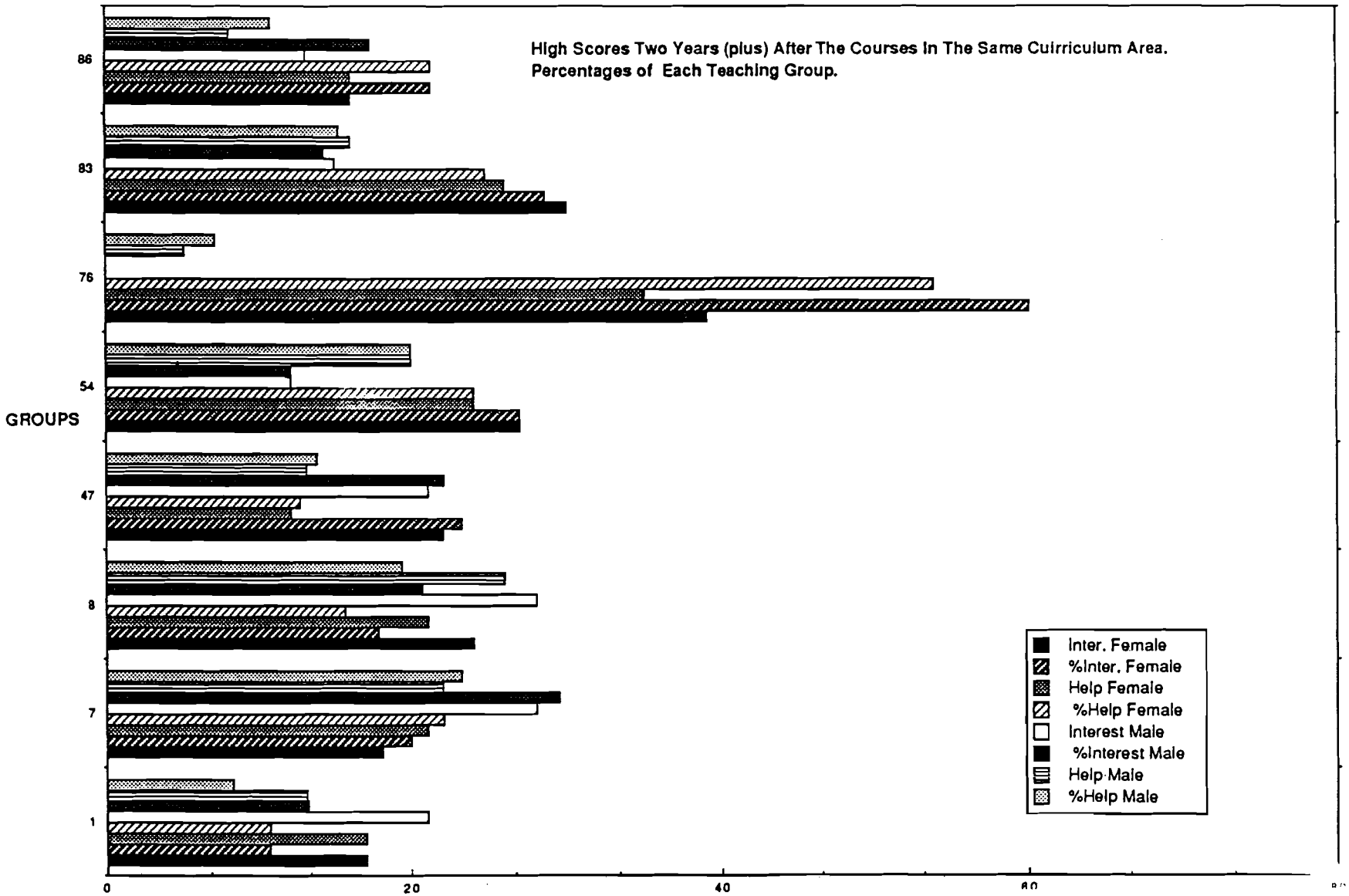
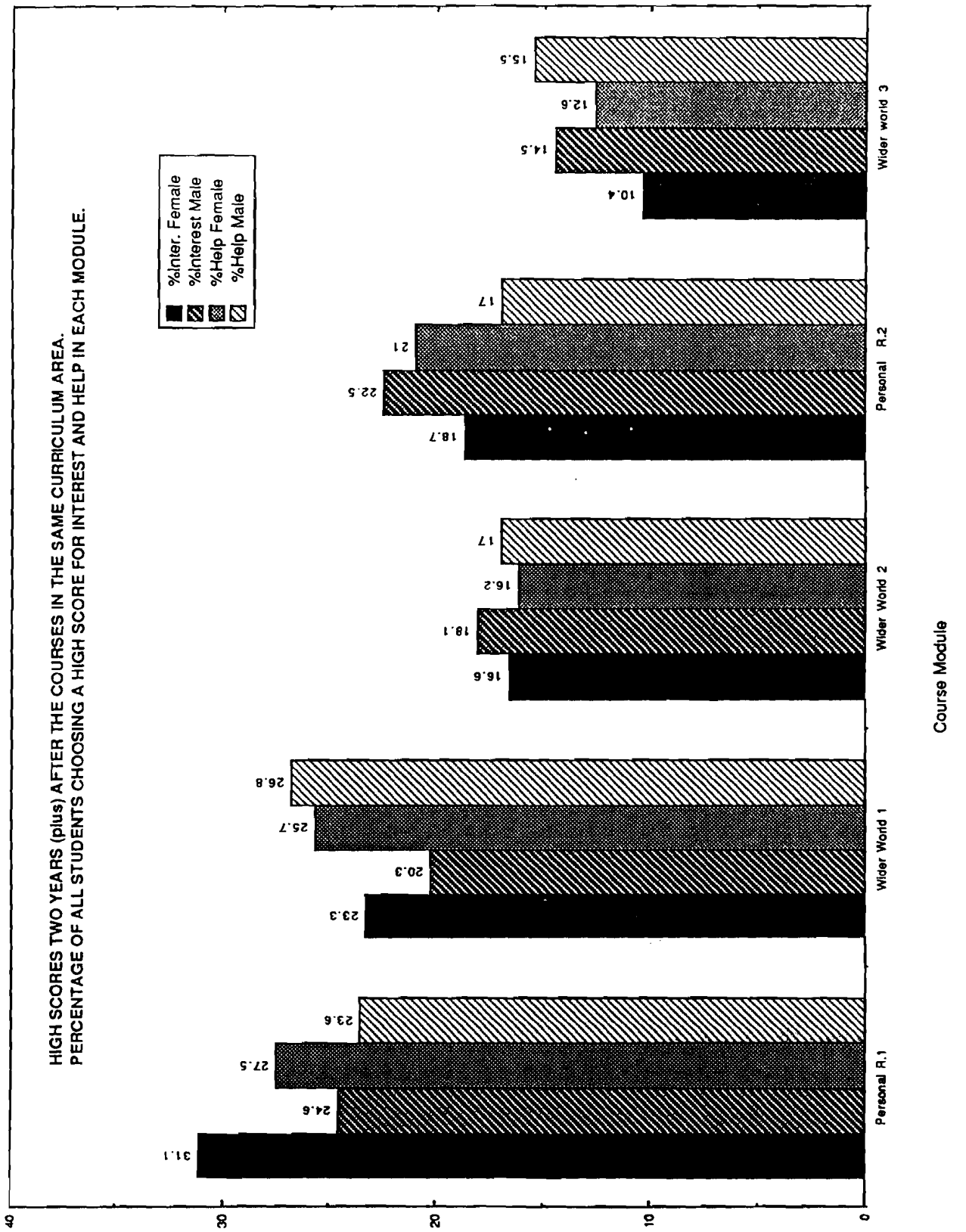

High Scores Two Years (plus) After The Courses In The Same Cuirriculum Area.
Percentages of Each Teaching Group.
GROUPS
86
83
76
54
47
8
7
1
0
20
40
Inter. Female
%Inter. Female
Help Female
%Help Female
Interest Male
%Interest Male
Help Male
%Help Male

Figure 18

Figure 19.


HIGH SCORES TWO YEARS (plus) AFTER THE COURSES IN THE SAME CURRICULUM AREA.
PERCENTAGE OF ALL STUDENTS CHOOSING A HIGH SCORE FOR INTEREST AND HELP IN EACH MODULE.
%Inter. Female
%Interest Male
%Help Female
%Help Male
40
30
20
10
0
31.1
24.6
27.5
23.6
23.3
20.3
25.7
26.8
16.6
18.1
16.2
17
18.7
22.5
21
17
10.4
14.5
12.6
15.5
Personal R.1
Wider World 1
Wider World 2
Personal R.2
Wider world 3
Course Module

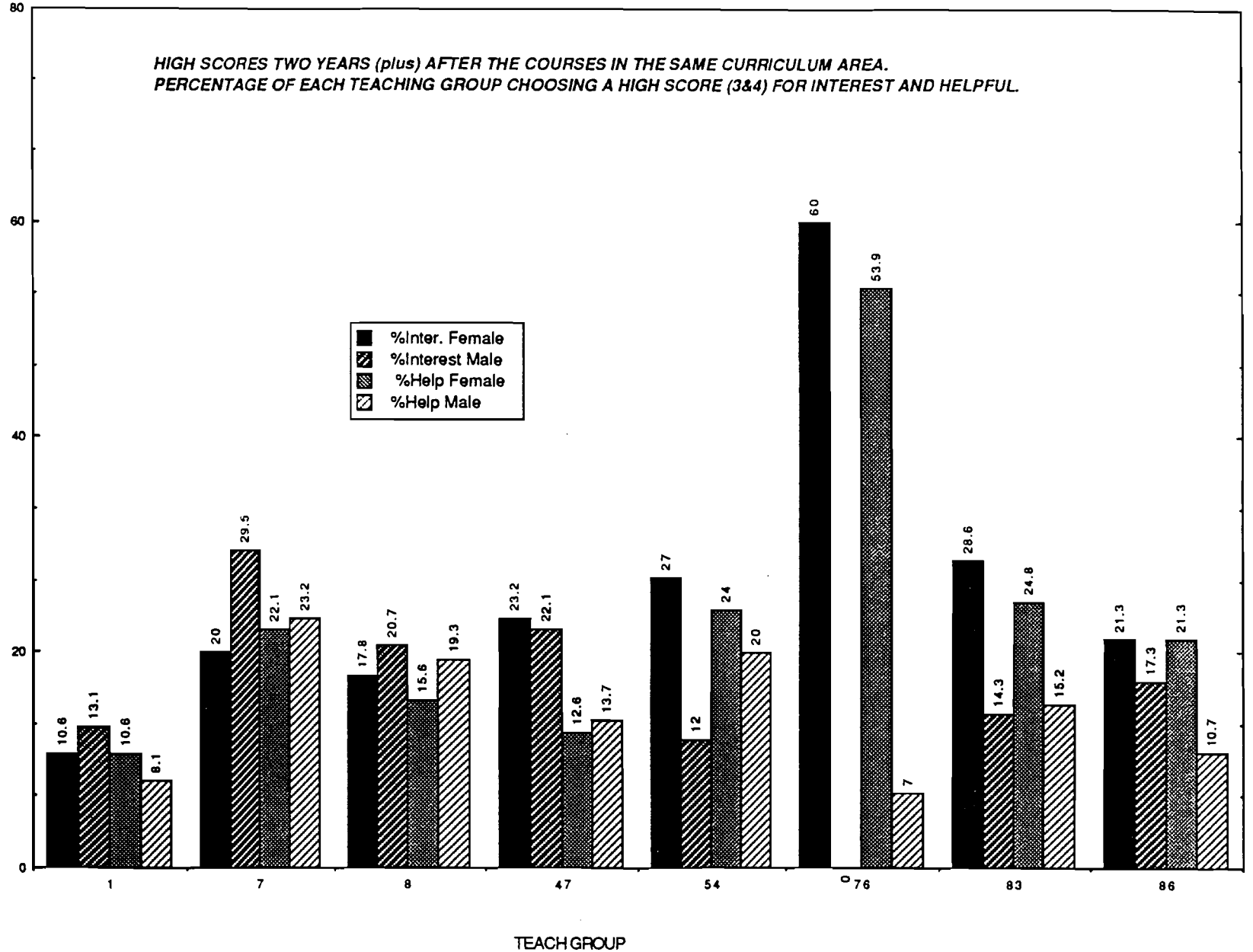

HIGH SCORES TWO YEARS (plus) AFTER THE COURSES IN THE SAME CURRICULUM AREA.
PERCENTAGE OF EACH TEACHING GROUP CHOOSING A HIGH SCORE (3&4) FOR INTEREST AND HELPFUL.
%Inter. Female
%Interest Male
%Help Female
%Help Male
80
60
40
20
0
10.6
13.1
10.6
8.1
20
29.5
22.1
23.2
17.8
20.7
15.6
19.3
23.2
22.1
12.6
13.7
27
12
24
20
60
0
53.9
7
28.6
14.3
24.8
15.2
21.3
17.3
21.3
10.7
1
7
8
47
54
76
83
86
TEACH GROUP

Figure 19a.

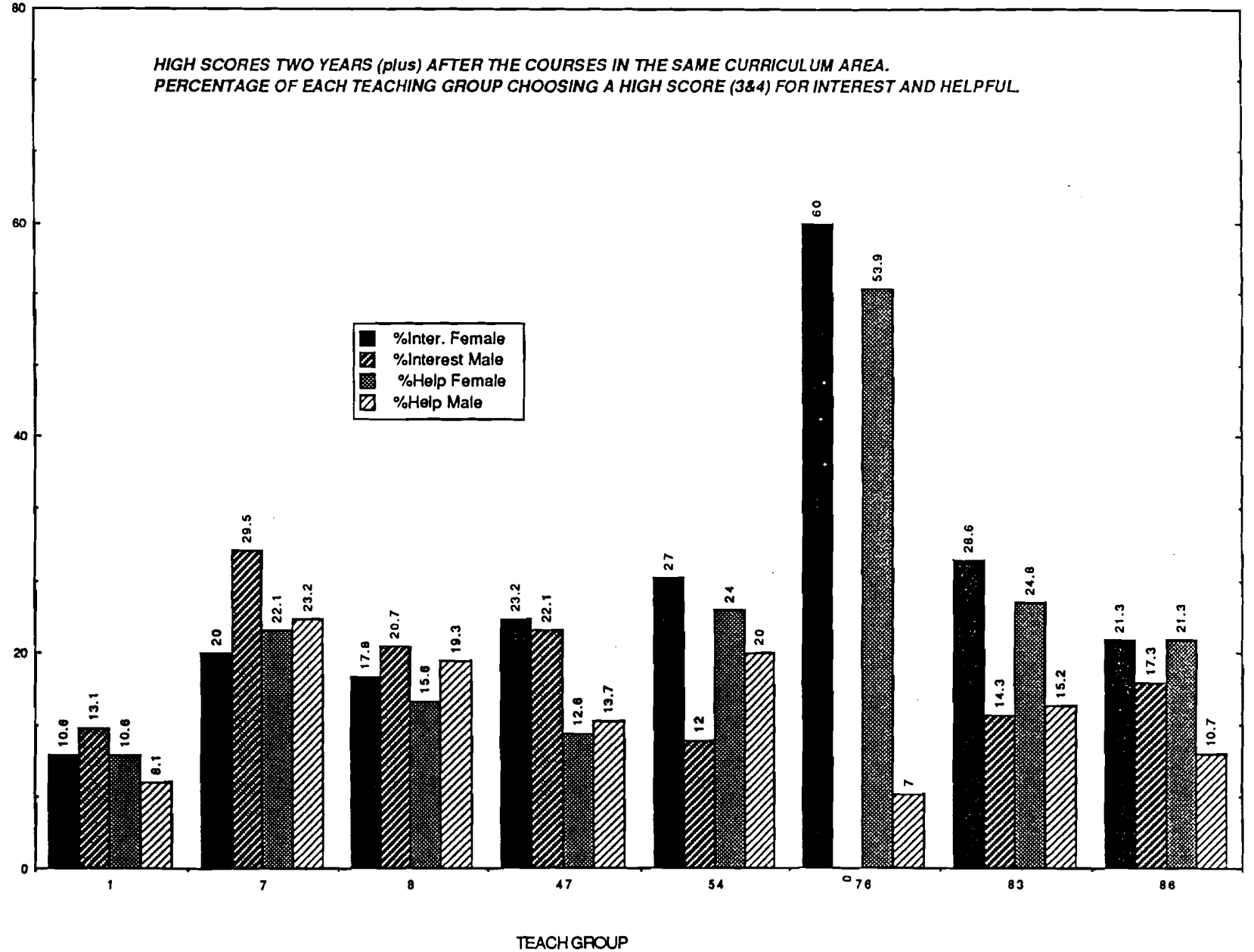

HIGH SCORES TWO YEARS (plus) AFTER THE COURSES IN THE SAME CURRICULUM AREA.
PERCENTAGE OF EACH TEACHING GROUP CHOOSING A HIGH SCORE (3&4) FOR INTEREST AND HELPFUL.
%Inter. Female
%Interest Male
%Help Female
%Help Male
80
60
40
20
0
10.6
13.1
10.6
8.1
20
29.5
22.1
23.2
17.8
20.7
15.8
19.3
23.2
22.1
12.6
13.7
27
12
24
20
60
53.9
7
28.6
14.3
24.8
15.2
21.3
17.3
21.3
10.7
1
7
8
47
54
76
83
86
TEACH GROUP

Figure 20.

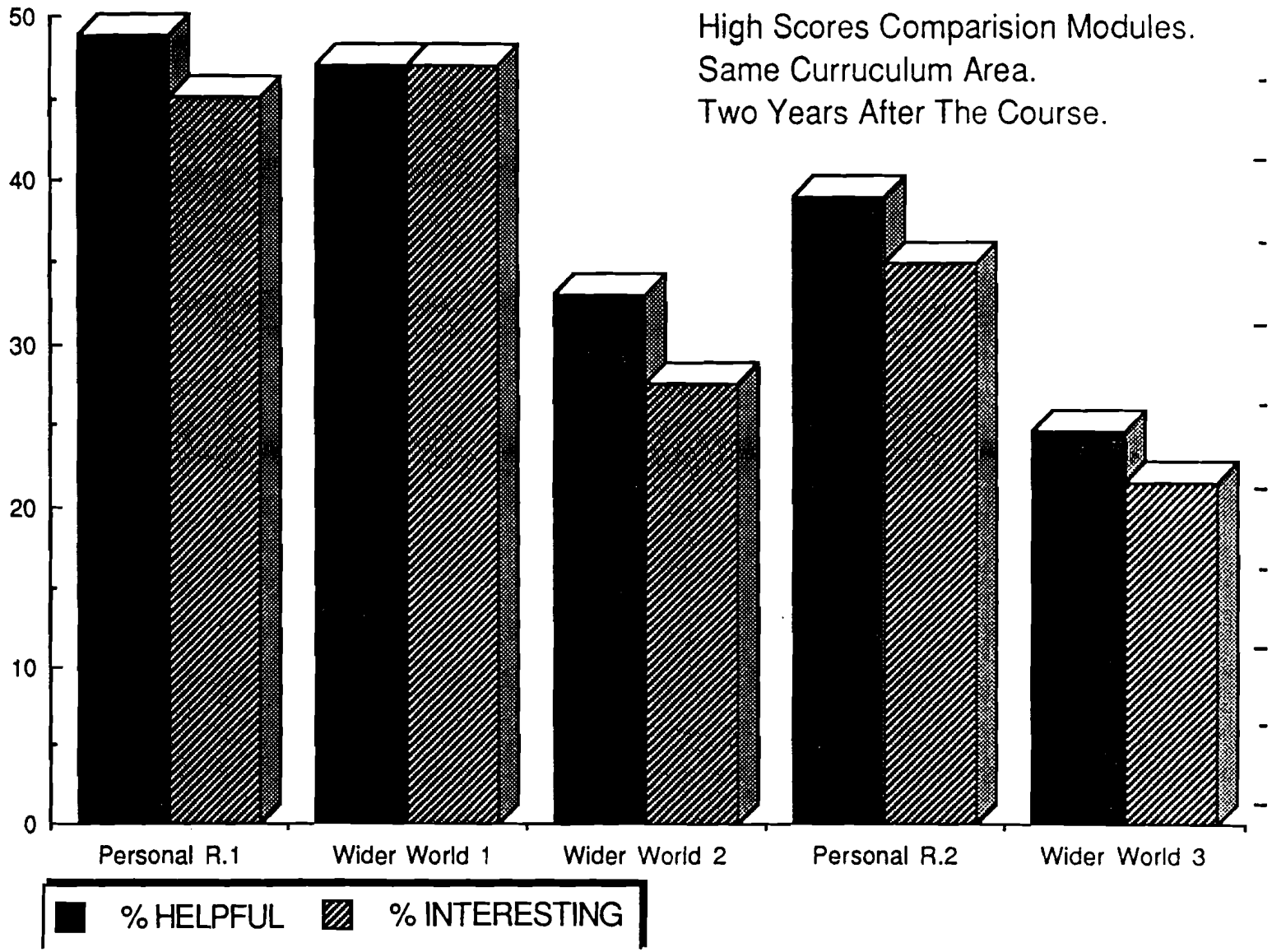

High Scores Comparision Modules.
Same Curruculum Area.
Two Years After The Course.
50
40
30
20
10
0
Personal R.1
Wider World 1
Wider World 2
Personal R.2
Wider World 3
% HELPFUL
% INTERESTING

Figure 21.

7.7 Staff Interviews Analysis

The interview was a structured one based around five areas, the first being personal background, then the lessons, discussions in the course, mediation and the future.

The personal backgrounds of the staff at first centred on their view or philosophy of teaching. All the six staff were interested in facilitating, meeting individual student needs and looking at the whole development, so they said such things as

> "Meeting the needs of the students, I am very student centred."

Two of the staff did emphasise that this sort of thinking did not eliminate a very structured environment within which the students could reach their full potential. One member of staff talked of

> " ... facilitating the transfer to life after school, and the relevance of the work was important."

None of the staff were new staff and four out of the six could be described as senior staff within the school having additional heavy responsibilities. One was the Head Teacher of the school.

In looking at their previous experience in problem solving or studying or learning to think types of materials, none of the staff had any specific psychologically orientated training. One member of staff had maths training with younger students and some experience of lateral thinking, which she found particularly helpful and relevant and contributed actively to the group in this area. Two staff had experience of previous learning skills types of courses and they contributed this experience, but most staff were very tentative and felt that they had not been fully equipped in this area, although they all had a wide experience. One for example,

had been teaching geography for sometime and was able to apply some of the problem solving approaches of GCSE and 'A' level courses to the work.

Under the title of personal background there was discussion about preparation for the Somerset Thinking Skills Course lessons. The amount of time this took during the first course of teaching was very high. Each lesson preparation time could be as much as one hour and many staff felt that they needed to work through the lessons themselves. They all pointed out how much easier it was, to complete the course for a second time. Two staff explicitly stated how they read the booklet, tried their activities themselves, and used such phrases as;

> "I did a dummy run."

One senior member of staff, pointed out quite forcibly that having read the book of instructions, it only made sense when it is in the classroom and he also wondered whether doing this course at the start of the year was very good for the group interaction point of view.

The staff were then asked about their preconceptions of the course. Most were fairly positive saying such things as;

> "I thought I might enjoy the course."
>
> "I am sold on the idea."
>
> "It fits in well with new courses in Personal and Religious Education (PRE) we were setting up."
>
> "There seems to be good material back-up."

Others were filled with "horror,"

> "I never thought of attempting this."

This staff member then went on to state that her confidence in attempting the course was because of the encouragement of her colleagues. They felt that she was well able to lead the learning. She was willing to make an attempt. She felt that this was only confirmed on the second time round, mainly because of the limited time factor. Others felt that the course was a little paper based and they also lacked confidence. One member of staff interestingly pointed out how she felt;

> " ... rather out on a limb."

This was not when she was being supported or talking about it, but when she was in the classroom, the first time through in particular. Also some comments were made under problems with the course, how much, and the depth of inset that was needed. All staff mentioned INSET with some comment on the importance of INSET at the commencement and throughout the course. When discussing problems, it seemed, at the first stage, that the total relying on teacher notes and not having the confidence to put more of one's own ideas or to allow the youngsters room to develop their ideas. This came through really in the need to have a well organised introduction. Most staff mentioned here or elsewhere the time slot that they had available. Those that had experienced both the thirty-five minute and the hour time slot stressed how difficult it was, in this sort of course, to attempt the former and what a natural period of time sixty to seventy minutes was for this sort of work.

One member of staff stressed that the whole context of the course "World Religions" threw some of the students. Others commented on the approach being so different that some students' minds were closed initially. One staff felt quite

strongly that as a teacher they were unable to open the minds of some of the students in the time allowed. Another suggested that team teaching in this area would be a good idea. Three of the staff wanted to stress that the problems could be overcome by the formulation of good questions that stretched the higher ability and did not turn off the others. They felt this was a skill they were beginning to develop and would want to carry on developing in the future.

In reporting on their experience of the lessons, the positive introduction, the use of the sheets and the small group work, came through. Transfer and generalisation tended to be stressed by the staff who had the widest experience of teaching the course. Most staff felt that the atmosphere of group responses was good, at first based upon the initial interest and then "the novel" approach that maintained the interest.

"Good atmosphere, students active and very involved in the work."

Most staff were pleased that the atmosphere and positive responses. One member of staff commented that

"Some students were confused by the lack of structure in the lessons."

These comments were within a context of the same staff being very pleased with the atmosphere in the group and having achieved on the whole, the objectives of the lessons. In fact, all staff felt that they had achieved their objectives, although one respondent did admit that sometimes the objective or aim of the lesson was a little "hazy."

In being asked 'Did the students share the objectives?' The response was usually "yes" but one respondent felt it was in token only. Another respondent said

"Yes, in general, but sometimes he forgot to do this and in thinking about the lesson found that this was the main activity that improved his lessons."

One respondent said quite definitely he did share the objectives with the students but he always did this as part of his teaching approach. Another respondent felt that she was more confident to do this on the second time through. Another was most pleased to have found that the positive nature of sharing the objectives with the students was reflected positively in the profile assessment at the end.

In commenting on the materials, all found that they were good, quite effective and could be used efficiently by the staff, once they were familiar with it. Some staff were 'thrown' initially by the lack of clear aims and objectives in the written materials. Only during the teaching of the course and in the limited INSET available, did the reason for this structuring of the materials become apparent. In its place, all the staff tended to put transfer and generalisation. Some found this was not followed up at all and discovered that it was very difficult, whereas others tended to set topics related to this as homework and worked out examples with the youngsters within the context of the school. Another member of staff felt that this was very much an easy part of the work, whereas another stressed the key nature of this element of the course, but also added
that they were

" ... really on a winner."

The materials were described as good, efficient and effective, by all staff although, some reservations in the sequencing of what they were doing and that some needed more challenge for the 'A' group with which we were working. Some social difficulties did present itself during working with some of the materials, but the reports on social interaction were excellent. The student recording/self assessment

results have been reported previously. The staff concerned felt that this happily fitted in with the whole school approach and was therefore that much easily done. Although some staff were a little disappointed on the amount of depth and that there was no tangible results as this was against the philosophy of the parts of the course we were doing.

In discussing the course, the main thrust focused on the group work and it's success together with the social learning of the students and higher ability helping lower ability students. This was difficult for some staff at first, but it seemed to be a real plus point that most respondents wanted to stress. The interviewer gained the impression on two occasions that in talking of mediation and developing these skills was a difficulty for the interviewee. Others, particularly those with more experience in the course and the one member of staff who had completed two of the Somerset Thinking Skills INSET Courses, were able to develop their ideas more easily. If there was a criticism it was the feeling in the staff interactions that they were sometimes having to steer to a set answer. Under discussions of the mediation idea, the staff did find it difficult to specify the mediation processes as distinct from their day to day teaching techniques. The transfer and generalisation within the cognitive processes and the idea of transcendence, was described as

> " ... often hard work all-round, but developed transfer and generalisation."

Typical comments on appropriate difficulty and complexity (challenge), were

> "Yes, you could extend those with high ability and yet not patronise the lower ability."
>
> "It took some time to build."
>
> "The patterns were a good idea."
>
> "This was mechanical in parts, the time factor was most important

here."

In sharing behaviour, examples were given and a response was

"A family type of group that went well."

"We all shared in [room] L17."

In discussing the sharing behaviour of mediation, one said

"This was never a problem with the talking and sharing we had an expectation at the end of the lesson to report back."

Another said

" ... this improved over the eight weeks."

Another said

" ... a naturalistic exercise, did positively assist, as we were all on the same ground."

Lastly, in considering mediation, we talked of the individual and psychological differentiation. This some made little comment on, others reported

" ... some very different responses and I had some surprises."

" ... better later, it was difficult to forecast those who would be phased by the approach."

Considering all the variables the responses were very positive.

Lastly in considering the future, all staff felt it had a high educational and social value. One said at the outset of this part of the interview that the process must be within the curriculum and this idea of metacognition had to be stressed more within the school. Other staffs general suggestions can be summed up in the following comment.

"Socially, the course had a very high response, the group work was good, it also increased general skills."

However, one member of staff reported that he felt

"... left in mid air."

When asked to comment if the course was valid in the use of time, personal and other resources, all the staff were positive.

"Good use of resources and time for all students. The course had great institutional validity, but it needs full commitment by staff and students to what is going on to be intellectually important."

Another suggested that there was a need for "short blasts" in other years, he suggested tutorial time as part of general skills. Others indicated that they were more definite.

"Yes! There should be more time."

However, from another point of view a senior member of staff suggested that to justify this course, it needs to be internalised by staff teaching this very different learning style. This interviewee felt that more INSET initially was very important as well as ongoing staff training. When we talked of the place in the curriculum, the interviewee went on to suggest a whole range of techniques for INSET. There were a lot of responses to the place in the curriculum by describing the student response.

"The students remembered the course, twelve months later."

All the rest of the comments were suggestions and positive responses in terms of where to fit the course in the curriculum, different ways of getting the ideas into the school curriculum and regarding the INSET problem.

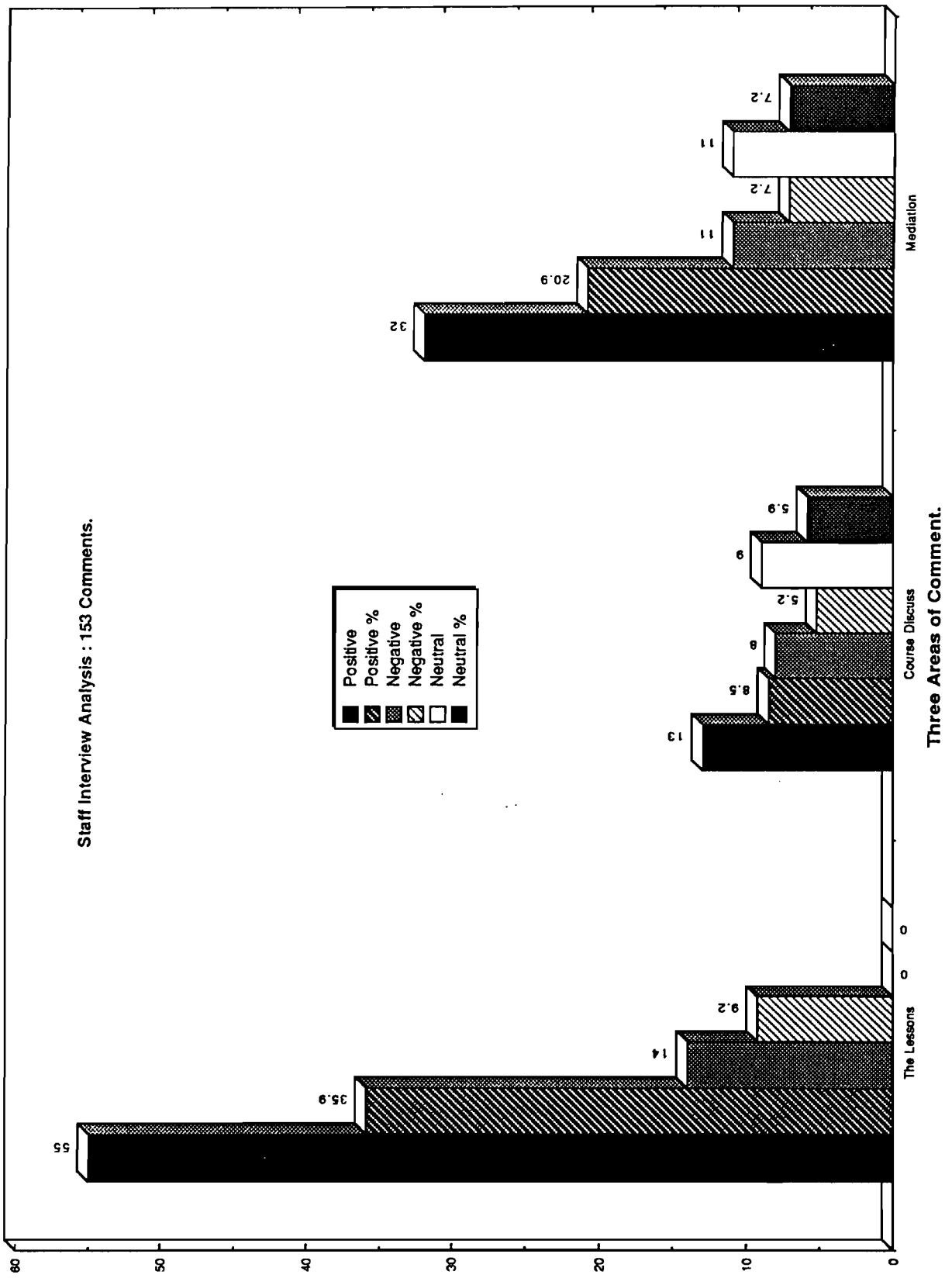
The writer has attempted to quantify the responses in regard to the lessons, the course discussions and the mediation discussions, by analysing the 153 comments as positive, negative and neutral comments. These appear following. The reader will note the neutral comments of 11% for mediation and 9% for course discussion, whereas in discussing the lessons themselves, the actual work that was going on in the classroom from day to day and its organisation, there were no neutral comments in response to this question. When the lessons and mediations positive comments were compared to the negative comments there was a major difference in both the lessons and on mediation, but less so on the general course discussion. The overall difference of the percentages, negative to positive, was small, and the neutral comments were a near approximation to these scores. In quantifying the 33 additional comments on the future place of the course, we can see that nearly 30% of the responses were talking of its educational value and a high 26.5% were suggesting major INSET initiatives in this area. In conclusion, the writer felt that the whole group of staff had tried to take a detached standing of the value of the course during the project. They had taken active steps as a group to resist the appeal or almost an expectation within the institution, both in terms of value and organisation, to be supporters, merely because one was taking part in the evaluation or working with the students on the course. Rather the group had sort a neutral a position as possible. The list of structured questions for the interview, was a result of the participating professionals informal discussions over several years, the length of this reporting stage of the project. This structured interview was the culmination of a series of informal, but professionally concerned discussions and interviews. The writer got the distinct impression that the nature of the teaching was changing in the light of experience and greater understanding of the course. Constant reference was made to the benefits of experience.

"... this was much better than the first time I did it."

"I would have liked a better INSET basis about this."

In other words, their own experience plus the feedback from other staff and the generalised reports from the study, all helped to effect what was going on in the classroom. A similar process was in operation when we were struggling with the recording of students' experiences within this particular course. In the third phase of the action research, what developed is reported.

Figure 22.


Staff Interview Analysis : 153 Comments.
Positive
Positive %
Negative
Negative %
Neutral
Neutral %
55
35.9
14
9.2
0
0
13
8.5
8
5.2
9
5.9
32
20.9
11
7.2
11
7.2
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10
20
30
40
50
60
The Lessons
Course Discuss
Mediation
Three Areas of Comment.

Comment : Has a Future Place
33 Additional Comments.

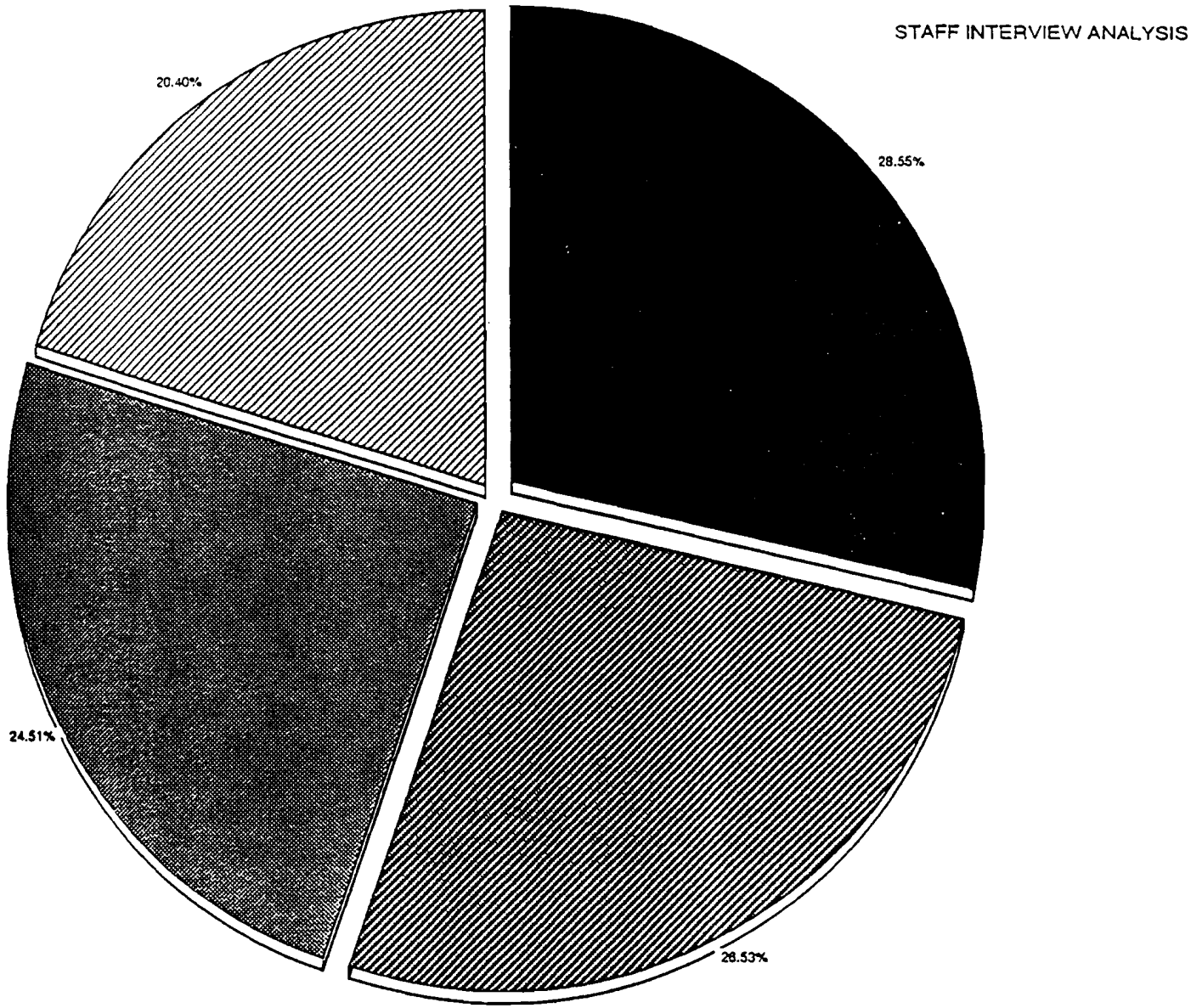

Figure 23.

7.8 Third Phase of Action Research: Summative Profiles

This phase of the work arose from the action research question: "How can we better record the learning and responses of the students to benefit their education experience?" Learning profiles were completed by the students as part of the STSC 1990/1991. A sample was taken of 32 males and 32 females from a larger number of similar profile formats. In response to this twist of the action research spiral offshoot, we sought to develop a new "profile" or logs for each module with the intended outcome that less time would be spent on completing the profiles, yet still maintaining the clear educational advantage it was felt accrued.

This main advantage was really that the students were encouraged to take more charge of their learning. There are other advantages, such as, encouraging staff to share with the students the aims and objectives of the whole module and each lesson. The students, in particular, had complained that throughout their courses they were involved in a major 'paper war' of learning profiles that were essentially asking the same questions from the students' perspective. The students' reported that the profiles were given more purpose by their use in the project.

The project structure was not the paramount consideration at this stage of our thinking. We were awaiting interim results before progressing further. However, bearing in mind our experience, referred to previously, together with the context within the school and the limited amount of time available for the whole range of educational objectives we sought to achieve, the Head of RE developed a compromise profile layout based upon four questions:

1. How far have you succeeded?

2. What, if anything, especially interested you?

3. What, if anything, have you found difficult?

4. In future ... as an attempt to foster the whole school policy of students taking responsibility for their learning.

The responses, shared with staff and one another, again confirm the feeling of success indicated by the students using the other methods of qualitative and quantitative reporting.

We note that what especially interested the students was the idea of metacognitive understanding (27.8% made some specific reference to it) and the activities, which were towards and instructional objective, comments such as the topic discussion was the most interesting part. They referred to deciding what was happening to the worksheets.

It was interesting to note the 43.4% who suggested that they had not found any real difficulties with the work they had been doing in the STSC, but in the future were going to apply the ideas in the form of transfer and generalisation to other lessons and problems they faced (39.4%) so they would suggest they would try to apply STSC to their future learning problems or they would use metacognition in other lessons or projects.

Looking at the four questions, without knowledge of the context of the lessons and work of the school, it may be considered that the questions were leading the students. However, given the light of the students experience and the context, the writer would suggest, on behalf of the staff group, that these responses are a valid reflection of the students experience and conclusions.

The positive results could be accounted for in part by the increased staff skills in the STSC generally and in mediation, in particular.

The writer found difficulty in attempting to quantify the responses from a purely research evaluative perspective. The previous profiles had the strength of having part of its structure that could be quantified, and were, in the writer's opinion relatively easy for the student to complete. However the summative profile indicated again some difference in the replies by gender.

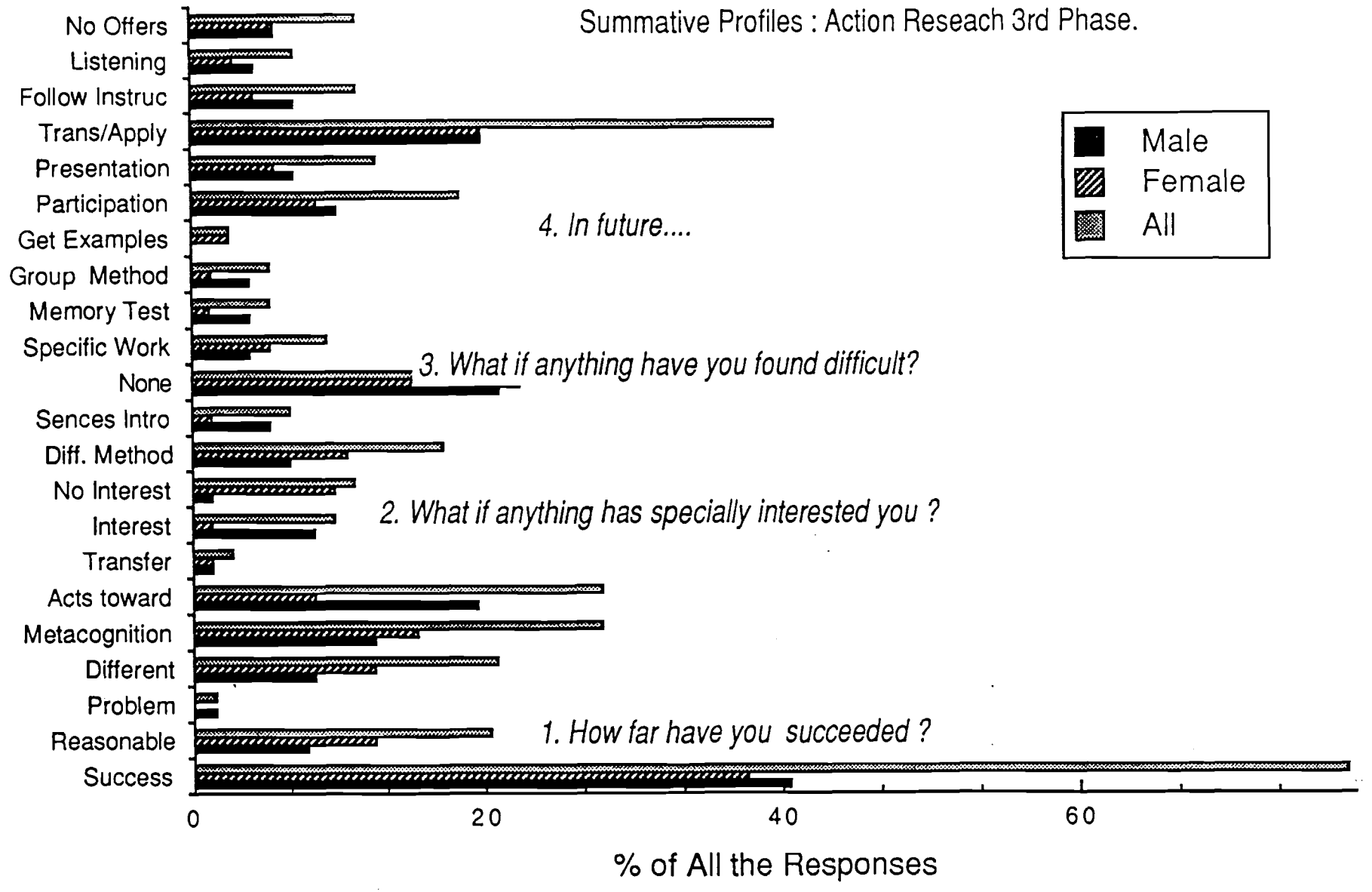
Summative Profiles : Action Reseach 3rd Phase.
Male
Female
All
4. In future....
3. What if anything have you found difficult?
2. What if anything has specially interested you ?
1. How far have you succeeded ?
No Offers
Listening
Follow Instruc
Trans/Apply
Presentation
Participation
Get Examples
Group Method
Memory Test
Specific Work
None
Sences Intro
Diff. Method
No Interest
Interest
Transfer
Acts toward
Metacognition
Different
Problem
Reasonable
Success
0
20
40
60
% of All the Responses

Figure 24.

4 Questions

Summative Profiles
3rd Phase of Action Research

Figure 25

Sample: 32 Males
32 Females

1. **How far have you succeeded?**

		Male	Female	All	
a) Successful	Number	26	24	50	I have succeeded well as I think I have learnt to look at things from a different view because of the Somerset Thinking Skills Course. I hope I have learned everything as well as I have this module.
	% of all responses	40.63	37.50	78.13	
b) Reasonable	Number	05	08	13	I have succeeded so far, I have learnt the five pictures.
	% of all responses	7.81	12.50	20.31	
c) Problem	Number	01	00	01	I haven't succeeded that much because I have been away a lot. So I have enjoyed my lessons so far. I hope I like it in the future.
	% of all responses	1.56	00	1.56	
	RAW TOTALS	32	32	64	

4 Questions

Summative Profiles
3rd Phase of Action Research

Figure 25

Sample: 32 Males
32 Females

2. What, if anything, has specially interested you?

		Male	Female	All	
a) Different Approach/View or of Mental Functions					
	Number	06	09	15	.. how many different ways there are of looking at things.
	% of all responses	8.33	8.33	20.83	.. I never encountered anything like it before.
b) Metacognition Understanding					
	Number	09	11	20	The way we use metacognition, I have found the
	% of all responses	12.50	15.28	27.78	metacognition key interesting. The key had five different parts.
Specific					
c) Activities Towards Instructional Objectives					
	Number	14	06	20	I found the topical discussion the most interesting part.
	% of all responses	19.44	8.33	27.78	We decided what was happening to the work sheets.
d) Transfer and Generalisation					
	Number	01	01	02	It helped me in tests.
	% of all responses	1.39	1.39	2.78	
e) General Interest					
	Number	06	01	07	Quite interested in finding out about metacognition.
	% of all responses	8.33	1.39	9.72	
f) No Interest					
	Number	01	07	08	The subject was OK, but did not really interest me.
	% of all responses	1.39	9.72	11.11	Nothing in the course interested me.
	RAW TOTALS	37	35	72	

4 Questions

Summative Profiles
3rd Phase of Action Research

Figure 25

Sample: 32 Males
32 Females

3. **What, if anything, have you found difficult?** (Continued)

		Male	Female	All	
f) All Areas					
	Number	01	00	01	I found some of the lessons difficult because I didn't understand the work because it was not explained that well.
	% of all responses	1.32	00	1.32	
g) Group In Classwork Approach					
	Number	03	01	04	I sometimes found it difficult to understand what we had to do as ... was a little vague. I find it difficult to express my views, to find the words just don't come.
	% of all responses	3.95	1.32	5.26	
h) To Obtain Examples					
	Number	00	02	02	Trying to explain what you see.
	% of all responses	00	2.63	2.63	Sometimes finding appropriate examples were difficult. I thought of hard examples rather than the obvious examples.
	RAW TOTALS	38	38	76	

4 Questions

S u m m a t i v e P r o f i l e s
3 r d P h a s e o f A c t i o n R e s e a r c h

Figure 25

Sample: 32 Males
32 Females

4. **In future ...**

	Male	Female	All	
a) Improve Class or Group Participation				
Number	07	06	13	I will try to contribute more in class discussions.
% of all responses	9.86	8.45	18.31	In future I am going to talk more and try to use it in class.
b) Improve Presentation				
Number	05	04	09	In future I shall try to improve my presentation of work.
% of all responses	7.04	5.63	12.68	
c) Transfer and Generalisation or Apply				
Number	14	14	28	I will use the key in other lessons.
% of all responses	19.72	19.72	39.44	I will try to apply STSC to other lesson and problems I face.
				I can use metacognition in other lessons and projects.
d) Improve Following Instructions and Homework				
Number	05	03	08	I think in future I could try to make sure I know what the
% of all responses	7.04	4.23	11.27	homework is or find out ... because I didn't know what to do.
				Ask for help more.
e) Improve Listening				
Number	03	02	05	I will listen more and take notes.
% of all responses	4.23	2.82	7.04	I will listen and understand more.
f) No Offers of Very General				
Numbers	04	04	08	I will try to put what I have learnt into practice whilst
% of all responses	5.63	5.63	11.27	I remember it. But I might well forget it.
RAW TOTALS	38	33	71	

4 Questions

Summative Profiles
3rd Phase of Action Research

Figure 25

Sample: 32 Males
32 Females

Responses

		Male	Female	All
Question 1	Number	32	32	64
	% of all responses	11.31	11.31	22.61
Question 2	Number	37	35	72
	% of all responses	13.07	12.37	25.44
Question 3	Number	38	38	76
	% of all responses	13.43	13.43	26.85
Question 4	Number	38	33	71
	% of all responses	13.43	11.66	25.09
TOTALS	Numbers	145	138	283
	% of all responses	51.24	48.76	100

7.9 The Gender Difference

In looking over the different types of data whether quantitative or qualitative, one cannot help to be struck by the gender differences. Essentially, our findings strongly indicated that according to the ability measure Test One that the whole sample was of equal initial ability. However, throughout the course of the project and in looking at the various types of data, we can see differences in response for males and females. Some of these differences are more marked than others.

The writer briefly draws your attention to the differences in some aspects the STSC work. Particularly that in 'comparing' section where in the reporting of all difficulties, the males were lower in estimating there learning and lower in three of the five main aspects. In the same curriculum area small differences were discovered. These will be addressed first.

In the same curriculum area, reporting two years later, we can observe for the teaching groups, males reported **interest** was higher than females in three groups, whereas females were higher than males in four groups, and on some occasion it indicated twice as much interest as the males. Whereas in the **help** high scores, again there were three groups where males had a higher percentage than females, and there were five groups where the females in the group reported they were being helped much more (teaching group 76 were thought to be abnormal results). We then go on to look at the high scores in the same curriculum area two years later by the teaching module, we can note that some of the modules were much higher in their response than others. This leads to many interesting questions from an action research point of view, but also that males were clearly much higher in three groups although these margins were not always large. On some occasions, such as in Personal Relationships 1, the difference was 31.1% versus 24.6%, that is a

difference of 6.5% points. So for this area, we could legitimately ask are we losing some interest because of a gender bias? When we compared the reported transfer one year plus after the events, some of the scores were quite near one another. For example, when looking at instructions as part of the module of the STSC the reported transfer was 75.8% for males against 73.3% for females. The writer interpreted these as a close result, given the sort of measures we were using.

In contrast when looking at the intervention work on comparing, we have a weighted percentage score of 65 for females against only 45.8 for males. Why is there this difference when the concept of 'comparing', is in our view neutral? The materials seem to the teaching staff to be very open ended and accommodate various examples and constructs that the students can or may wish to put upon them. The teaching staff were of both genders. However we did not at this point relate the scores on any of the qualitative measures to the staff. This was forreason ethical reasons. When we looked at the percentage of comments immediately following the intervention course, 70.4% of males suggesting that they had been helped, whereas only 53.02% females felt that they had been helped.

On the other comments, such as problems and little help or repetitious, we found that the females were reporting more highly than the males. When we amalgamated these comments with all that included difficulties, we found that the females were scoring 47% against 32% for males. In reporting which areas helped and looking at those comments we find that males predominated in all the sections reported on the course, but in being asked to estimate their learning achievements immediately after the course, we note that females reported greater achievement in the **mental label, analysing/synthesising and instructions** while males suggested

they achieved more in their learning on **comparing techniques** and on **looking for alternatives.**

There has been a considerable amount of national research into the different kinds of educational experience of each gender. In particular into the reasons for females poor achievement in maths and science subjects. cf. (Appendix H for GCSE results). Most research has concentrated on the hidden curriculum, teacher and student attitudes to subjects and a general sexist bias in education. For examples see the Equal Opportunities Commission Research Bulletin 6 (Spring 1982). Clarricoates (1980) and Stanworth (1981).

It could be that the communications from the teacher were interpreted differently by females and males. Male students tend to attribute success to ability, but female students to luck. This was indicated in Nicholls classic study (1975).Dweck (1974, 1984) showed that younger females and males receiving the same amounts of positive and negative evaluations by teachers but the nature and the goal of the evaluations was different. young males tended to be based upon there conduct and not about the intellectual quality of their work. By contrast the young females evaluations were based on the intellectual quality of their work. It may be that the females become quite sensitive to negative feedback as an indication of lack of ability. Mediation statements can therefore be very directional. Could the mediation statements used in the project be received differently by each gender?

Positive feedback is used differently for young females and males. It could be that given the international nature of the course, between peers and with the teacher as mediator different interpretations of feedback could have come through. French

and French (1984 indicated that how a focus on the verbal interactional dimensions of a classroom might in fact cause the gender imbalances reported by researchers. French and French saw the problem not so much as that of bias or poor classroom management but in interactional terms. The answer lies for them, in the manipulation of the interactions within the classroom. This is an area of special interest in further research, in looking at the conversations that are taking place within the STSC learning environment. We will to some extent address this aspect later in the report when discussing mediation.

When looking at the weighted percentages on learning achievements in total, we find that the male and female responses are about the same. In posing the question, why are there these differences in responses? The project is **NOT** able to provide any answer. It had not really been expected and had not been a first priority in our design. However, our research experience is now such that we would have the confidence to rectify these sorts of omissions by modifying another round of action research.

Before embarking on a discussion of our conclusions the above has led the project to consider again the key area of mediation.

7.10 The Concept of Mediation

As we have observed, the work of Feuerstein and all the developments stemming from his work are based upon a powerful system of belief. These convictions are not unlike the assumptions of many practising teachers in its positive, optimistic view of the possibilities for change in the human intellect.

To account for the causes of differentiated cognitive development, Feuerstein postulates that learning takes place through two modalities, that is; qualitative attributes or aspects of sense experience. In addition to the Piagetian **Stimulus - Organism - Response** model he argues that cognitive development is more significantly effected by Mediated Learning Experiences (MLE).

Children receive a great deal of MLE long before school, however the teacher provision of MLE has been shown to have a powerful effect [Feuerstein, Rand, Hoffman and Miller (1980)]. Studies of adults and adolescents have demonstrated the human capacity to increase cognitive functioning into adulthood. [Budoff (1987)].

Recent research suggests that MLE is an important in helping learners transfer knowledge. Specific conditions necessary for the transfer of knowledge were distilled from various researchers by Perkins and Salomin (1989). These included Brown and Kane (1988); Brown, Kane and Long (1990); Brown and Palincsar (1990); Gick and Holyoak (1987); and Salomin and Globerson (1987). They discuss five specific conditions as described by Brown et al.

> "... transfer to new problems does take place . . . when (**a**) learners are shown how problems resemble each another; (**b**) when learner's attention is directed to the underlying goal structure of comparable problems; (**c**) when the learners are familiar with the problem domains; (**d**) when examples are accompanied with rules; particularly when the latter are formulated by the learners themselves; and perhaps most importantly, (**e**) when learning takes place in a social context ... whereby justifications, principles, and explanations are socially fostered, generated and contrasted."
>
> (p. 22).

MLE seems to facilitate all these conditions while also helping students learn how to learn. The student learns to make important domain specific connections. It becomes .pamore powerful when teachers explicitly mediate factors that lead to independent learning when they used MLE as an instructional model.

In essence, MLE results in making a conducive environment for the flow of energy among domain specific cognitive schemata, which are subclasses of information within a given domain. Perkins and Salomin (1989) describe the relationship between these two types of knowledge as 'a hand' that reaches into the various domains to retrieve, classify and connect or 'grip' specific knowledge.

This subtle process takes place when an adult emphasises, extends and interprets the stimuli from the environment so that an internal map is built up of the world by the subject, in which experiences are meaningfully related. Mediated experiences cannot escape the subjects attention. The subject is assisted to appreciate, select and ignore or notice.

The role of the significant adult (H) is emphasised in that as it stands between the subject and the stimulus and again the response. The model then becomes

S - H - O - H - R.

The rôle and actions of the mediator become central in the learning of the subjects.

Feuerstein distinguished many aspects of mediation, some of which he considered to be culturally determined and others he termed 'universal'. The three universal criteria of MLE are:

a. Intentionality/Reciprocity

b. Meaning

c. Transcendence.

Intentionality is helpfully defined by Greenberg (1990) as:

> "deliberately guiding lessons in a chosen direction."
>
> (p. 35).

It is the imposition of the mediator on to the subject. A way has to be found by the mediator of orienting the subject to a specific stimuli and/or experiences.

Reciprocity refers to the feedback from the child that indicates the mediator's intentions are understood. This may take time to establish. The subject is not perceived as passive. Greenberg (1990) states that:

> "Even when a teacher is firmly in charge, students exert tremendous and appropriate control over the lesson. Effective mediators perceive the thoughts of students and turn them to face the direction of the mediation."
>
> (p. 36).

In other words Reciprocity or what Greenberg usefully calls Responsiveness takes place when the mediator makes sure of a response from the student, which establishes that the intent is clear. Responsiveness is an important facilitator of effective MLE.

Meaning is succinctly defined by Blagg (1991) as

> "concerning the way in which the mediator endows the learning experience with purpose, relevance and excitement."
>
> (p.19)

This could be termed helping students find significance and value in the learning activities.

Transcendence is defined by Greenberg (1990) as:

> "Helping students connect the content of lessons to other contexts or domains as well as to variables of how to learn."
>
> (p. 36).

That is; transcendence is the need to embellish the learning experience with a purpose and significance that goes further than the specific needs of the task. Greenberg (1990) states very firmly that transfer of knowledge will NOT occur unless the mediator transcends the area of content of the lesson. Transcendence occurs when a connection goes beyond the immediate needs of the given situation.

In the search to operationalise MLE different researchers have come to amend the list of culturally determined aspects of MLE. Jensen (1990) has five distinct components of MLE in order for a structural change in functioning to occur. They are the three universal ones referred to above with the addition of **Mediated Regulation of Behaviour** and **Mediation of a Feeling of Competence.**

Mediated regulation of behaviour is required to put the targeted cognitive function in its proper location in the sequence of the mental act. If you do not have this aspect, the learner may activate the newly acquired modes of functioning at the wrong time or place. Motivationally this is very destructive.

Mediation of a feeling of competence is the necessary motivational support for the learners. They may be inadequate at the point of departure, as the learner attempts to function in a new and unknown ways.

These five broad components of the MLE are presumed to be involved in the enhancement of structural cognitive modifiability. They have been constantly modified since being initially described by Feuerstein (1980). Falik and Feuerstein (1990) indicated that there were eleven elements that described a MLE. After the three universal criteria there is **(4)** The Feeling of competence; **(5)** Regulation and Control of Behaviour; **(6)** Sharing Behaviour; **(7)** Individuation and Psychological Differentiation; **(8)** Goal - Seeking, Setting, Planning and Achieving Behaviour; **(9)** Challenge; the search for novelty and complexity; **(10)** Awareness of the Human as a Changing Entity and **(11)** Mediation for an Optimistic Approach.

The eight above (4 - 11) are described as 'situational' because they are conditioned on the circumstances and the specific nature of the interaction. However each of these critical elements must be present and built into the mediation. The difficult task of observing and developing these concepts in the classroom is only recently being addressed. The work of the Cognitive Enrichment Network - Follow Through Project (COGNET) and the reports of Greenberg (1990a & 1990b) have been most helpful to the writer.

Greenberg (1989) has twelve variables related to MLE in her MLE Observation Analysis System that was produced with the assistance of Reuven Feuerstein and Carol Lidz. It also seems indebted to the work of Klein (1984). They are:

Intent

Responsiveness

Domain Specific Transcendence

General/Strategic Transcendence

Subjective Meaning

Objective Meaning

Feeling of Competence (Task - Regulation)

Feeling of Competence (Praise and Encouragement)

Self - Regulation

Goal - Directedness

Reciprocity

Greenberg used this instrument to analyse teacher student interactions. None of the teachers had any knowledge of MLE theory at the time of the interactions. Audio and Video tapes with their observational notes were analysed. All teachers used Intent and Responsiveness consistently. Reciprocity was the only other in which 90 percent or more observations occurred at the highest level. Although the sample is small and spread over differing groups it is clear that teachers in the research project used MLE as they interacted with students but not at a level that truly meets the criteria for transfer of knowledge, referred to above.

The researchers suggested that the teachers, untrained in MLE, needed to fine tune their natural mediation to increase effective learning, except in the case of cognitive processing.

The experience of the research projects teaching staff seemed to indicate some difficulty in distinguishing between these specific MLE activities and their 'normal' teaching activities. Especially as the changed context secondary education had moved away from knowledge based to more skills based learning experiences under the General Certificate of Secondary Education and the National Curriculum.

Blagg (1991) found in his study that these criteria were difficult to operationalise. He found a difficulty when staff untrained in the methodology, would have to become involved for practical reasons such as staff absence or reappointments.

In discussion, staff perceptions were that the problem was exacerbated by our general lack of a large theoretical base at the commencement of the pilot study.

The courses provided an introduction and began the familiarisation with the specific materials but may not have provided enough about the above concepts in particular.

Indeed it was the staff's own reading and sharing in the main study that established and alerted the members of the project to the need for more theoretical understanding and the difficulty of operationalising mediation in the classroom. As Greenberg (1990) suggests:

> " ... implementation of effective MLE requires extensive theoretical understanding that enhances the natural desire to mediate."
>
> (p. 35).

Further, the discussion suggested, that it was clear that:

> " ... teachers in the research project used MLE as they interacted with students but not at a level that truly meets the criteria for transfer of knowledge ... Consequently, many teachers may only need to fine tune their natural mediation in order to further effective learning in students, except in the case of cognitive processing ... [the teachers were found] to have an imprecise understanding of cognitive processing"
>
> (p. 42).

Burden (1990), in discussing the successful implementation of Instrumental Enrichment, stressed the importance of identifying the essential variables. He stated that the most important variable was the quality of mediation offered by the teacher. This was not built into our research design as we were targeting the assumption of success in the whole school setting. We were rather wrestling with the materials. On reflection and taking into account such work as Burden (1990), Greenberg (1990), Falik and Feuerstein (1990), Kozulin (1990), Gilg (1990) and Nakra (1990) it may well have been an opportunity to gain more data on the nature and quality of this variable in the particular context of our project.

However one is left with the distinct impression in examining the field and the final interview notes, that we did not have the theoretical and practical background to clearly isolate aspects of this variable. We could **NOT** recognise and form adequate observations about the criteria within the interactions. We have more confidence **after** the experience of carrying out the research. However in carrying out the project we have gained a greater insight for the next round of the Action Research. The design of the project did not allow sufficiently for this feature. Strict observation of the interactions need to be developed as well as a deeper examination of the mediators' view of their rôle.

CHAPTER 8:

Discussion, Interpretation and Conclusions

"Interpretation is the revenge of intellect upon fact."

Susan Sontag (1933-)

8.0 Summary and Discussion

As we have noted, the uniqueness of this research lies in the different approaches employed in the collection and examination of data. Now we are able to suggest that the thesis makes an original and significant contribution to knowledge for the following reasons.

In seeking to critically evaluate the "Thinking Skills Approach," an exceptionally large sample has been used. Other studies have relied on very small scale samples of discrete groups of subjects. Almost all of these have been on students diagnosed as having marked learning difficulties. By contrast the work described in this research has covered the whole range of ability.

The study took place in the context of a 'typical' secondary school within its 'normal' day-to-day life. Whereas previous uses had been in the context of a specialist remedial intervention programme which took students out of their everyday environment and then reintroduced them into their normal school regime. Given an extremely conservative interpretation of the data we were able to report some highly significant results, which demonstrate that average students can develop approaches that can considerably improve their learning, their perception of how they learn and performance metrics of ability.

We are able to provide educational managers with good evidence for decision making in this area. The programme is both effective and practical within a normal school context.

8.1 Summary of Research Problem, Method and Findings.

The research problem was to see if the independent variable, the Somerset Thinking Skills Course (STSC) Module, would have the effect of increasing scores on the non-verbal IQ Tests. and that the report from the qualitative methods would support the view that the STSC is helpful in developing problem solving approaches and learning across the ability range. We were also concerned to see if the variable was sufficiently robust to make this change within the general milieu of an upper secondary school given the major constraints of time and staffing.

Our methodology was eclectic. The research was essentially educational research with the implication of being objective, orderly, repeatable, empirical, available to the public and meaningful. We were concerned to take both quantitative and qualitative approaches. In addition the research was carried out as action research, that is, modifying our design in the light of our experience as the project progressed. We were clearly using the results to evaluate the work for policy decisions. We were also concerned to illuminate the project within the context of an innovation.

Our findings were essentially that both qualitative and quantitative results indicated the difference that the course made to the students. Quantitatively we found that we could initially conservatively suggest that there was **NO STATISTICAL DIFFERENCE** between the experimental and control groups. That is they were from the same population. There was no significant difference in gender on Test one or Test Two.

The analysis of variance indicated with a high degree of confidence, that there was a difference between the two tests the experimental treatment had an effect. This was confirmed by the T-Test in the experimental and control groups. The cross-tabulation indicated the differing ability levels of the teaching groups, the Paired T-Test strongly indicated that the mean of the experimental group had increased whereas the control group had actually fallen. There could be a statistical regression feature. The fall is difficult to account for, it could be due to motivation of the control group in carrying out Test 2. The tests were a novel event in the day to day learning of the students.

We can further suggest that the males increased their scores more than the females. The qualitative results were more imprecise. The reporting of the qualitative results was made easier by the categories into which they fell. These followed the main aspects of the Introductory Module of the STSC. Within the **'helpful'** category, when viewing the course generally, students had a high 65%, 59.87% recorded scores in the high categories, that is, an average score and above. This compared with the same curriculum area where the helpful scores were below 50% at the highest and a low of 24%. Within the **'problems'** replies these were only 19.75% of all the comments made, some of these problem areas were overcome by the students as they worked within the module. The comments involved a historical sense of reporting what had happened. The main area of difficulty in understanding and applying was the **'analysing and synthesising'** concepts which would be taught differently in the light of this study. The **'instructions'** part of the course was reported as very repetitive, although transfer was high as reported by the same student population later.

One year plus after the course indicated a high level of transfer from the course into other areas. All students were able to give an example of a **'clear mental label'** and the comments supported the transfer as fairly easy for the students in this area. However, the reported and illustrated transference was high in all the course areas, even in those that had proved difficult for some students. **'Analysing and synthesising'**, for example, were able to indicate some transfer by applying the ideas at an 80% level.

Generally the **'comparing and Alternatives'**, and **'instructions'**, which some students had found repetitive, were again very high in the 80% to 90% response. The only low reports of transference were a few students who had an additional category of work they had covered outside the main areas of the module structure that are referred to as the **'senses.'** This was a part of the course, which used a consideration of the senses as an instructional 'means' to introduce some of the course concepts. The classifying of these responses may indicate some initial confusion by this small group of students.

One year plus after the course, students were asked to look at the cross-curricular issues. The results were extremely positive, 131 comments against 43 negative comments. In this area, males tended to score lower than females. The success and enjoyment of the course was confirmed, as well as the difficulty with analysis and synthesis. Some students really disliked the "test."

A **Two Year Plus** comparison was made to establish the order of the positive result of the feedback for the STSC. We sought to relate the results of a questionnaire given to **students two years** or more after the intervention. To gain an association we looked at the modules in the same curriculum area, but **not** specifically the

Somerset Thinking Skills Course Module.

Please refer to Appendices D, C and E.

The questionnaire results supported the validity of the higher order of scoring on the Somerset Thinking Skills than the existing modules. The questionnaire extended understanding of the context of the work although our comparisons still had to be tentative as we cannot satisfactorily account for the true independence of the learning until we have regular data. Or concerns about the nature of the performance indicators are relevant here.

Is it possible to refine the generalised trends into something more student specific? Can we form measures that give an indication of the thinking and motivations that lie behind the learning? Suggested areas to explore is the work of Biggs (1987) whose small final profiles we have found to be helpful practically, to students in other contexts. Entwistle (1987) suggests that there is a lack of British measures. We find his measure rather cumbersome for our purposes in this study. We have made reference to the work of Adey and Shayer (1991) above but as yet, cannot relate their Performance Indicators, the Science GCSE results to our type of study. This is because the project has a wider context to generalise and transfer the learning from our discrete course. That is, the habits of thinking and learning appropriately applied to all learning [Sternberg (1986)]. Good Performance Indicators remain elusive.

The staff interview analysis commenced with an examination of some of the input into the course evaluation. The staff all had a long teaching experience, although few had little direct psychology orientated background, which it is felt may have

helped in teaching this course. They described the preparation time as initially high, but once the module had been taught, their satisfaction and enjoyment increased. They needed INSET at the start and more background and basic concepts being developed as well as INSET during the course. Some staff experienced an initial feeling of isolation. Many had started this course with some initial fears and lack of confidence. Most staff thought that this course would be useful in other areas of the curriculum but it needed this initial introduction and INSET that has been referred to above.

From their experience the teaching staff emphasised the need for a good introduction, that sharing the objectives with the students was essential and that the teaching time of a one hour slot was much more appropriate than the thirty-five minutes of the original course. The materials they felt were good and appropriate and lent themselves to creative development particularly within the introduction and the forming of good questions. There was a difficulty in defining mediation and making distinctions between this and their everyday conversation with students. Most felt that the transfer and generalisation was not a problem and that the group work fostered this idea as well as the mediation. Students and staff were working at problems within the module as they were going along and it was emphasised **by all** those who had taught the module more than once, that in the light of this experience, the results they felt were better and their job satisfaction rose and the lessons became more enjoyable.

Please refer to Figures 22, 23 and Appendix N.

The third phase in action research terms; reduced the profile down to four questions. Although the responses were difficult to analyse because they were

more general, the results did tend to confirm the previous outcome. Essentially they found that the students were able to transfer and apply the main concepts of the course. The response for success was high.

8.2 Conclusions

Despite the very limited programme of intervention, we can conservatively conclude that the Somerset Thinking Skills Course as the independent variable, did make a difference to the problem solving or thinking of the students. We have taken into account the context - the limited inputs and their quality and the product of the student quantitative scores and the teacher reports.

This study could be said to support the robust nature of the concept, the quality of the materials and their practical use within the milieu of a large upper secondary school in Dorset.

The qualitative materials have led to a constant ongoing change and modification within the case study and the teaching. This change indicated, in particular a change in the approach to the teaching of the Analysing and Synthesising ideas in the introductory module. The writer, would agree in the light of this experience, that Feuerstein's contributions have long lasting implications and we would follow the work of Blagg (1991) in suggesting that

> " ... we regard Somerset Thinking Skills Course as a promising way forward rather than an end product." It is at least prompting teachers to think about their role in fostering pupils cognitive development and offers vantage points, novel materials and teaching strategies to enhance that role."
>
> [Blagg (1991) p.169]

However, this study has left us dissatisfied in several areas and opened wider implications than at first envisaged, both regarding teaching, reporting evaluation, managing innovation and future research.

8.3 Implications

The project has illustrated that the successful teaching of thinking skills does not simply depend on the design of the programme but on a whole range of school system issues, the behaviour of teachers, personality factors, in-service training and support issues. However from our study we are left with three main areas to briefly indicate the writer's views of the implications for future development. We conclude with a comment on our aspirations for the future.

In **teaching** the course, our experience leaves us in no doubt that further work on this approach is needed. Further exploration of why the students were encouraged and were able to recognise their own success on one hand and how staff conceptualised the increased job satisfaction. We found an important conformation of the use and efficacy of mediation techniques in a secondary school context. More refinement of the techniques in very specific special education contexts (Blagg N. et al 1990) is being carried out, however the importance of developing the present work further into how it can be promoted in the habits of our day to day teaching. How is it the students learned from the group work? In what ways was the students enjoyment related to the context? are some of the avenues that demand to be sensitively researched and reported .

In **reporting** the study the structure that was found to keep the themes of the research, case study, action research, evaluation and the ongoing permutations in our minds. The methodology assisted the cohesive reporting of the results and observations both during and at the end of the study. Further refinement would lead to this methodology becoming a common and effective feature of evaluation programmes. Interim reporting should be formalised in this type of study within an institutional context. The writer is able to recommend the idea of an interim report

after Catherine Marshal (1984) as extremely helpful to the reporting process and the development of the research inn the minds of the staff associated with the project. An additional executive summary facilitated the dissemination of the work. (cf. appendix R).

Implications for **future research** are however much wider than what has been mentioned above. We would agree with Burden (1987) when he suggests that there is a general unavailability of appropriate assessment techniques in this area and it is difficult to apply traditional laboratory based experimental design to complex real world interventions. We would also agree with Bradley's (1983) suggestion that multi-variant research designs could be a possible way forward but we would suggest that further work in linking this quantitative research to qualitative research that brings out the complexity of the situation. Our methodology is eclectic and includes action research as well as both the quantitative and qualitative paradigms. Further development in an Action Research perhaps within a CIPP model after Stufflebeam (1971) would seem a promising area to explore. A most interesting question that has arisen is about the meaning that adolescent students attribute to the introduction of this strange curricula animal. This seems rarely examined in the literature. It will be very interesting to develop further observational techniques to look, in detail the classroom interactions within both a gender and mediation orientation. We intend to examine in greater detail into the teacher views of classroom interaction mediation and correlate this with their mediated learning skills.

In our view, most importantly, we were able to demonstrate the degree of transfer and generalisation into the everyday lives of the students in a clearly defined manner. This we feel is an important issue for future research, we note the

experience recently reported of Adey and Shayer (1991) in their description of Cognitive Acceleration through Science Education (CASE) project and how their transfer and generalisation was expressed in better GCSE results for science. Perhaps work on performance indicators (Fitz-Gibbon C. 1990) over the whole curriculum as referred to above is worthy of further exploration. As would be the gender issue inherent within our own work and the CASE project as well as the GCSE results as interpreted by both SEAC (1991) and the Department of Education and Science (1991) graphs are attached in the Appendix. This seems to be an area that demands from both research and ethical considerations future research work.

Our **aspriations for the future** arise from what this study has indicated that the original work of Feuerstein and the developments of the Somerset Thinking Skills Course are worthy of serious consideration within the curriculum and that they give positive benefits to the students. Much further work needs to be done in an attempt to quantify and reliably validate the experience of the students in this area. The project suggests that future consideration should be given to the whole ability range development in metacognition and mediated learning. As Coles M.J. and Robinson W.D. (1989) suggests that

> "The problem now is not whether we can teach thinking. The evidence suggests that we can. The problem continues to be whether we are willing to make the pedagogical changes necessary to do so, ... " (p.20).

Although the writer agrees with Rutter (1979) where he suggests that

> "Research into practical issues, such as schooling rarely comes up with findings that are totally unexpected. On the other hand, it is helpful in showing which of the abundance of good ideas available are related to successful outcomes."(p.204)

The writer would also wish to link the above to that of Belmont, Butterfield and

Ferranti (1982), when after their review of transfer of thinking where they came to the conclusion that

> "It is unknown how much improvement can be expected, but we suppose that cognitive researchers have barely scratched the surface." (p.153)

The changes in the concept of intelligence over the last thirty years and the rise of programmes that claim to improve the intellectual skills of school students. The Somerset Thinking Skills Programme makes our evaluation in terms of a practical and effective course for students across the ability range of a upper school a highly relevant and educationally significant.

This significance is gained by a detailed report is set within a context of what is conceptualised by 'intelligence' and associated developments in the field. The originating Instrumental Enrichment Programme of Feuerstein is described with reference to his emphasis on 'mediation', as well as the design of the Somerset course. Stufflebeam's (CIPP) model and Parlett's Illuminative Paradigm are used to structure part of the report and reflect the study's innovatory nature.

The hypotheses that the course will increase the scores of the non-verbal IQ tests administered before and after the intervention was confirmed. The results are positive in these three areas. Statistical significance was achieved between test one and two. The course participants did report generally that the development of a more heuristic approach. If these changes were robust enough to happen within the milieu of an Upper Secondary School the writers indications of the future rest **not** in pious hopes but realistic possibilities.

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Appendices

During and Immediately After the Course:
Level of Achievement

Appendix A

		Male Level of Achievement						Female Level of Achievement						Male High Level Weights 4 - 6	Female of Achievement Weights 4 - 6	4 - 6 Male/Female % of Weight
		1	2	3	4	5	6	1	2	3	4	5	6			
Clear Mental Label	Choice Total	0	0	4	9	15	11	0	0	9	21	15	6			
	*Weighted Score	0	0	12	36	75	66	0	0	27	84	75	36	177	195	372
	% Total (300)	0	0	4	12	25	22	0	0	9	28	25	12	59%	65%	62%
Analysing and Synthesing	Total	0	3	11	20	10	3	3	6	16	11	12	2			
		0	6	33	80	50	18	3	12	48	44	60	12	148	116	264
	%	0	2	11	26.47	16.67	6	1	4	16	14.67	20	4	49%	65%	44%
Instructions		0	0	5	6	14	14	0	0	7	12	15	12			
		0	0	15	24	70	70	0	0	21	48	75	72	164	194	358
	%	0	0	5	8	23.33	23.33	0	0	7	16	25	24	54.67%	65%	59.67%
Comparing		0	2	1	13	20	11	0	3	11	9	17	10			
		0	4	3	52	100	66	0	6	33	36	86	60	218	181	399
	%	0	1.33	1	17.53	33.33	22	0	2	11	12	28.33	20	72.67%	60.33%	66.50%
Alternatives Possibilities		1	0	4	13	17	13	1	4	6	17	12	10			
		1	0	12	52	85	78	1	8	18	68	60	60	215	188	403
	%	0.33	0	4	17.38	28.33	26	0.33	2.67	6	22.67	20	20	71.67%	62.67%	67.17%
TOTALS		1	10	75	244	380	298	4	26	147	280	355	240	1300	1500	3000
														922	874	1796
														61.47%	58.27%	59.87%

* Weighted Score = RAW x Level

At Least One Year After the Course: Student Comments

Appendix B

Comment Area	Able to Indicate An Area Where Have Applied			No Evidence Understanding			Explain			1	2	3	4	5	6	1	2	3	4	5	6	Totals of 4-6 Story Transfer Male	Female
			%			%			%		Level of Transfer						Level of Transfer						
Clear	M	20	50				M	0	100	Nos Chosen	0	5	2	5	4	3	1	2	5	6	2	5	12	13
Mental Label	F	20	50				F	0	100	R Score x Weight	0	10	6	20	20	18	1	4	15	24	10	30	58	64
Total		40	100							% of Total Poss	0	8.33	5	16.67	16.67	15	.83	3.33	12.3	20	8.33	30	19.33	21.33
Analysing &	M	17	42.5	M	0		M	2	5		0	1	2	6	5	1	1	0	5	6	3	4	12	13
Synthesing	F	17	42.5	F	0		F	1	2.5		0	2	6	24	25	6	1	0	15	24	15	24	55	64
Total		34	85							% of Total Poss	0	1.67	5	20	20.83	5		0	12.3	20	12.5	20	18.33	21.33
	M	17	42.5	M	0						0	1	1	4	6	7	0	1	2	4	3	10	17	17
Instructions	F	19	47.5	F	1	2.5					0	2	3	16	30	42	0	2	6	16	15	60	88	91
Total		36	90							% of Total Poss	0	1.67	2.50	13.33	25	35	0	1.67	5	13.33	12.5	50	29.33	30.33
	M	19	47.5				M	1	2.5		0	2	1	10	4	2	0	0	3	8	1	3	16	12
Comparing	F	14	35				F	0	0		0	4	3	40	20	18	0	0	9	32	5	18	78	55
Total		33	82.5							% of Total Poss	0	3.33	2.50	33.33	16.67	15			7.5	26.67	4.17	15	26	18.33
Alternatives/	M	17	42.5	M	1	2.5	M	3	7.5		0	1	1	8	6	2	0	1	7	7	3	3	16	13
Possibilities	F	18	45	F	0		F	0			0	2	3	32	30	12	0	2	21	28	15	18	74	61
Total		35	87.5							% of Total Poss	0	1.67	2.5	26.67	25	10	0	1.67	17.5	23.33	12.5	15	24.67	20.33
Comments M100	M	90	90	M	1	1	M	6	6														73	68
Total F100	F	88	88	F	1	1	F	1	1														353	335
Overall 200		178	89																			Weight % of Total Weights (1500)	23.53	22.33
Sences (Additional Comments)										No Chosen	0	0	1	1	1	3	0	0	1	2	0	1		
										Weighted	0	0	3	4	5	18	0	0	3	8	0	6		
													2.50	3.33	4.17	15			2.56	6.67	0	5		

Students Choosing High Scores (3 or 4) For Interest and Help in Teaching Groups and Modules in the Same Curriculum Area

Appendix C

Males

	Interesting										Helpful									
T.Sp	01	07	08+	47	54	76	83	86	Scores	%	01	07	08+	47	54	78	83	86	Scores	%
1 PR1	3	6	9	7	3		3	3	34	24.6	4	4	10	2	3	1	2	3	29	23.57
2 WW1	6	6	5	4	2		2	3	28	20.3	4	4	4	4	7	1	3	3	33	26.82
3 WW2	2	4	4	3	5		5	2	25	18.1	1	3	5	1	5	1	3	0	21	17.07
4 PR2	6	6	6	5	2		3	3	31	22.5	2	2	4	4	3	1	3	2	21	17.07
5 WW3	4	6	4	2	0		2	2	20	14.5	2	4	3	2	2	1	5	0	19	15.44
Score	21	28	28	21	12	0	15	13	138		13	22	26	13	20	5	16	8	123	
% of Group	13.13	29.5	20.7	22.1	12	0	14.29	17.33			8.13	23.2	19.3	13.7	20	7.7	15.2	10.07		

Students Choosing High Scores (3 or 4) For Interest and Help in Teaching Groups and Modules in the Same Curriculum Area

Females

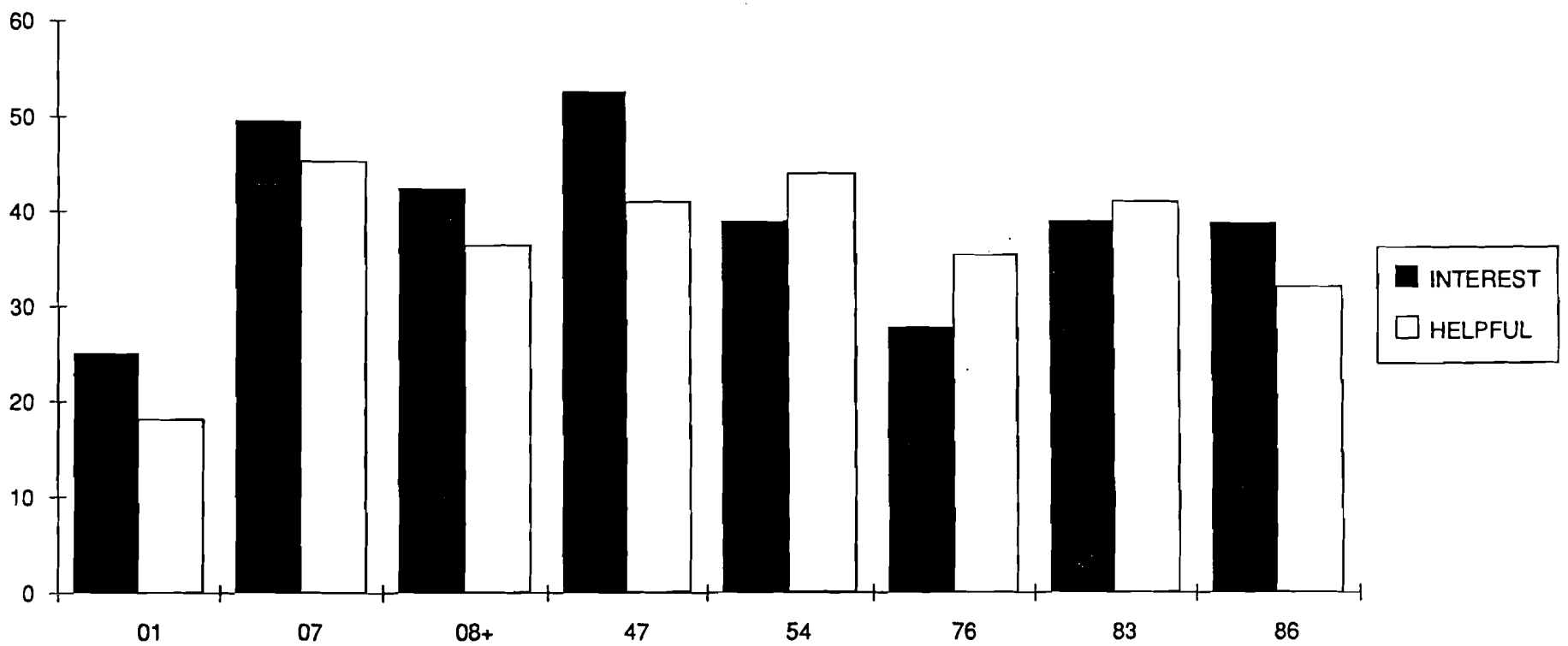
	Interesting										Helpful									
T.Sp	01	07	08+	47	54	76	83	86	Scores	%	01	07	08+	47	54	78	83	86	Scores	%
1 PR1	8	6	4	7	8	15	8	4	60	31.1	6	6	4	2	7	10	6	5	46	27.50
2 WW1	5	2	8	4	6	8	6	6	45	23.3	4	4	6	3	7	8	6	5	43	25.70
3 WW2	2	2	6	3	7	6	4	2	32	16.6	2	3	5	1	6	6	3	1	27	16.18
4 PR2	2	5	4	5	6	7	6	1	36	18.7	2	6	4	4	4	6	6	3	35	20.95
5 WW3	0	3	2	3	0	3	6	3	20	10.4	3	2	2	2	0	5	5	2	21	12.57
Score	17	18	24	22	27	39	30	16	193		17	21	21	12	24	35	26	16	167	
% of Group	10.6	20	17.8	23.16	27	60	28.6	21.3			10.6	22.1	15.6	12.6	24	53.85	24.8	21.3		
n x 5 =	32 160	19 95	27 135	19 95	20 100	13 65	21 105	15 75			32 160	19 95	27 135	19 95	20 100	13 65	21 105	15 75		

Evaluation Questionnaire: 2+ Years After the Course

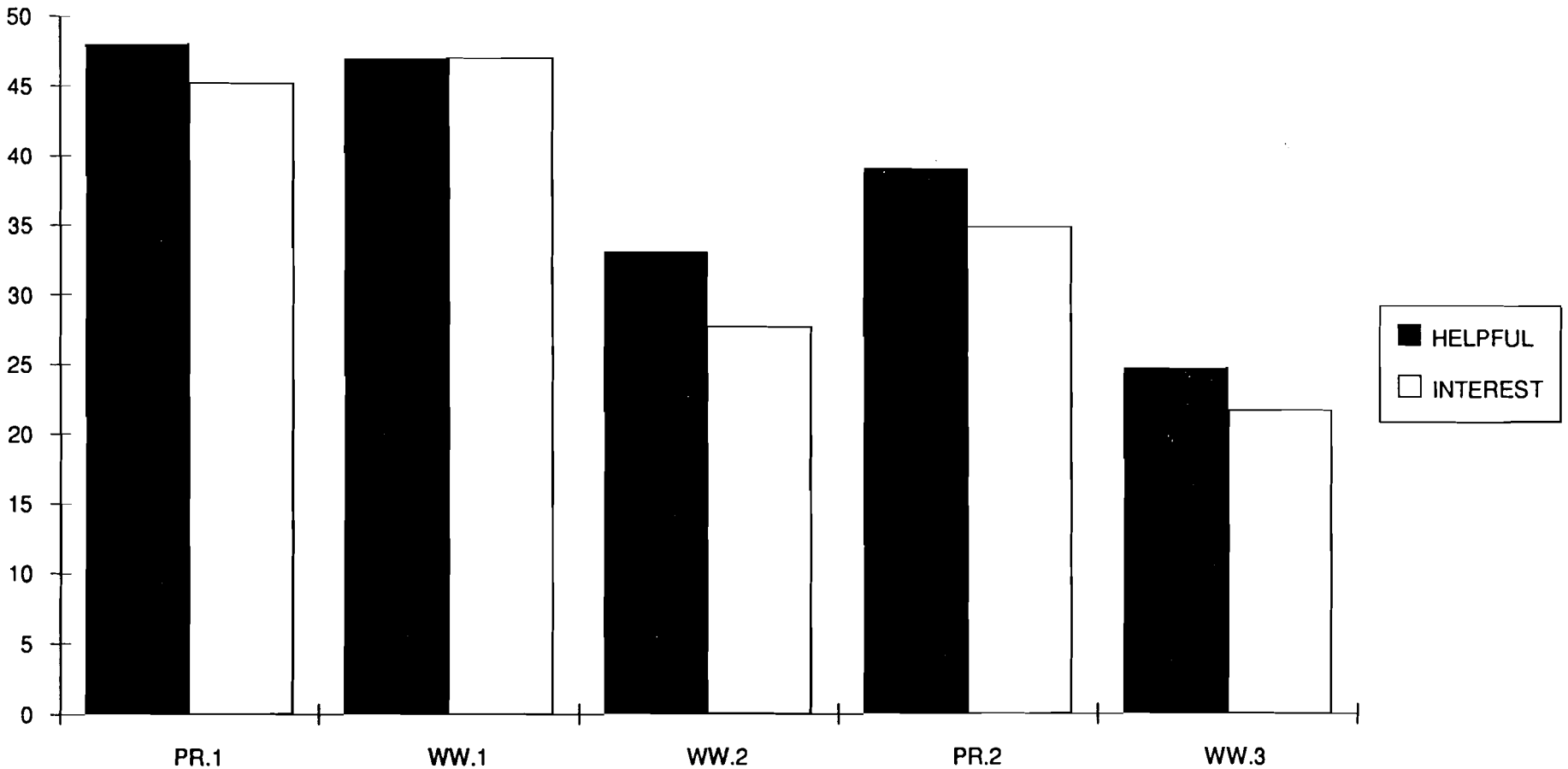
Appendix D1

The Times	Scores 3/4 Chosen		Dull - Interesting 01	67	08+	47	54	76	83	86	Total Scores	%
1.	Personal Relationships	1	10	12	12	16	11	04	09	07	81	48.8
2.	Wider World (World Religion)	1	12	09	14	14	08	04	08	09	78	46.99
3.	Wider World (World Religion)	2	04	06	11	04	13	04	09	04	55	33.13
4.	Personal Relationships	2	10	11	11	11	07	03	08	04	65	39.16
5.	Wider World (World Religion)	3	04	09	08	05	00	03	07	05	41	24.70
	TOTALS		40	47	56	50	39	18	41	29	320	
	%		25	49.47	42.42	52.63	39	27.69	39.05	38.67	38.55	
	Possible Maximum		160	95	135	95	100	65	105	75	830	
	Group Numbers		32	19	27	19	20	13	21	15	166	

% OF STUDENTS BY TUTOR/TEACHING GROUPS WHO CHOSE HIGH (3/4) SCORES. TWO PLUS YEARS AFTER THE COURSES. IN THE SAME CURRICULUM AREA.



% OF STUDENTS WHO CHOSE HIGH SCORES IN THE SAME CURRICULUM AREA. PERSONAL RELATIONSHIPS 1 & 2, WIDER WORLD 1 (LOCAL COMMUNITY), WIDER WORLD 2 & 3 (A MAJOR WORLD RELIGION).

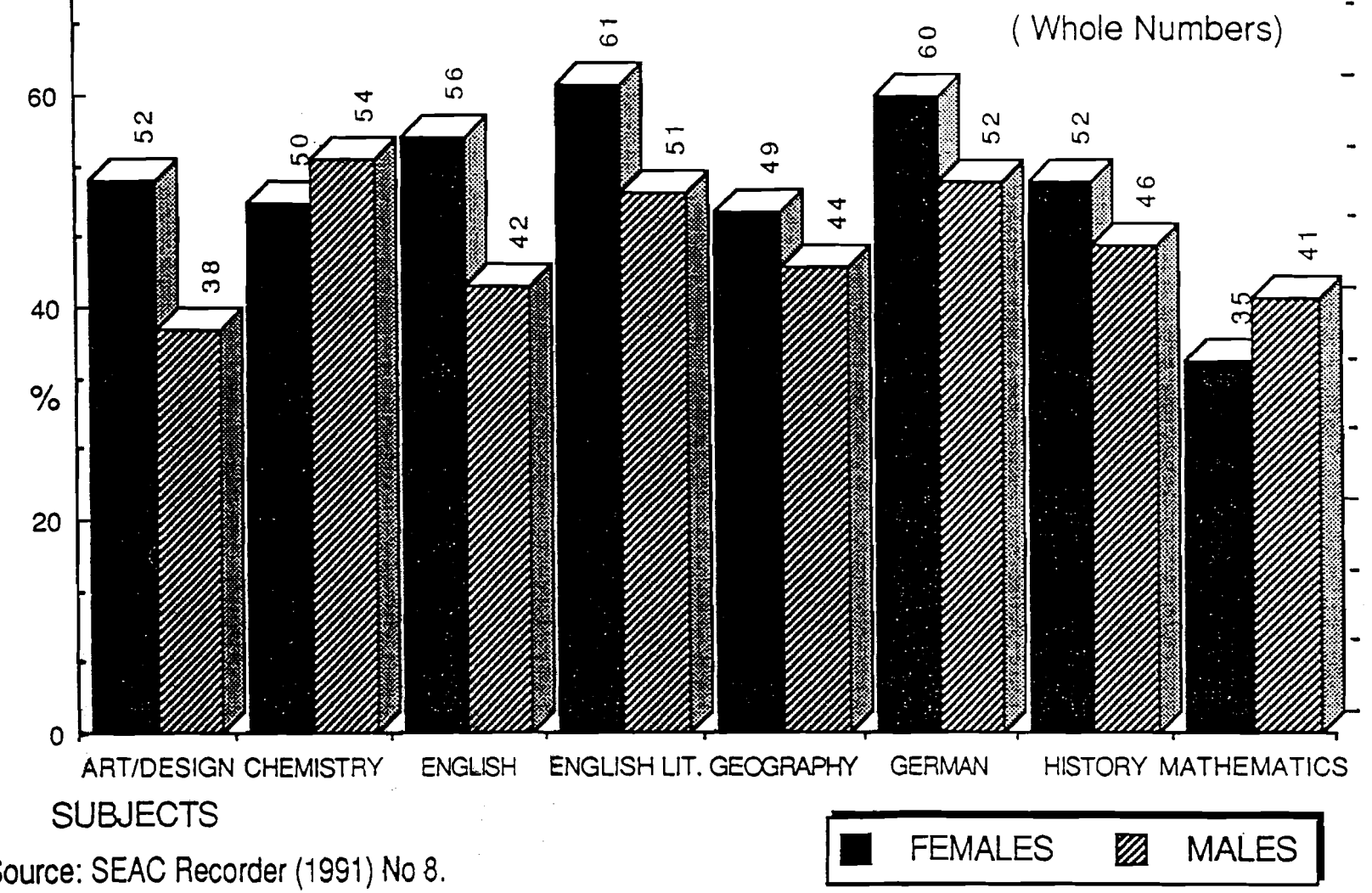


APPENDIX F.

APPENDIX G

PERCENTAGE OF FEMALES AND MALES ACHIEVING GCSE GRADES A-C 1989.

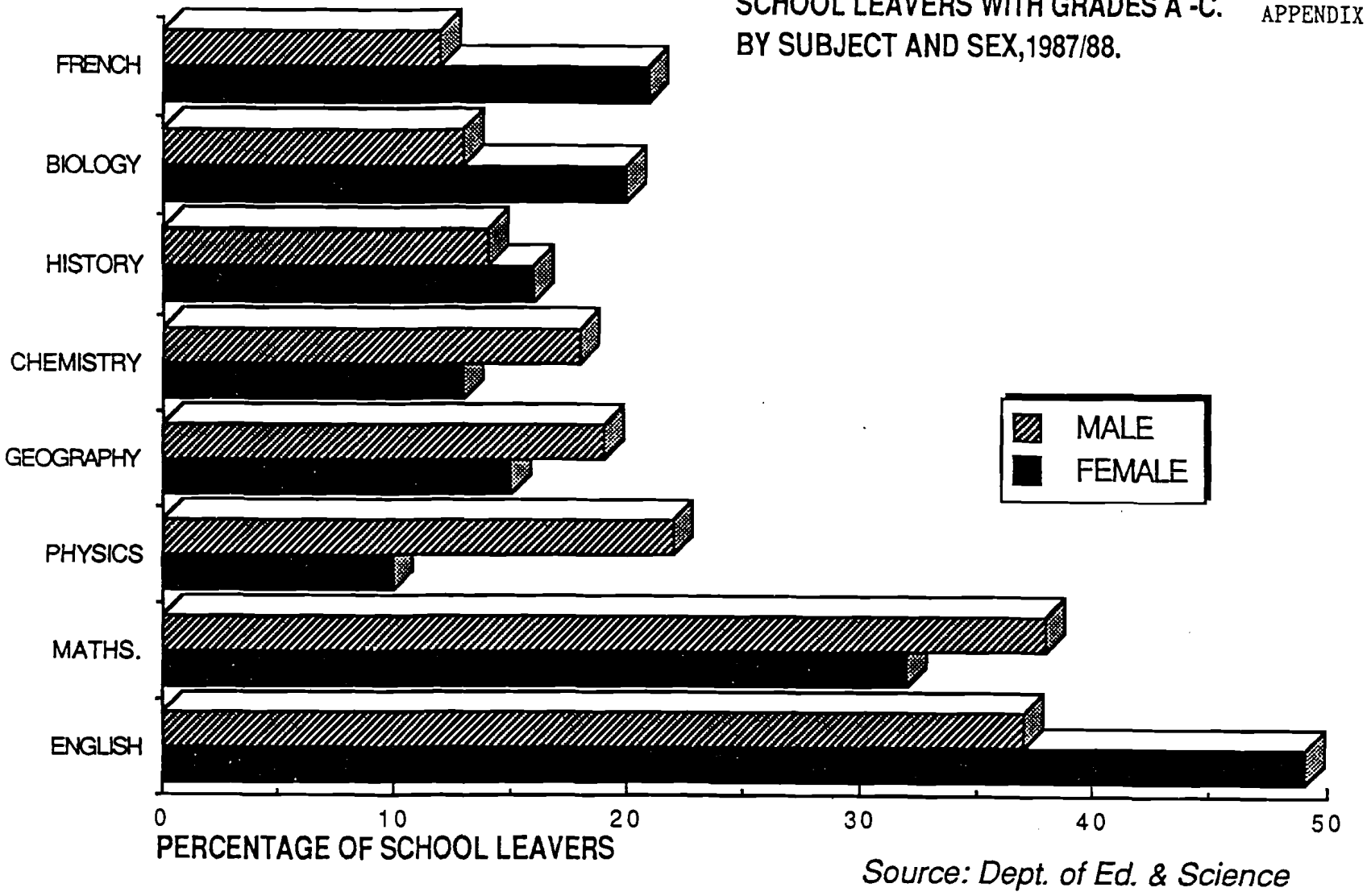
(Whole Numbers)



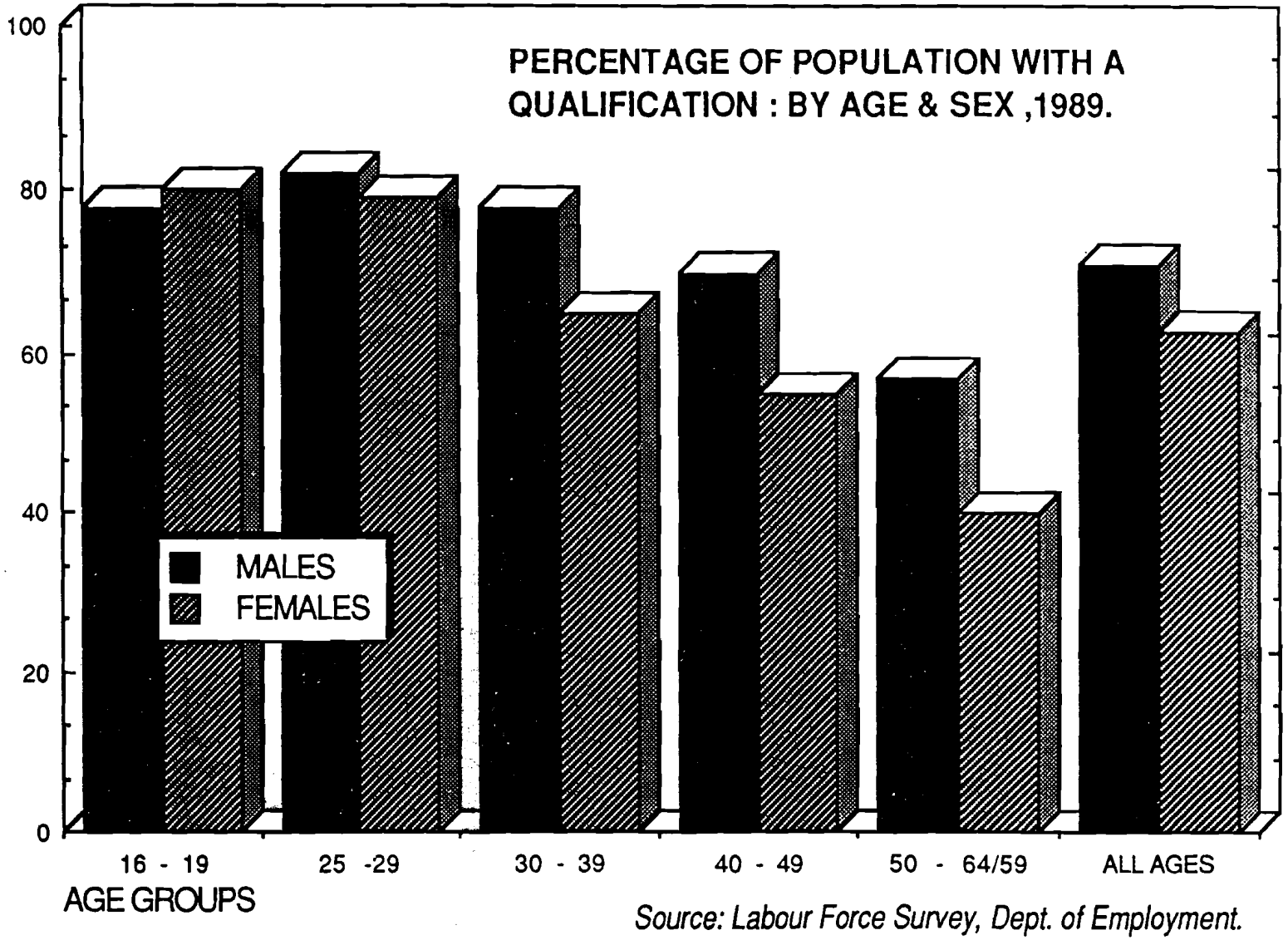
Source: SEAC Recorder (1991) No 8.

APPENDIX H

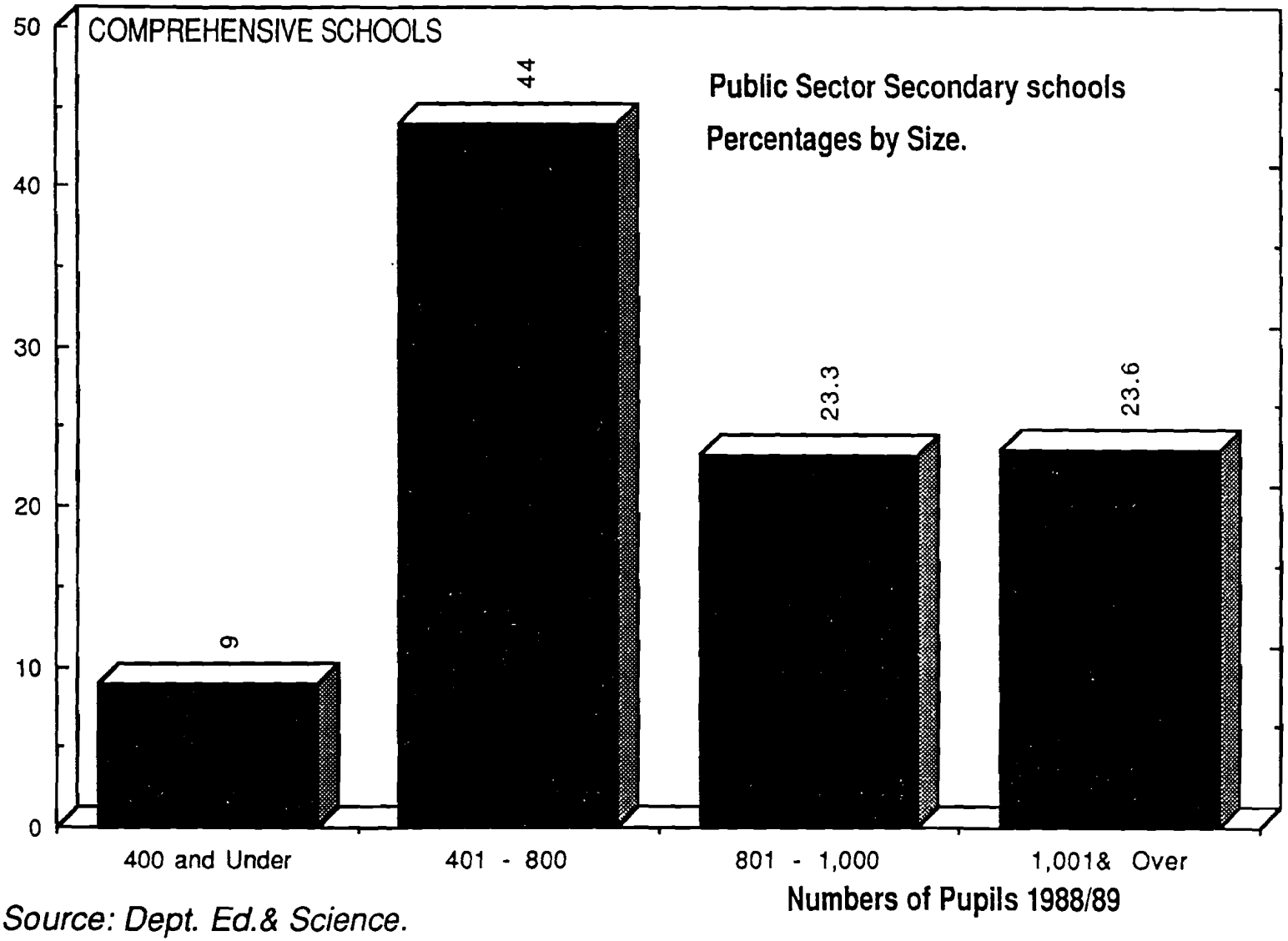
SCHOOL LEAVERS WITH GRADES A -C. BY SUBJECT AND SEX,1987/88.



Source: Dept. of Ed. & Science



Source: Labour Force Survey, Dept. of Employment.



Source: Dept. Ed.& Science.

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

APPENDIX N

INTERVIEWEE ..... No....

DATE .../.../19... INTERVIEWER ..... No... ...

PERSONAL BACKGROUND

1. Personal Philosophy of Teaching

2. Previous Experience in the Problem Solving, Study/Learning/Thinking o allied areas.

3. Preparation for S.T.S.C. lessons.

4. Preconceptions of the course.

5. Problems.

THE LESSONS.

a. Stucture of the lessons.

b. Atmosphere/ Group Responses.

c. Achivement of Your Objectives.

d. Students Sharing the Objectives.

e. Transfer and Generalisation.

f. The Materials.

g. Student Recording/Self Assessment.

DISCUSSIONS IN THE COURSE.

i. The Roles you had to fulfill.

ii. Roles Students had to undertake.

iii. Your Interactions.

iv. Small Group/Shared Work.

MEDIATION.

A. Intentionality/ Reciprocity.

B. Meaning.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

D. Confidence and Self Esteem (Competence).

E. Appropriate Difficulty and Complexity (Challenge).

F. Sharing Behaviour.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

FUTURE.

1. Educational/Social Value.

2. Validity in the use of Time, Personel and Other Resources.

3. Place in the Curriculum.

QUEEN ELIZABETH'S SCHOOL

LEARNING PROFILE

Name of Student..... Class.....

Name of Staff.....

Department.....

Theme/Module/Topic.....

verall aim of the module:

LEVEL OF ACHIEVEMENT

WORK AND SKILLS COVERED	Date Work Finished	I made a little progress ←					I understand this & developed my own ideas →	COMMENT
(1)								
(2)								
(3)								
(4)								
(5)								

ATTENDANCE

GENERAL COMMENT

ASSESSMENT OF CROSS-CURRICULAR SKILLS

. Attitude to Learning:	
. Study Skills	
. General Economic awareness:	
. Communicate Effectively:	
. Work with others effectively:	
. Understanding of the World of Work:	
. Effective Personal interpersonal skills:	
. Solve Problems:	
. Deal Positively with Change:	

f Assessment

ed..... Signed.....

(Student) (Teacher)

e..... Date.....

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

INTERVIEWEE .....MASSIE.....Tape1...B..... No..25...

DATE .6/.3./1991. INTERVIEWER .....STEPHEN..... No..36...

PERSONAL BACKGROUND

1. Personal Philosophy of Teaching Development of the whole child
Personal Development Plan.

2. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas. Not alot of experience, Recent (2yrs)

3. Preparation for S.T.S.C. lessons. Book (Teachers Notes) Good, Time was the factor that caught out.
Basic Instruction giving. Needed Formal Training, Relied Totally on the notes.

4. Preconceptions of the course. Not seen together as a group.
None.

5. Problems.
Last minute T.T. problem how I came to teach it, "Have a go approach"

THE LESSONS.

a. Stucture of the lessons. Stick to T. Notes.

b. Atmosphere/ Group Responses.

c. Achivement of Your Objectives. Yes.

d. Students Sharing the Objectives. Yes.

e. Transfer and Generalisation.

f. The Materials.

g. Student Recording/Self Assessment.

DISCUSSIONS IN THE COURSE.

h. The Roles you had to fulfill.
DISTINCTIVE MATERIALS AND SKILLS

i. Roles Students had to undertake.

iii. Your Interactions.

iv. Small Group/Shared Work.

MEDIATION.

A. Intentionality/ Reciprocity.

Not really trained to answer this area.

B. Meaning.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

D. Confidence and Self Esteem (Competence). Built up, but limited to 6 week Block of 35mins. per week.

E. Appropriate Difficulty and Complexity (Challenge).

F. Sharing Behaviour.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

FUTURE.

1. Educational/Social Value. Yes, can see other areas of the curriculum Need Block of S.T.S.C. links to other areas. Staff must make the Transfer and Generalisation — Coherence.

2. Validity in the use of Time, Personel and Other Resources. To justify this it needs to be internalized by staff teaching this different learning style.

3. Place in the Curriculum. Need to TRAIN STAFF. Suggest Techniques in a

Discussion of How to Train Staff.

1. Two or Three to have 1st hand training
2. Wk. Shops.
3. Volunteers on Training Day
4. Evaluation of success or otherwise.
5. Must be a structured approach.

IV

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

INTERVIEWEE ...Joan..... [Not Typed]. No..92.

DATE 30./1../19.91 INTERVIEWER ....S.Tephens..... No..36..

PERSONAL BACKGROUND

. Personal Philosophy of Teaching

Meeting the needs of the students, Student centered.

2. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas.

With younger children - Maths Training, Lateral Thinking and Ophons types of training. 1st time STSC.

3. Preparation for S.T.S.C. lessons.

Read Booklet, Tried the activities myself. (Bunny Run). Found this easy.

4. Preconceptions of the course.

Thought that I would enjoy the course.

5. Problems.

Felt rather out on the limbs." Needed INSET. More depth of training needed Context of world origins threw some students, Closed doors of some never opened.

THE LESSONS.

a. Stucture of the lessons.

Introduction, Sheets, small groups.

b. Atmosphere/ Group Responses.

Initial Interest - novel approach maintained the interest. Some students were confused by lack of structure.

c. Achivement of Your Objectives.

Yes on the whole.

d. Students Sharing the Objectives.

Yes.

e. Transfer and Generalisation.

Not followed up. This was found to be difficult.

f. The Materials. Good, efficient and effective, some were a "little childish"

g. Student Recording/Self Assessment.

Easy as others doing it (with school context) Not the depth hoped for

DISCUSSIONS IN THE COURSE. No Results.

h. The Roles you had to fulfill.

I Fitted in well with

i. Roles Students had to undertake.

Social Learning good. The language of the sheets of some sheets the lower ability could not get at first. So were

to getting into the course. soon.

iii. Your Interactions.

everyone could be right.

iv. Small Group/Shared Work.

Problems, but useful educationally/socially in Listening skills.

MEDIATION.

A. Intentionality/ Reciprocity.

Yes. Clear in my mind

B. Meaning.

Clarify this for all groups this was the key to the lessons for me.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

Yes there was some, students were "not-thinkered."

D. Confidence and Self Esteem (Competence).

Yes. Everyone could shine, higher ability still room to stretch them.

E. Appropriate Difficulty and Complexity (Challenge).

Patterns Good. You could guess to use the appropriate one for group levels.

F. Sharing Behaviour.

This happened and seemed to improve.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

Some very different responses, had some surprises

FUTURE.

1. Educational/Social Value.

Yes: Thinking differences and processes, must have in the curricul the meta cognition processes

2. Validity in the use of Time, Personel and Other Resources.

Yes. There should be more time.

3. Place in the Curriculum. Students Remember 12 months Later.

UEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

NTERVIEWEE .....Stephen..... N No..3.6...

ATE 8./.3/19.91 INTERVIEWER ..... No.45...

PERSONAL BACKGROUND

. Personal Philosophy of Teaching Facilitating student development.

3rd Time through - STSC.

. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas. Some on previous learning skills courses.

. Preparation for S.T.S.C. lessons. Went on the 2 courses of the S.T.S.C. & Gretor.

. Preconceptions of the course.

Felt it was a little paper based

. Problems.

Metacognition : a new psychological concept for me and Q-E-S.

THE LESSONS.

. Stucture of the lessons.

Good structure & notes, if you look and bear in mind the Transfer and Generalisation of note.

. Atmosphere/ Group Responses.

Good, active and involved.

. Achivement of Your Objectives.

Yes, Sometimes my aim was hazy.

. Students Sharing the Objectives.

Yes but sometimes I forgot to do this (found it helped when worked

. Transfer and Generalisation.

Set homeworks which was to relate the lesson, find example etc.

. The Materials. This worked well.

Good on the whole. efficient - & cost effective.

. Student Recording/Self Assessment.

We may as all in school were doing it.

DISCUSSIONS IN THE COURSE.

. The Roles you had to fulfill.

Took time to develop the mediation role.

i. Roles Students had to undertake.

They filled & well as (leader of) gp. - partner. etc.

Stephen.

iii. Your Interactions.

Good on the whole. Sometimes I was 'steering' rather to a set answer

iv. Small Group/Shared Work.

Went well, easy to change aspects go on to next if activity slow - Peter helped.

MEDIATION.

A. Intentionality/ Reciprocity.

Yes. 2nd time through I was much more confident

B. Meaning.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

This was often hard work all round. But developed T. e g.

D. Confidence and Self Esteem (Competence).

Seemed to help those who were lacking.

E. Appropriate Difficulty and Complexity (Challenge).

Yes you could extend those with high ability and yet not patronize the lower ability. Lots of experiences to relate.

F. Sharing Behaviour.

Improved over the eight weeks.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

Better later, difficult to forecast those who would be 'phased' by the approach

FUTURE.

1. Educational/Social Value.

High

2. Validity in the use of Time, Personel and Other Resources.

Must have meta cognition in

3. Place in the Curriculum. Suggest Tutorial Work. Inset.

N

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

INTERVIEWEE .....John...Tape 1...0.-..... No..23...

DATE .5./.3./1991 INTERVIEWER .....Stephen..... No.36...

PERSONAL BACKGROUND

1. Personal Philosophy of Teaching
Students to Achieve as much as possible

2. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas. Not specifically, but Geography problem solving experience.

3. Preparation for S.T.S.C. lessons. Took about 1 hour, to work through really my self preparation. Much better 2nd time.

4. Preconceptions of the course. 1. I'm sold on the idea, 2. PRE-Nervous at the same time.
3. Good Material backup. 4 Needed Confidence.

5. Problems. Really about timing the lesson.

THE LESSONS.

a. Stucture of the lessons. Tailored to the group. Able to do this.

b. Atmosphere/ Group Responses. Pleased,

c. Achivement of Your Objectives. Yes.

d. Students Sharing the Objectives. Yes, always do as part of my teaching approach.

e. Transfer and Generalisation. Felt this was easy

---

f. The Materials. Liked by the students.

g. Student Recording/Self Assessment. Could not remember.

DISCUSSIONS IN THE COURSE.

i. The Roles you had to fulfill. Preparation (not a specific Aim) and teach notes.

ii. Roles Students had to undertake.
Group work.

iii. Your Interactions.

iv. Small Group/Shared Work.

MEDIATION.

A. Intentionality/ Reciprocity.

B. Meaning. Asking Why questions.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

Cf. above.

D. Confidence and Self Esteem (Competence).

E. Appropriate Difficulty and Complexity (Challenge). Mechanical in parts, Time factor most important.

F. Sharing Behaviour. All shared L17, Family type of group. This went well.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

FUTURE.

1. Educational/Social Value. Social High. Group Works. Also in General Skills.

2. Validity in the use of Time, Personel and Other Resources.
Short Blast in other years, perhaps Tutorial as part of/General Skills.

3. Place in the Curriculum.
Parish week induction Course — Module for Staff - Teaching in Lower

N.

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

INTERVIEWEE ....Jass.....Tape..1-231..... No..86...

DATE .25/.2/1991 INTERVIEWER .....Stephen..... No..36...

PERSONAL BACKGROUND

1. Personal Philosophy of Teaching Student enjoyment — P.E. Context.
Transfer → life After School. Relevance.

2. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas. Not really, not confident in this area, Some experience in a previous taught course. But yes related to P.E.

3. Preparation for S.T.S.C. lessons. Basis of staff handbook.
Intro. Changed groups — 3/4 weeks. Time More share. of ideas from one group conscious of group dynamics.

4. Preconceptions of the course.
Horror, never thought of attempting this. Others confidence in share/be able to, willing to try. [More out second time around] Time limited

5. Problems.
Staff INSET, Problem with lesson — Good Questions, higher ability, turned off others. — the doubt.
More time required in a slot. 1hr. not coming.
Team Taught would have been good.

THE LESSONS.

a. Stucture of the lessons. some went well
Some not go very well, Selection of materials, abstract not, [back up] use of initiator.
Bridging.

b. Atmosphere/ Group Responses.
[Good response]. covered above

c. Achivement of Your Objectives.
Profile confirmed tentative view of interviewee,

d. Students Sharing the Objectives.
2nd time round objectives shared, more confident.

e. Transfer and Generalisation.
Key. — Every element, really on a winner.

f. The Materials.
Fine, but could distract from main point. (Informal talk comes through here)
Social Difficulties Problem: 1st Run [would have been better 2nd Run]. Social Interaction.

g. Student Recording/Self Assessment.
Good, support of Interviewee.

DISCUSSIONS IN THE COURSE.

h. The Roles you had to fulfill. Initial motivator. It was a new approach. Introduction.

i. Roles Students had to undertake.

Jan.

iii. Your Interactions.

iv. Small Group/Shared Work.

Stephen drawn in

MEDIATION.

A. Intentionality/ Reciprocity. Not a problem

Introduction

B. Meaning.

Profiles,

C. Cognitive Processes; Transfer and Generalisation (Transcendence).

D. Confidence and Self Esteem (Competence).

Took some time to build

E. Appropriate Difficulty and Complexity (Challenge).

Very variable. To hard, to easy.

F. Sharing Behaviour.

Never a problem with talk, share expectation at the end of the lesson to report back, Jan. share.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

FUTURE.

1. Educational/Social Value.

✓

2. Validity in the use of Time, Personel and Other Resources.

30 mins not enough time, broke it up, no continuity.

3. Place in the Curriculum. At the right time do early in yr. 9. Tutors

IV.

QUEEN ELIZABETH'S : SOMERSET THINKING SKILLS COURSE - STAFF EVALUATION.

INTERVIEW TOPICS.

INTERVIEWEE ...Simon.....Tape 1..A...238. - 439 No..37...

DATE .10./.2./1991. INTERVIEWER .STEPHEN..... No.36....

PERSONAL BACKGROUND

1. Personal Philosophy of Teaching INDIVIDUAL EXPERIENCE, STRUCTURED ENVIRONMENT. INDIVID. LEARNING. MIXED ABILITY.

2. Previous Experience in the Problem Solving, Study/Learning/Thinking or allied areas. NOT TEACHING - 25 of T. Table, Rather School Management.

3. Preparation for S.T.S.C. lessons.
Read book, Instructions - make source, only when did it - the classroom. 1st Module - Pilot broken.

4. Preconceptions of the course.
Starting year? Group interaction.

5. Problems.
Time.

THE LESSONS.

a. Stucture of the lessons.
Developed - sheets discussion, Difficult to find who taking these sheets so seriously. Students

b. Atmosphere/ Group Responses.

c. Achivement of Your Objectives.
Did achieve,

d. Students Sharing the Objectives.
Totally.

e. Transfer and Generalisation.

---

f. The Materials. - leading questions, here is a new picture.
Done more, needed more challenge. Sequence. less random.

g. Student Recording/Self Assessment.
Recording self assessment.

DISCUSSIONS IN THE COURSE.

h. The Roles you had to fulfill.
To watch up front.

i. Roles Students had to undertake.

iii. Your Interactions.

iv. Small Group/Shared Work.
2d module, they know one abetter, not going deeply at face value.

MEDIATION.

A. Intentionality/ Reciprocity.
Difficult.

B. Meaning.
Age. do they know how they think?.

C. Cognitive Processes; Transfer and Generalisation (Transcendence).
What all about.

D. Confidence and Self Esteem (Competence).
Group work, Very helpful.

E. Appropriate Difficulty and Complexity (Challenge).

F. Sharing Behaviour.
Normative exercise, did positively assist.
all on same ground.

G. Individual and Psychological Differentiation. (Different/Divergent Responses).

FUTURE.

1. Educational/Social Value.
Eg. interaction, More overt progression. — "I left it to mid air.

2. Validity in the use of Time, Personel and Other Resources.
Good use, For all students, Institutional Validity.
Full commitment to what doing - intellectual.

3. Place in the Curriculum. compared to say Islam.

REPORT ON PILOT STUDY

S J PETTIFER,

DORSET INSTITUTE OF HIGHER EDUCATION,

COMMUNICATIONS AND MEDIA DEPARTMENT.

Tutor's: Prof T Wheeler and Dr A Campbell

Aim: Study of student's performance after the intervention of a thinking skills programme.

Objectives:

1. Using the first module of the Somerset Thinking Skills Course, Blagg H, et al, Basil Blackwell/Somerset County Council, 1988 — provide an opportunity for "gifted" students to "learn to learn" (Metacognition) by developing students' cognitive resources and strategies.

2. To measure any change in thinking abilities.

3. Indicate areas for development from this pilot study.

Hypothesis: That the independent variable, the STSC module one will have an effect of increasing scores on non-verbal IQ tests. That the variable is sufficiently robust for the change to happen within the general milieu of an urban Upper Secondary School with the major constraints of time, staffed by individuals from various academic backgrounds lacking experience and training in the STSC. Further that this effect will be independent of the intellectual ability of the students selected.

Introduction: Somerset Thinking Skills in the context of metacognition.

Interest in the area of metacognition has expanded from an initial focus on memory associated with Flavell (1971) to a much wider spread of investigation. As exemplified by the work of Gagne and Dick (1983) who noted the increasing contributions coming from research in the broad domain of cognitive psychology. Schmitt and Newby (1976) contended that this work would effect methods of teaching and thus would move practice away from a prescriptive instructional approach. They went on to argue that incorporating metacognitive aspects into what has been described as the conditions of learning (Glaser, 1976) would enhance instruction and result in higher competencies which would involve strategic, self-controlled behaviour and the ability to adapt, thus transcending more mundane skill orientated behaviour. Strategic behaviour is defined as having the characteristics of intentionality and purpose on the part of the learner, that is they deliberately select, control and monitor their strategies to achieve their desired goals or objectives (Keller, 1983: Paris, et al, 1983).

Metacognition is defined as the awareness and knowledge of one's own cognitive processes (Flavell, 1976) as well as the ability to monitor, regulate and evaluate one's thinking (Brown 1978) and for some time the term remained imprecise (Cf Bracewell, 1983), but with a more precise operational definition it provides a useful framework. Research on

Appendix O.

metacognition training has become popular with both developmental and process orientated psychologists, it is a meeting place between "cognitive processes" and "behaviour modification" (Meichenbaum, 1980). Educational technologists (Gagne, 1980), and theorists on intelligence (Cf Sternberg, 1979, 1985). Schmitt and Newby (1986) suggest that two independent phenomena are involved in metacognition: knowledge and regulation.

In the United States of America there are a number of cognitive skills programmes that claim to provide the materials to teach various component processes involved in intellectual activity. Sternberg whose triarchic theory of human intelligence emphasises environmental opportunity as a modifiable process rather than a fixed metric such as IQ conceptualises human intelligence. Bragg (1988) suggests that Sternberg has now developed new techniques for assessing intelligence and teaching critical thinking skills. Bragg et al (1988), after reviewing and comparing a number of these programmes came to the conclusion that the cognitive intervention programme which has attracted most attention and has been subject to the most research is Feuerstein's Instrumental Enrichment. The STSC course has been developed out of Somerset's experience in using IE. Some criticism has been levelled at this intervention programme by Bragg (1988) who contended that is only likely to be of use to students of more limited intellectual ability.

In the context of changing ideas about the nature of intelligence and learning, the clinical work of Feuerstein, inspired and influenced by Jean Piaget came to believe in the enormous plasticity and modifiability of the

human intellect and what a crucial role was played by significant adults in a child's cognitive development.

He emphasised direct exposure to a rich range of stimulants and that cognitive development was critically effected by mediation. In this process, features of the environment are emphasised, interpreted, extended and embellished, so ensuring that the child builds up an internal model of the world in which various acts of experience are related meaningfully.

"Thinking Skills" has become a general phrase to encompass many processes involved in learning and problem solving. Different researchers and specialists have emphasised different processes. There is no universally accepted taxonomy of cognitive processes. The literature tends to focus on two broad groups of teachable cognitive skills, that STSC calls COGNITIVE RESOURCES and COGNITIVE STRATEGIES. (C F Blagg et al 1988. Cf the Appendix for STSC's Problem-Solving Loop, which summarises their review and conclusions.)

Biggs (1985), based upon his previous work developed the concept of metalearning in study processes where he makes the distinction between other more basic metacognition and this more sophisticated kind. He developed Taylor's work (1984), on a personal study contract and quotes Taylor, (page 254):

"To make a study contract that has a reasonable chance of succeeding ... students need to be aware of their own ability in relation to the situational context."

So in his view the term metalearning is proposed here as a rather specialist application of metacognition to student learning. Metalearning is therefore a sub-process of metacognition, just like metamemory and metamotivation, that refer specifically to learning and study processes in Institutional Settings and particularly to students awareness of their motives and control over their strategy selection and deployment. Cf Biggs (1985, 1987). His findings led him to develop an Elaborated Model of Student Learning. So in answer to the problem of intervention, whether students learn anything from training to become better students, Biggs suggests that it depends on the students metalearning capability. He agrees with Wagner and Sternberg (1984) that:

"Emphasis on metacognition training does result in some degree of durability and transfer" (P 199).

Biggs goes on to suggest that the programme should not be about giving the tools but producing a level of self-awareness so that students can perceive what they want and how to get it, and if they are motivated to want them sufficiently, then he suggests that it is likely that they will become better learners. If this awareness cannot be erased we can still teach highly specific testing that is close to the task, but the determinant of the style of intervention is the metalearning capability. His recent work (1988) on the role of metacognition in intensive learning and assessment of student approaches to learning develops a major theme from Brown (1984) who suggested that metacognition may succeed where formal disciplines failed. Wagner and Sternberg (1984) suggest that metacognitive processes might be the direct target of schooling as they demonstrate a broader degree of

transfer than cognitive strategies on their own. However, they question the concepts of the metalearning level and the appropriate motivation. There seems to be a growing body of literature to be monitored further. It seems feasible of the many strands of cognitive psychology to pull the elements of Biggs, Sternberg and Feuerstein together with their talk of cognitive skills and cognitive strategies. The initial course of action would seem to be to establish whether the STSC has an effect on students' performance being carried out as it is, within an institution. Hence the rationale for this pilot study.

Method:

a) Subjects.

14 year old students in an upper secondary school, a year group of 350 in a school population of 1400, 13 to 18 years. We took samples of 118 students, with a Control group of 51 and an experimental group of 67. Class intervals on the standard age score of T' — 145+/130 : 129/115 : 114/100 : 99/85. The groups were divided into balanced cells on the basis of their gender.

b) The Test.

The T' which was the non-verbal battery of the Cognitive Abilities Test (Level F): Thorndike, R, and Hagen, E, standardised by France N, published by Nelson 1973.

T^2 was the Figure Reasoning Test. Daniels, J C, Crosby, Lockwood. 1949.

The choice of the tests were in part to respond to the convenience of using existing vehicles within the institution, to encourage direct comparisons of results by teaching staff as well as to avoid the multiplicity of testing with its attendant methodological drawbacks and ethical considerations. T^1 was given by a non-participating trained member of staff within a general institutional wide enquiry into "gifted" students. These enquiries were made within the higher ability mathematics and english sets of the year population in question (they are taught and allocated by ability).

c) The Independent Variable.

The STSC module one was then participated in by the students led by the four members of staff, each with varying backgrounds but having a positive approach. This took place in the summer term of 1989 for 10 weeks, one 35 minute period per week (maximum time was therefore 5 hours and 50 minutes). The groups were selected on the basis of maths/english ability groups. The staff were only briefly able to familiarise themselves with the course and training.

d) The Second Test.

This test was administered by two members of staff at the end of the course.

e) The Results.

The results were then tabulated and entered into the SPSS/PC+, the statistical package for the IBMPC's.

Results (Please consult appendix)

1. The sample was skewed. On Test 1 the mean of the sample was 118.1548 with a standard deviation of 7.210 and a standard error of 0.787, therefore, 68.5% approximately of the sample fell between the scores of 110.9448 and 125.3648.

2. The overall mean difference between T^1 and T^2 was only 1.0714 which was not high enough to reject the Null hypothesis, the standard error was 0.842, the standard deviation 7.713 with a two-tail probability of 0.001, the correlation 0.369.

3. When, however, the mean scores were taken of the lower scoring cells (N=24) this gave a mean on Test 1 of 109.333, standard deviation of 4.249, and a standard error of 0.867. On the T^2 the mean was 113.4583, standard deviation of 5185, and a standard error of 1.120.

4. The difference mean was now -4.1250, with a standard deviation very similar to 2 above, a standard error of 1.518, but with a two-tail probability of 0.472 and a T value of -2.72. The correlation was now -0.154 giving some indication that larger and lesser scores were nearer together than for the whole group.

Discussion

a) Although the STSC did not have an observable effect for the whole sample, those of the sample who registered nearer the population median, this independent variable did seem to have some effect.

b) We should note that the intervention in such a way was a very stringent test of the STSC materials because of

1. The extremely limited time overall: The staff further reported that the 35 minute session made it difficult to mediate and carry out full group discussion. Both important aspects of the course (Blagg, 1988). In the full research programme we have negotiated 9 hours 20 minutes in 70 minute periods.

2. The staff were untrained and inexperienced. Some training has been undertaken and experienced gained!

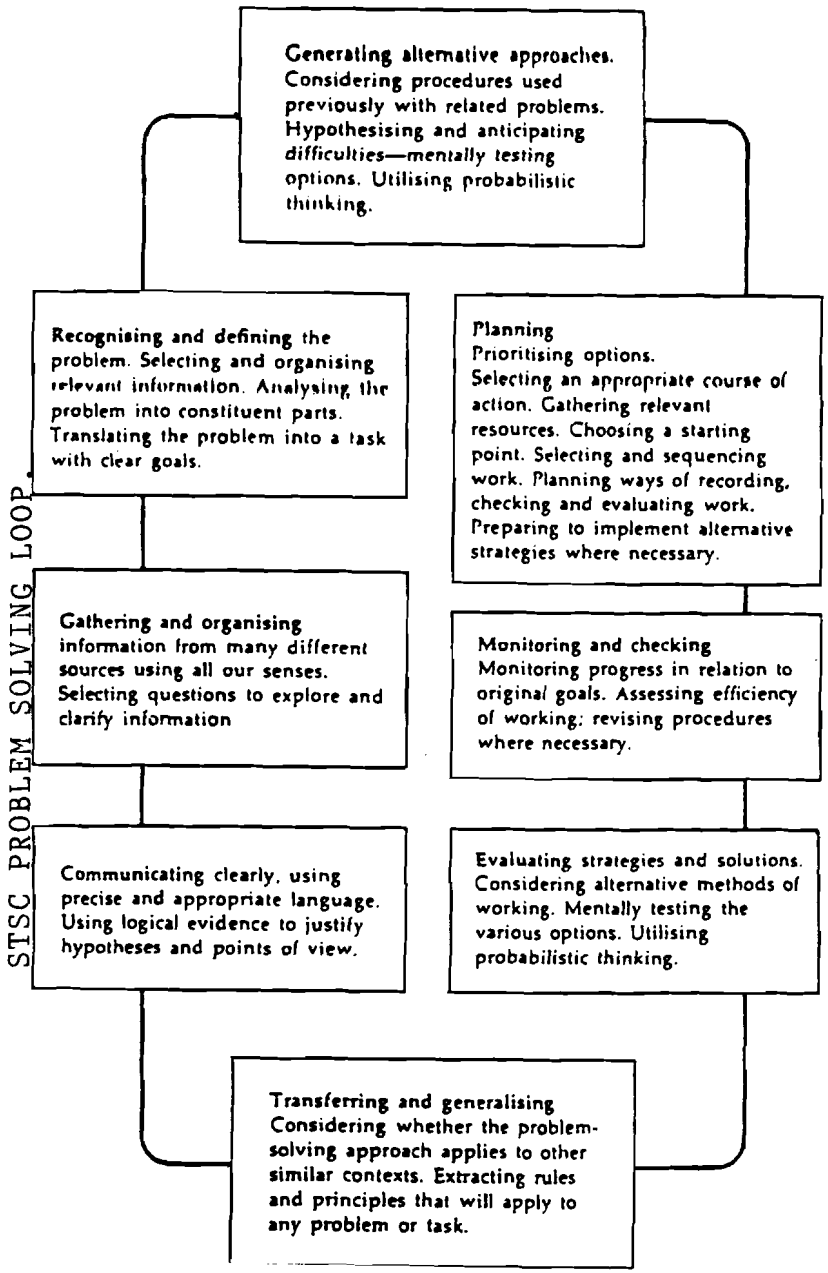
3. The idea of mediation as a teaching methodology was only superficially considered by the staff until well into the course.

4. Because of the skewed nature of the sample with a high proportion of students scoring at the very highest point, a "ceiling" effect was observed.

5. The measures and methodology seemed to have provided a robust tool for a whole year group population research.

6. Participants were strongly of the view that teaching in mixed ability groups would be more realistic and a positive attribute towards adopting the STSC innovation. Their reasons pertained to the immediate history and projected future of the school.

7. Biggs (1987) research may add a further refinement to the study looking as it does at student motivation and Locus of control. Non-quantitative methods such as repertory grid techniques could also be considered alongside the existing measures. It does seem rather invidious to be seeking to develop thinking skills and not have students involved in the valuation and reporting back except in a rather ad hoc fashion.



STSC PROBLEM SOLVING LOOP.

Blagg, N. 1988. STSC Handbook. BLACKWELL.

SPSS/PC+ The Statistical Package for IBM PC

```
GET /FILE 'qel.sys'.
The SPSS/PC+ system file is read from
    file qel.sys
The file was created on  6/24/89 at 11:11:37
and is titled SPSS/PC+ System File Written by Data Entry II
The SPSS/PC+ system file contains
    115 cases, each consisting of
      9 variables (including system variables).
      9 variables will be used in this session.
-------------------------------------------------------------------------------
Page   2                              SPSS/PC+                          6/24

This procedure was completed at 11:45:33
-------------------------------------------------------------------------------
Page   3                              SPSS/PC+                          6/24

SELECT IF (COGABIL LE  130).
-------------------------------------------------------------------------------
Page   4                              SPSS/PC+                          6/24

T-TEST /PAIRS COGABIL FIGREAS.
The raw data or transformation pass is proceeding
     86 cases are written to the uncompressed active file.
-------------------------------------------------------------------------------
Page   5                              SPSS/PC+                          6/24


Paired samples t-test:  COGABIL   IQ on Cognitive Abilities
                        FIGREAS   IQ on Danial NV Reason

Variable     Number                    Standard    Standard
           of Cases      Mean         Deviation     Error

COGABIL         84    118.1548          7.210       .787
FIGREAS         84    117.0833          6.481       .707


(Difference) Standard    Standard  3        2-Tail 3    t     Degrees of  2-Tai
     Mean    Deviation     Error   3  Corr. Prob.  3   Value     Freedom   Prob
                                   3               3
    1.0714      7.713       .842  3   .369  .001  3   1.27        83       .207
-------------------------------------------------------------------------------
Page   6                              SPSS/PC+                          6/24

This procedure was completed at 11:52:00
-------------------------------------------------------------------------------
Page   7                              SPSS/PC+                          6/24

SELECT IF  (cogabil le 115).
-------------------------------------------------------------------------------
Page   8                              SPSS/PC+                          6/24

T-TEST /PAIRS COGABIL FIGREAS.
The raw data or transformation pass is proceeding
     26 cases are written to the uncompressed active file.
-------------------------------------------------------------------------------
```

Paired samples t-test: COGABIL IQ on Cognitive Abilities
                        FIGREAS IQ on Danial NV Reason

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
COGABIL	24	109.3333	4.249	.867
FIGREAS	24	113.4583	5.485	1.120

(Difference) Mean	Standard Deviation	Standard Error	3 3 3 Corr.	2-Tail Prob.	3 3 3 t Value	Degrees of Freedom	2-Tai Prob
-4.1250	7.439	1.518	-.154	.472	-2.72	23	.012

his procedure was completed at 11:54:10

FINISH.

End of Include file.

A CASE FOR SCIENCE

Children who are 'taught to think' get better exam results than those who are just instructed – this was the powerful conclusion of a seven-year research project into science teaching financed by the Economic and Social Research Council.

The researchers also claim that, unless children are helped to develop higher mental skills, most will have little chance of reaching the educational standards that the government has predicted will result from implementation of the new National Curriculum.

At present, about 20 per cent of schoolchildren get 'C' grades or better in their GCSE science exams. The government's target is for this figure to rise to 50 per cent within the next five years. However, to reach this standard, schoolchildren require more than mere instruction. They need to have reached a stage of intellectual development that only 30 per cent of students have achieved by the time they do their GCSEs. The reason that many don't is not because they are unintelligent, but because they have not had the opportunity to develop the reasoning skills needed to understand many basic scientific principles. These skills, it is claimed, are not instilled by instruction, but by teaching children to think.

Who makes this claim?

The researchers involved in the CASE (Cognitive Acceleration through Science Education) project are three former science teachers: Michael Shayer, Philip Adey and Carolyn Yates, all of King's College, London. Their work draws on principles established by the Swiss psychologist Jean Piaget, who is renowned for his research into children's mental development, and by the Israeli educationalist Reuven Feuerstein, whose best-known work demonstrated how special teaching methods can help socially and culturally disadvantaged children attain the same educational standards as their peers.

To test the idea that children can be taught to think, the CASE researchers developed a series of simple 'thinking lessons' for 12–13 year olds. Using basic, inexpensive equipment, these lessons are designed to make children think about such concepts as probability and variables, which are essential for understanding the principles of science. At the age of 12, most children find it hard to grasp these concepts, and tests show most adults still don't understand them.

The 'thinking lessons' involve little more than asking children to work out the various elements that might affect, for example, how a pendulum swings or whether an object will float or sink. The lessons are not instructional but experimental; the aim is not so much to ensure that the children come up with the right answer than to get them to think about how they *might* come up with *any* answer. They work in groups and are encouraged to compare notes and explain their ideas to other children as well as the teacher.

Do 'thinking lessons' work?

The project was initiated in 11 classes in eight comprehensive schools in 1985, and the children had one thinking lesson every fortnight for two years. At the end of this time, they were given Piaget-type mental development tests to see whether the lessons were having any measurable effect. These tests showed that there had been a distinct improvement.

Two or three years later, in 1989, the children's GCSE exam results were compared with national figures and and with the results of other classes in the same schools that had not been given thinking lessons. The results were startling: the CASE pupils scored significantly higher than other children.

In science, over 40 per cent of the boys got 'C' grade or above, compared with 12 per cent of boys in classes in the same schools who had not had thinking lessons. CASE also seemed to have an effect in other GCSE subjects. For example, 49 per cent of the boys got 'C' grade or better in maths (compared with 16 per cent in non-CASE classes), and 44 per cent got similar grades in English (16 per cent in non-CASE classes). The following year (1990) yielded similar results.

With the girls, the best results came to those who had started CASE a year younger – that is, in their first year of secondary school. In the 1990 GCSEs, 50 per cent got 'C' grades or better in science (compared with 33.3 per cent among non-CASE pupils), 55 per cent got 'C' grades or better in maths (compared with 42 per cent), and 85 per cent got 'C' grades or better in English (compared with 58 per cent).

These differences between boys' and girls' results suggest that girls may respond better if they begin thinking lessons earlier. As it is often claimed that girls do less well in science and maths, this is one aspect of the CASE research that calls for further investigation.

The success of the CASE project has shown how a relatively small investment in teaching time can achieve dramatic results when well directed. Bearing in mind that

the whole course had been completed two or three years before they took their GCSEs, it seems that simply teaching children how to think can have a long-term effect on their intellectual development.

How much of this is due to the teachers and how much to the CASE method? Sceptics might argue that CASE's success was the result of the teachers' enthusiasm or the individual teachers involved, and that such success would not happen if the project were applied more widely. However, the CASE research did make a comparison between classes of children which had received thinking lessons and similar classes in the same schools which had not. Although there were differences in performance between different schools, overall the children who had been through the CASE course did significantly better than those who had not.

CASE has enormous implications for teacher training. Millions of pounds are spent every year on in-service training of teachers, but unlike CASE, the results are very seldom subjected to scientific scrutiny.

Many schools have shown interest in trying the CASE method, but some have been deterred by the cost – about £1600 to train two teachers. Now that state schools are beginning to manage their own budgets, headteachers and governors will have to decide whether they can afford this training for their staff.

For further information about CASE, contact :
Dr Philip Adey and Dr Michael Shayer
Centre for Educational Studies
King's College
University of London
Cornwall House Annexe
Waterloo Road
London SE1 8TX
Tel : (071) 872 3079

Better Learning, a booklet outlining the CASE research and results, is available from the same address, price £2.50.

Centre for Educational Studies
Kings College, University of London
Cornwall House Annex, Waterloo Road, London SE1 8TX

BETTER LEARNING

A report from the
Cognitive Acceleration through Science Education (CASE) project

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Kings College London

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Appendix P1.

Can thinking be taught?

What do people mean when they talk about "raising standards of education"? Leaving aside the common but questionable assumption that standards have fallen, there are two possible meanings: children may successfully be taught more facts and skills within particular school subjects, or they may learn to use their minds more effectively so that they can continue to learn better in all academic subjects. To improve the former requires more efficient instructional skills, and we do not deny that there is room for improvement in this area.

But improving pupils' ability to learn (improving their "intelligence", in some meanings of that word) offers a far more efficient way of raising long-term achievement. It requires a different, and for most teachers new, approach to what happens in classrooms. The exploration and crystallisation of such a new approach has been the purpose of the Cognitive Acceleration through Science Education (CASE) project.

The idea of improving children's ability to think is not new. Traditionally, teaching classics was often justified as a means of developing of logical thinking. More recently, mathematics and science have been promoted not only for the useful skills that they impart, but also for the supposed role they play in the development of general thinking. Unfortunately, no evidence has ever been found that teaching Latin, or maths, or science, by themselves do anything for the production of more generally intelligent human beings.

There also the "Thinking Skill" courses, such as those of deBono, Sternberg, and Feuerstein. Again, there is very little evidence that these programmes have any useful practical effect on children's ability to learn new material, although Feuerstein's Instrumental Enrichment has been shown to have value for slow learners. There is also the problem of persuading head teachers to carve out a slot in the school timetable labelled "Thinking", and of training teachers to deliver it.

Nevertheless, psychologists continue to investigate the possibility of teaching effective thinking. By the early 1980s there were a number of straws in the educational wind which suggested that the teaching of thinking as a generalisable skill might not be an unattainable goal. These straws consisted of evidence from a few researchers that certain sorts of teaching did enhance thinking skills which were transferable to new contexts.

In 1984 Michael Shayer, working at Chelsea College, obtained a grant from the Economic and Social Research Council to build on this evidence in a systematic way, and apply the principles to ordinary school learning. He was joined by Philip Adey (with whom he had worked in previous projects) and by Carolyn Yates, who brought recent experience from school teaching. Until 1987 this team worked at Chelsea, later merged with Kings College, to develop a teaching method which incorporated key principles likely to help pupils develop their intellectual power. As its title suggests, the CASE project worked through the science curriculum as a subject area which offered particular promise while minimising the disruption to the school timetable. The aims of the project were always broader than the delivery of more effective science teaching.

The key principles

These are the principles which we abstracted from the work of Piaget, Feuerstein, and others as having potential for the development of reasoning:

Cognitive conflict. Children develop their ability to think when they confront, and struggle with, intellectual problems. It is unfortunate that in the difficult conditions of many schools, there is a strong temptation for teachers and learners to enter into an unspoken conspiracy to avoid undue mental effort. Pupils can be kept busy and reasonably well-behaved with work that does not tax them unduly. Although such a strategy is understandable, it does little to help pupils develop their own intellectual power. Problems which make children think, make them search for solutions, are difficult to manage but are crucial in the promotion of higher level thinking.

We are not here advocating difficulty for its own sake, and we emphatically do not see any value in setting problems which pupils find difficult and then punishing them if they fail to find solutions. The cognitive conflict which we are promoting involves careful preparation and continual monitoring by the teacher to provide the right level of support and encouragement for each pupil so that, although they may struggle, they are able to make progress.

To an alien who had never seen either a rabbit or a top hat, it would be unsurprising to see the rabbit pulled from the hat. For all he knows, top hats may be rabbits' normal habitat. In the same way, problem situations must be carefully set up if they are to provide the right level of surprise for the student. The activities developed by the CASE project pay as much attention to the preparation of problem situations, and to their follow up, as to the discrepant event itself.

Reflection. Cognitive psychologists use the term "metacognition" to refer to the reflection by a learner on his or her own thinking processes. Whatever it is called, it is widely agreed that if higher level thinking is to be generalised, students must be encouraged to think about their own thinking. "How did you solve that problem?" "What were you thinking of when you reached that conclusion?" "You seem to have an interesting answer; go and explain it to Bob over there". These are commonplace remarks in CASE classrooms, and all are aimed at focussing pupils' thinking on their own problem-solving processes.

Bridging. A third principle culled from the literature is that if a new thinking skill is to be generalised, is to be transferred from the particular context in which it was developed, then a conscious effort must be made by teacher and learner to apply the same principle to new contexts. We call this process bridging: building bridges from the science-like activity to other subjects and to the world outside.

Reasoning patterns. Certain types of reasoning have been identified as characteristic of higher level thinking. These include control of variables, proportionality, equilibria, ascribing probability values to cause and effect relationships, and comprehending a correlational relationship between variables. These cannot be taught directly, but the teacher who is aware of them will be better equipped to help pupils develop the reasoning patterns for themselves.

The practice

How are these principles translated into a teaching method? The answer is partly through printed materials, partly through inservice training of teachers.

The CASE project developed a set of materials including a teachers' guide and pupils' worksheets for 30 lessons, offered as examples of activities which incorporate the principles established as most likely to promote higher level thinking. These activities were drafted by Adey, Shayer, and Yates and then taught by them in London comprehensive schools. They were then revised and given to teachers in a wide variety of schools in England. The final version of the activities, published as *Thinking Science*, offers a sample of the type of lessons which, taught with understanding, can have real effects on childrens' intellectual development.

Simply to go through these activities without some understanding of the underlying principles is unlikely to produce the results which the trial teachers achieved with their pupils. Within the CASE project we were able to help teachers reach this understanding through an inservice programme including some days at Kings College and, probably more importantly, cooperative teaching by researchers and teachers together in each school. We are convinced that this in-school cooperative teaching plays a key role in making practical the theoretical principles on which the method is based.

Trialling the method

The Thinking Science method has been evaluated using a pre-test/post-test and long-term follow up technique which may be unique in the history of curriculum development.

Science Advisers in various Education Authorities were asked to recommend mixed comprehensive secondary schools which were representative of schools in their borough. In some cases they suggested well-ordered schools where they felt that the method would be given a thorough trial. In others, they suggested schools that they felt would value the attention of the research team. All of the schools had a wide ability range of pupils, and all were representative of their regions in terms of ability and cultural mix of pupils. Schools were chosen in Avon, Bedfordshire, Cheshire, Gloucestershire, Inner London, Surrey, and Wigan. In each school one or two classes (the "CASE" classes) were chosen to trial the materials, and one or two other parallel classes chosen as controls. In some cases the same teacher taught both CASE and control classes. We started with 11 CASE classes and 11 control classes in 8 schools. Some were first years (aged 11+) and others were second years (aged 12+).

CASE classes were given a Thinking Science activity about once every two weeks instead of a normal science lesson. Control classes continued with their regular science curriculum. The trial continued for two years. After this two year period, there were no further differences in treatment of pupils from CASE and control classes. In most schools they did not even remain in distinct class groups, and in some cases pupils moved from middle schools to high schools.

The arrangement of trials and tests is shown in figure 1.

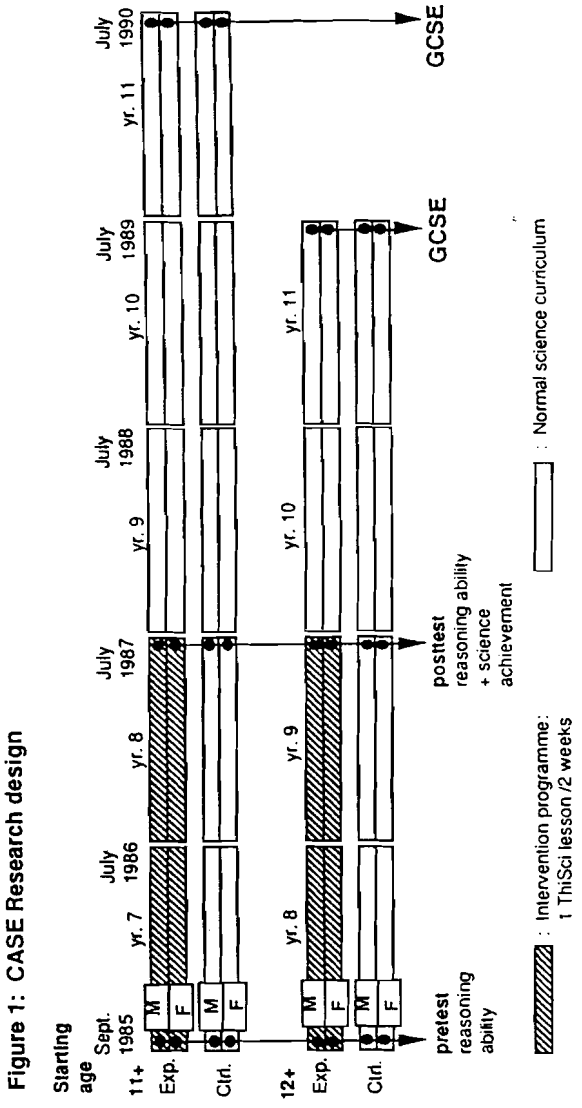


Figure 1: CASE Research design

At the start of the trials, all pupils were given a test of their reasoning ability. They were tested again at the end of the two year period for reasoning ability and also for science achievement. Those who had used Thinking Science from their second years took GCSE two years after the end of the trial. For those who trialled the material from their first years, GCSE came 3 years later. GCSE results were obtained for as many of the ex-CASE and ex-control pupils could be found.

Results

Full details of the results together with the statistical procedures used are given in the academic papers cited in the bibliography. Here some detail is omitted in order to present a clear picture, but the story told is a true reflection of the results that were achieved. Although the immediate post-tests were encouraging, we concentrate here only on the most convincing evidence: the long term effects shown by GCSE results.

Figures 2 and 3 provide a summary of our "best" results, showing what can be achieved. We found, for instance, that the effect was strongest with girls who used the Thinking Science materials in their first and second years, and with boys who used the material in their second and third years. These are the results shown.

Figure2: Boys 1989 GCSE Grades in comparison with Controls:

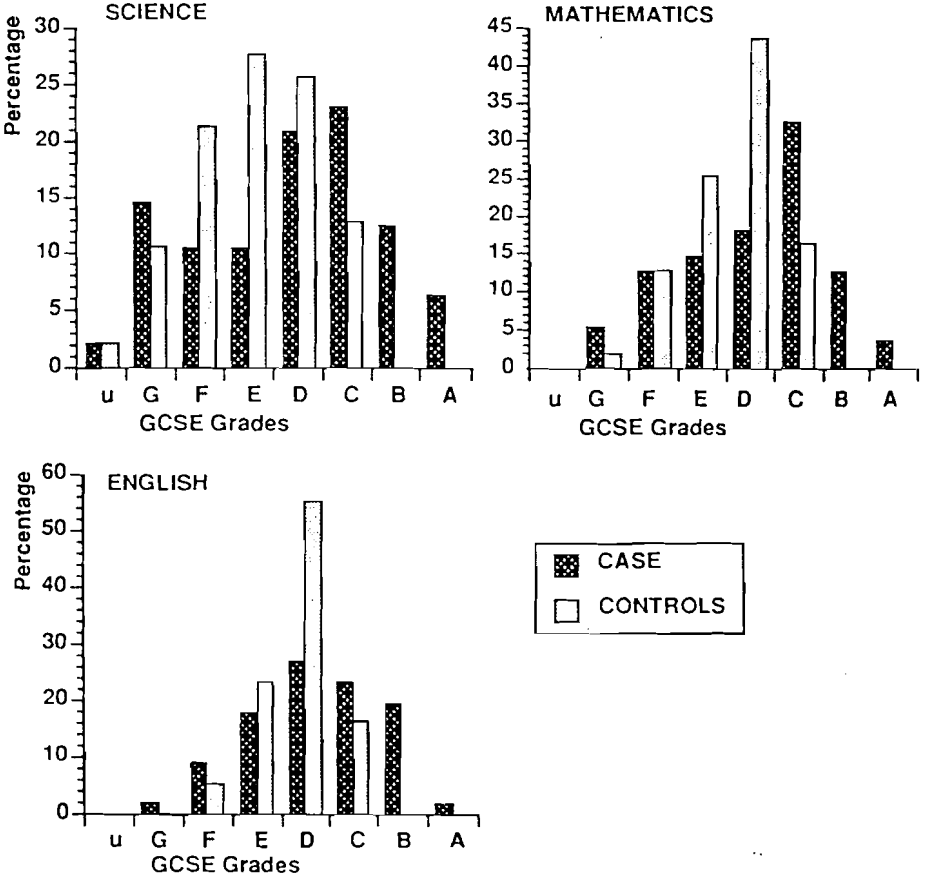
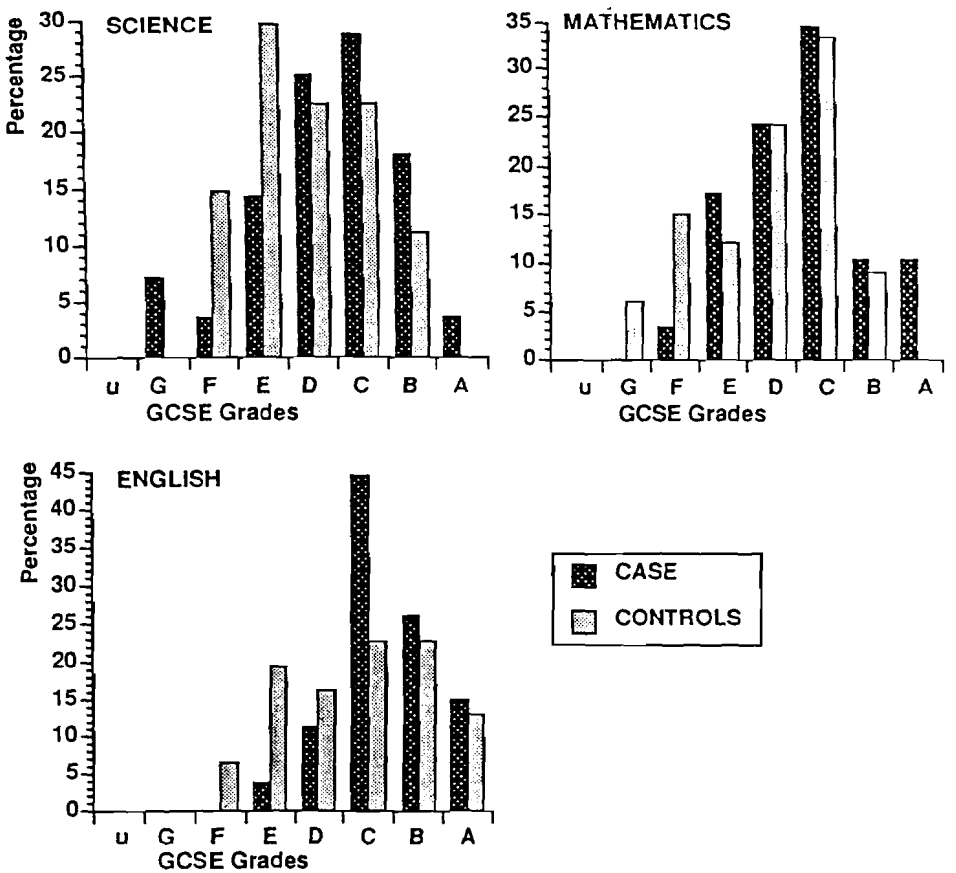


Figure 3: Girls 1990 GCSE Grades in comparison with Controls:



Each figure shows the percentage distribution of grades in GCSE science, maths, and English obtained by CASE pupils and by the corresponding control group. The control group may be taken as representative of the grades currently obtained by the population as a whole.

In every case, the CASE (Thinking Science) pupils are scoring significantly higher grades than the control group. The total percentage of grades C or above obtained by CASE and control pupils from the groups shown are summarised in this table:

Percentage GCSE grades C and above

	Boys 1989		Girls 1990	
	CASE	Control	CASE	Control
Science	41.7	12.8	50.0	33.3
Mathematics	49.1	16.4	55.16	42.42
English	44.6	16.1	85.18	58.06

It is worth emphasising again that the only difference in treatment of the CASE and control groups had been the Thinking Science programme used by the CASE group two or three years prior to their GCSE examinations. 'CASE' and 'control' pupils did not remain as separate groups after the trial period, and all pupils received exactly the same teaching during the two (or three) years leading up to the GCSE examinations. What seems to have happened is that the ex-CASE pupils were better equipped to benefit from this teaching.

What we have here is a long term effect - one that lasts for years after the treatment. And we have a very general effect - one that shows up as better achievement in widely different subjects. We believe that the only satisfactory explanation for such results is that the teaching and materials of the Thinking Science programme had a profound and permanent effect on the children's ability to think and to learn new material.

Our results show the potential of a teaching methodology which concentrates not so much on particular concepts within particular subjects, but rather on the development and conscious generalisation of thinking skills. Of course, one cannot learn thinking in the abstract: one has to think about something and the thinking skills have to be developed within a subject area. The trick to broadening specific thinking skills to general intellectual development seems to be (a) to encourage reflection by pupils on their own thinking processes, and (b) to make conscious bridging from the particular to the general.

Now, good thinking skills alone will not get you good GCSE or A level grades. You also need good instruction to learn some content. But if, in the early years of your secondary education, you have been given the chance to develop higher level thinking skills then you will benefit far more effectively from instruction in any subject.

What next?

CASE results show that it is possible to increase greatly the percentage of high grades at GCSE which ordinary pupils can get in ordinary schools. The efficient way to do this is not a massive investment in content-based instructional technology, but through a well timed, well targetted, and well delivered programme to develop the intellectual ability of pupils aged from 11 to 13 years.

We now have the experience and a good working knowledge of how this can be done, but there are at least two sets of questions which require further investigation. Firstly, we do not yet fully understand the mechanism by which the teaching methodology leads to the results reported here. An important task for which Michael Shayer has received further funding from the ESRC is to look in fine detail at the classroom transactions typical of Thinking Science lessons, and to assist teachers to apply the methodology to all of their science lessons. This work is currently being undertaken in three Cambridgeshire schools.

Secondly, there is an amazing lack of evidence as to what sort of inservice training of teachers is actually effective in changing classroom practice. 'Amazing', because millions of pounds and millions of person hours are spent in inservice training, and yet the techniques used are based on tradition and a gut feeling of what seems to feel nice. Applications to the DES and to other

research funding bodies for a grant to investigate cost-effective ways of improving the learning of pupils through the inservice training of teachers have so far been unsuccessful. This is disappointing, given the oft-repeated desire to "raise educational standards", the track-record of the Kings College team, and the fact that they have established a methodology that works.

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Results of the Cognitive Acceleration through Science Education project are being published in refereed academic journals listed in the bibliography, and will be fully described in a new book to be published next year. In April 1991 they were presented at the American Educational Research Association meeting in Chicago and at the National Association for Research In Science Teaching meeting in Wisconsin.

Acknowledgements

The CASE project was supported from 1984 - 87 by a grant from the Economic and Social Research Council. The Chelsea College Centre for Science and Mathematics Education welcomed us, gave us a home and much support, and that support was continued after the merger between Chelsea College and Kings College London. Since 1987, Shayer and Adey's work on the project has been included within their employment at Kings College, and that of Carolyn Yates has been supported by the Metropolitan Borough of Wigan Education Authority. For all of this support we are grateful.

The project would have been meaningless without the enthusiasm and support of the teachers, and their pupils, who trialled the materials for two years. The results we report are a reflection of their enthusiasm and hard work.

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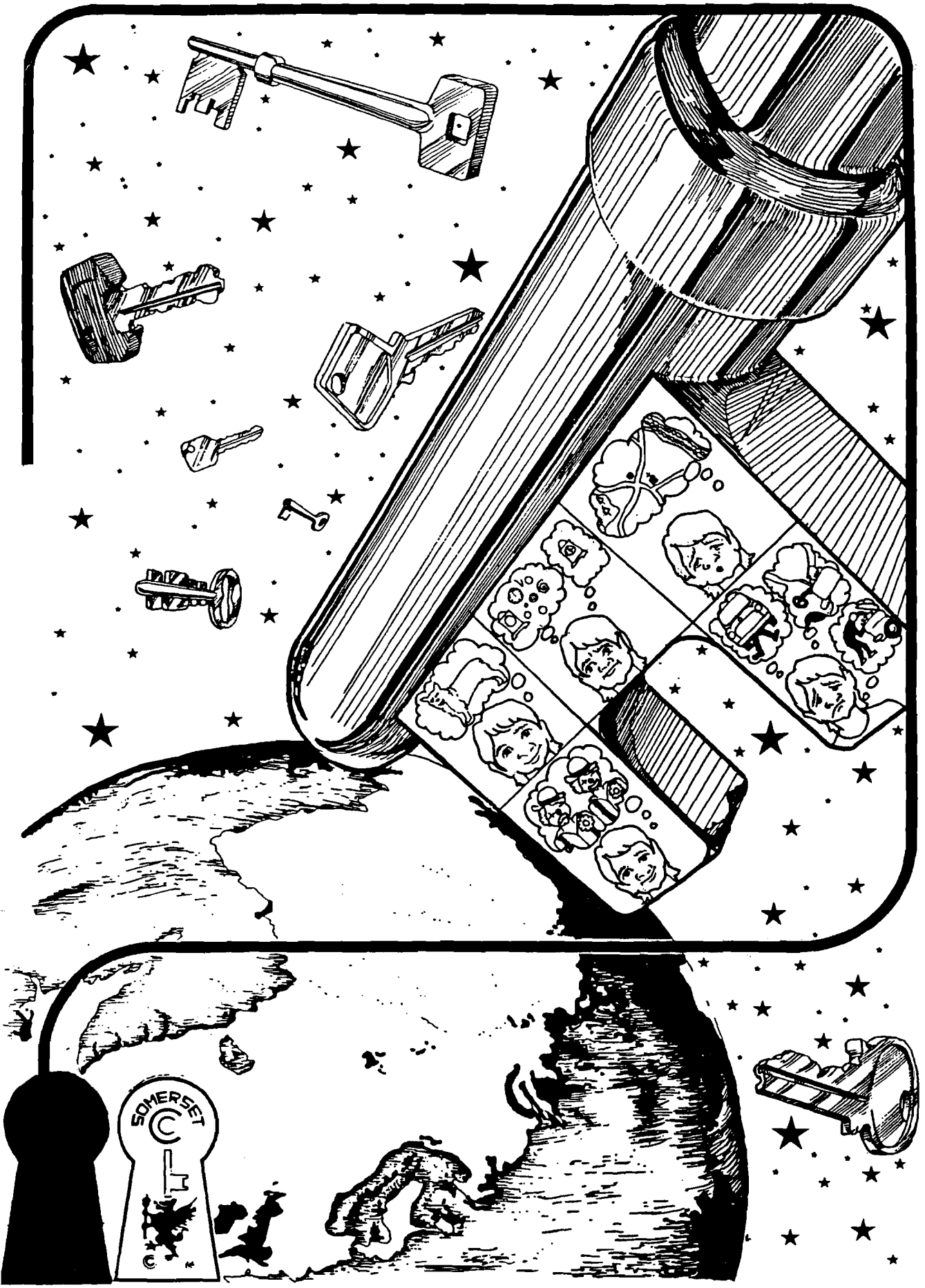

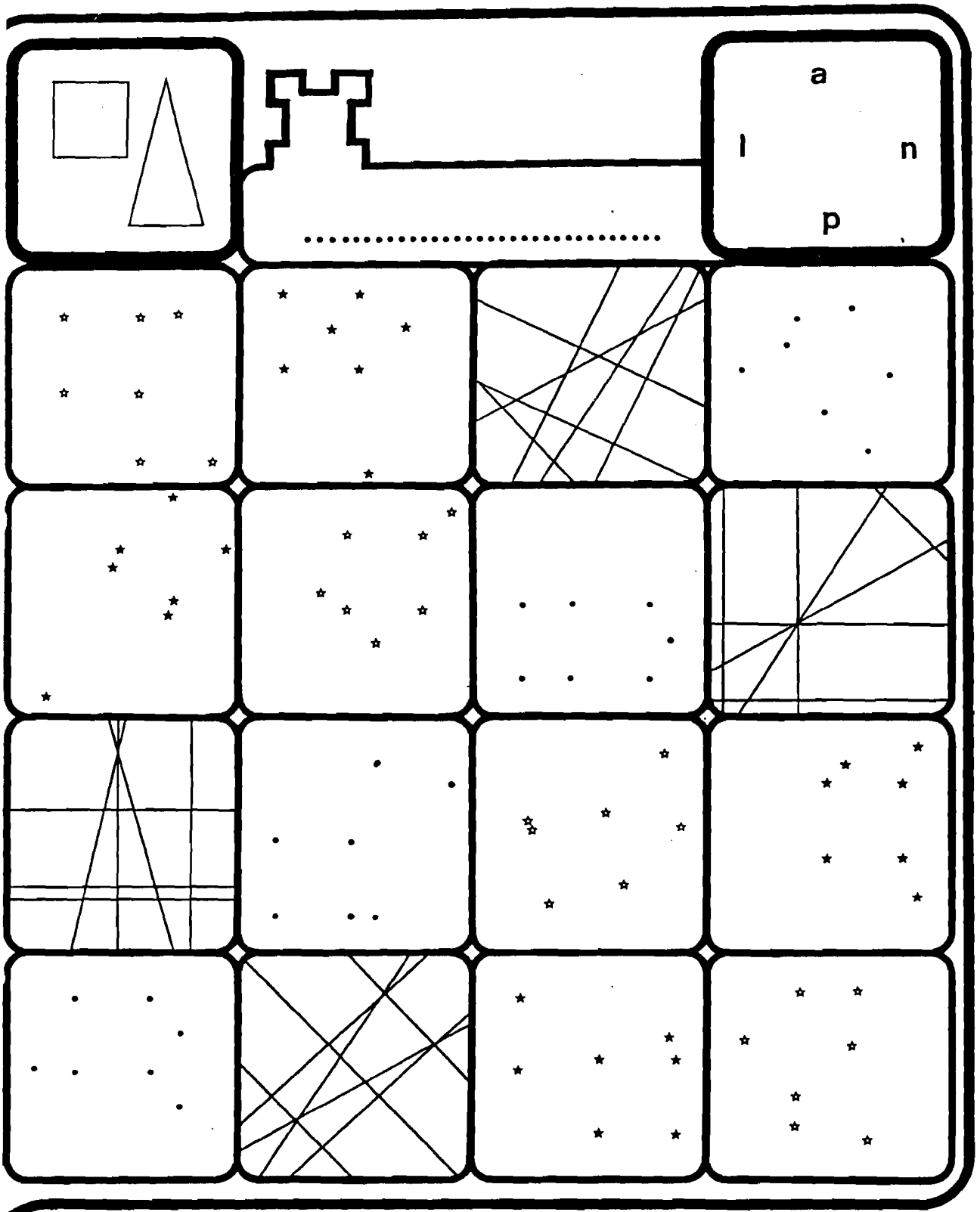

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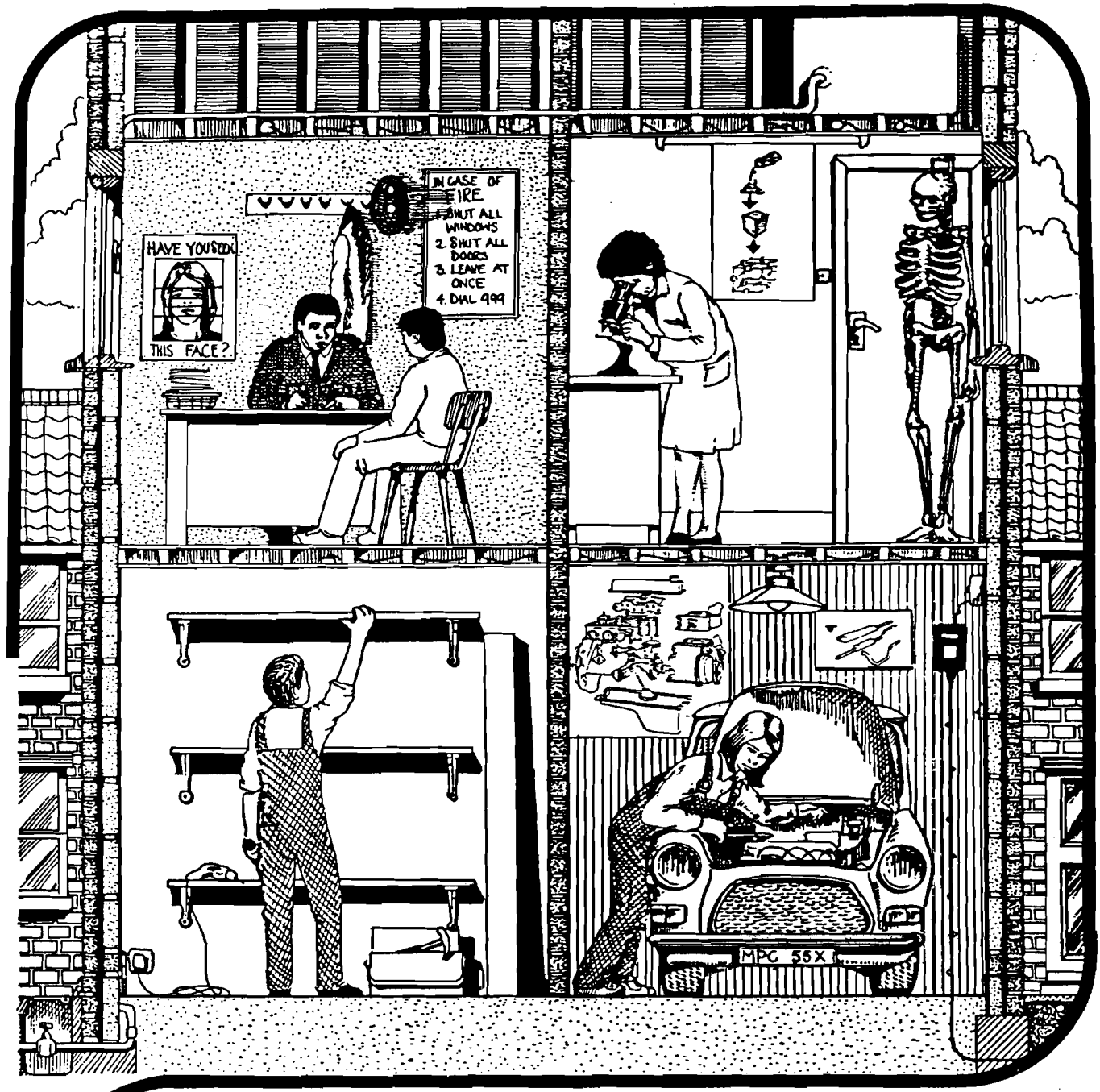

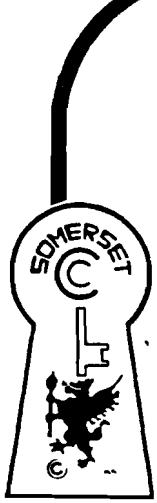

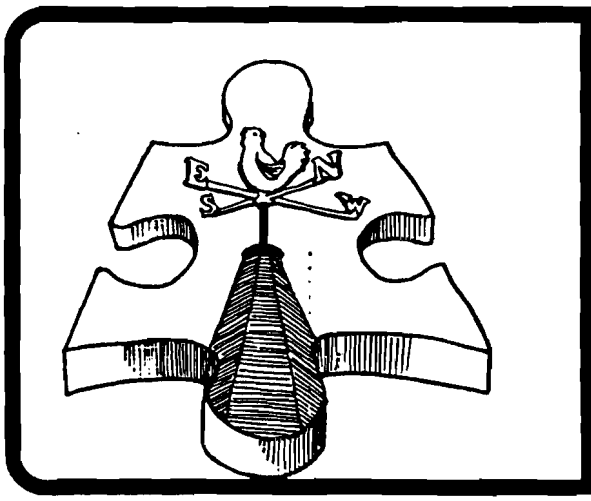

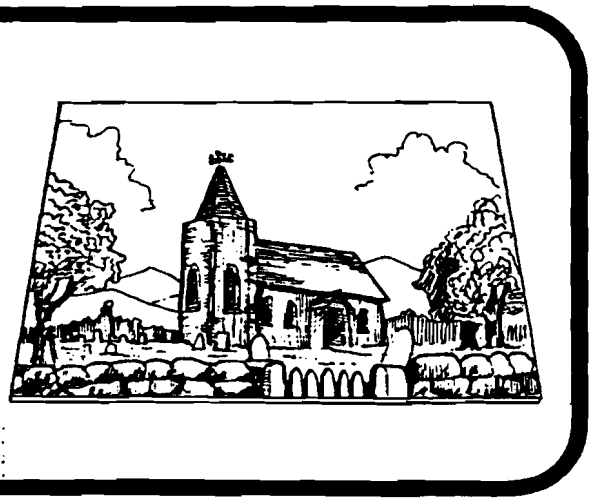

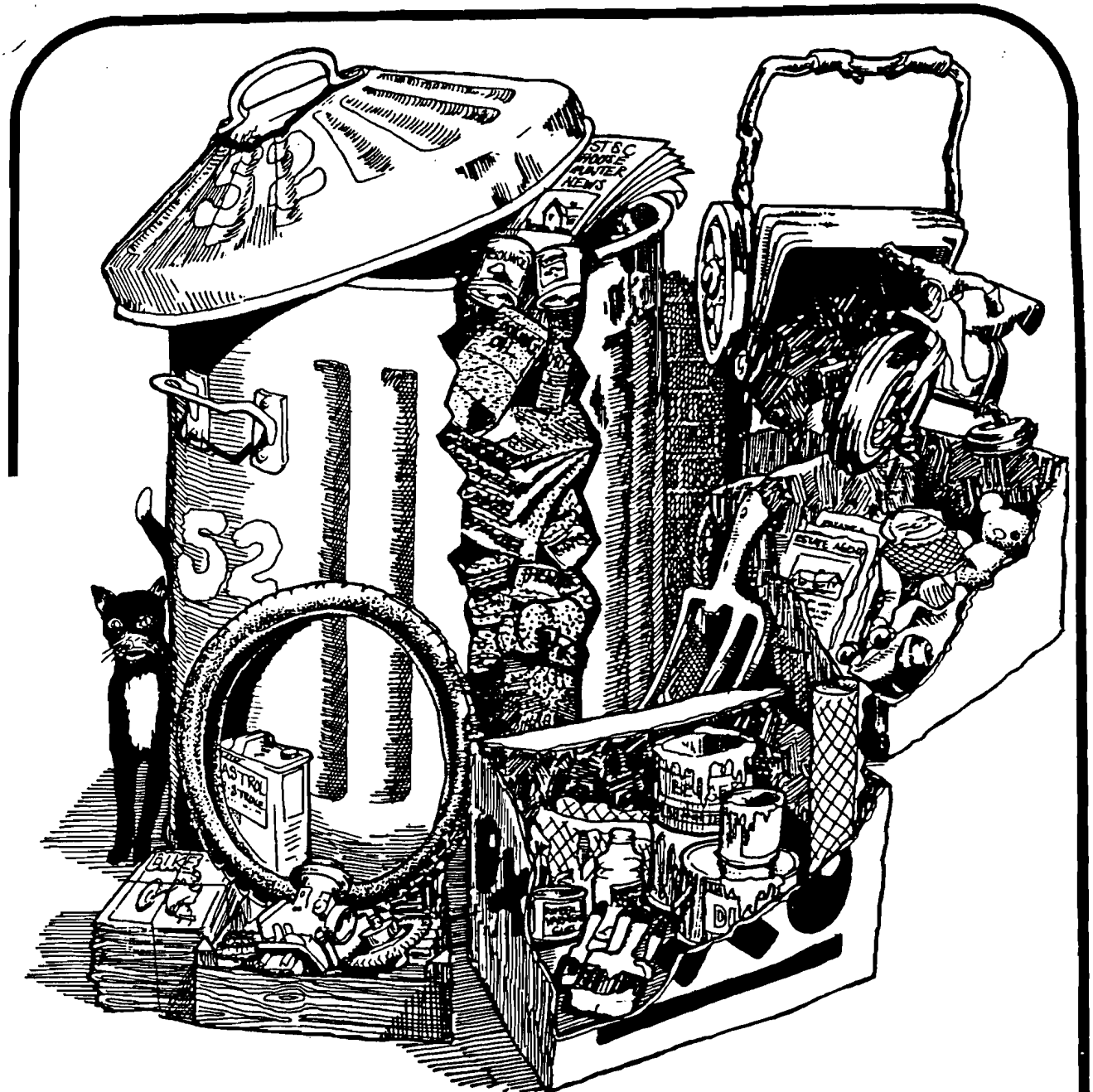

This picture shows refuse from 52 Westover Green. What can you deduce about the occupants? Design a method of recording evidence to support your hypotheses.