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The effect of the teaching of an explicit top-level expository text structure on the structure of year seven children's semantic memory

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USE OF THESIS

THE EFFECT OF THE TEACHING OF AN EXPLICIT TOP-LEVEL EXPOSITORY TEXT STRUCTURE ON THE STRUCTURE OF YEAR SEVEN CHILDREN'S SEMANTIC MEMORY

BY

F. Les Puhl Diploma of Teaching

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ABSTRACT

In order to examine the effect of the teaching of a top-level expository structure through writing on children's schemata for text structure, children in year seven were asked to display graphically the relationships between 42 randomly presented text items related to a central topic. The text items were designed to approximate the kinds of information that may be found in an encyclopaedia or a science text about a given topic.

One class of children was then allocated to the control group and the other to the experimental group. The experimental group was taught the top-level structure for a scientific report using a specific writing strategy. The control group were taught the top-level structure for the narrative using a similar basic strategy.

After approximately four, seventy five minute, treatment sessions a post test was administered to determine if there were any changes in the complexity of the associations between given text items that the students were able to make.

Three weeks later a third test was administered to determine if there had been any long term change to the students' text structure schema. A comparison of the performance of the experimental and control group in the post-test and delayed test supported a hypothesis

that the treatment would cause long-term changes to the structure of an individual subject's semantic memory. The results also showed the limitations of of teaching reading using only narrative materials.

This study supported the research findings of Sloan (1983) which concluded that fluent readers differed significantly from less fluent readers in their ability to generate diagrams showing complex semantic relationships.

The effectiveness of the treatment was also compared against previously established measures of reading fluency in order to determine if there were any correlations. An analysis of the data showed that the treatment was effective ($p < .01$) for two of the three categories of reading fluency established.

"I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text."

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CHAPTER 1

Introduction and Statement of the Problem

Introduction

A common perception held by many secondary school teachers is that children commencing secondary school are unable to read adequately. This perception is based on the apparent inability of many of these children to process secondary school texts, particularly content area texts. If the perception of secondary school teachers is correct, then primary schools have failed to carry out one of their principal responsibilities, that is, the teaching of reading. However, it appears that in many cases the children who are failing in their reading tasks at secondary school, were able to carry out successfully the reading tasks required of them at primary school.

One possible explanation for this disparity is that there is a significant difference between primary and secondary school reading tasks. Another possible explanation is that there are deficiencies in secondary school texts. However, whilst both explanations have some validity current research indicates that the former explanation may be more important than the latter. Research carried out in the United States and Great Britain, indicates that children may be experiencing difficulty making the transition between elementary school and secondary school texts because they lack adequate exposure to a variety of text types in their elementary school years. (Chapman 1983, p. 41; Flood 1984, pp. 2-3, 65-66; Morris 1984, p. 166)

Children's main exposure, whilst at primary school is to narrative text. This exposure has enabled most children to internalise the the top-level structures of a narrative text. Thus, most children are able to activate appropriate schemata to help them process unfamiliar narrative texts by the time they reach secondary school. However, secondary school children are required to read texts that vary considerably from the narrative, "story" format. Various researchers have identified between six (Meyer, Brandt & Bluth 1980, p.75) to nine (Sloan & Latham 1989,p.3) different basic text types used in secondary school. Children will be exposed to these different text types as they progress through their secondary schooling.

Traditionally the teaching of reading has been seen as a function of the primary school. Therefore, there is very little or no instruction in secondary school on how the new text-types that students are exposed to in secondary school should be read. Hence, young secondary school readers are experiencing difficulties coping with differing types of texts dealing with unfamiliar content, and which do not contain a story structure with which they are familiar. (Chapman 1983, p. 41)

Most learning is still acquired from text books. If children are to become successful learners then increased attention must be given to the development of teaching strategies which will make the multiplicity of text types used in secondary school accessible and comprehensible to them. Primary school reading programmes are often narrowly focused and fail to recognize that narrative, "story" reading is an inadequate preparation for using expository texts. A balanced programme should teach children the skills necessary to cope with the variety of reading situations which will face the individual.

The Problem

Several researchers have shown that some students are aware of structural patterns in expository writing, whereas other students are not. Importantly, these differences in awareness of structural patterns have correlated with the amount of information students recall after reading expository text. Researchers report that readers who use the author's top-level organisational structure tend to perform better on recall, summarization and other comprehension tasks than readers who not use this structure. (Berkowitz 1986, p. 166-177; Flood 1984, p. 117; Richgels et al 1987, pp. 179-182)

The idea of teaching the top-level structure for expository texts is being applied and evaluated by many teachers and researchers who believe that there is a need for systematic instruction in a variety of text structures. However, many researchers who have given their subjects training in top-level structures, have just mentioned areas of teaching rather than specific methods. This research study is part of the preliminary work needed to test the effect which the explicit teaching of top-level expository text structures, developed by Sloan and Latham (1989), through a specific writing strategy, has on the strategies children use to organise raw written data. This study should lead to further more comprehensive research, exploring the effects which the internalization of top-level text structures have on the retention and recall of new information obtained during the reading process. This in turn should lead to the development of content and teaching strategies which will have a direct and positive impact on children's literacy.

Definition of Terms

The following items have special relevance to this study.

Top-Level Text Structure

This refers to the major sections in an outline of a text. It also refers to the major conceptual or global organisation of a text, sometimes called the macrostructure, and can either be explicitly stated in the text or implied.

Text Structure Schema

This includes the reader's knowledge of how authors structure their ideas - as a narrative or as one of several types of exposition. It refers to a set of expectations about the internal structure of the text being read which serve to facilitate encoding and retrieval.

Content Schema

This refers to the reader's world knowledge. (Anderson & Pearson 1984, Ohlhausen and Roller 1986)

Cluster

This term refers to groups of conceptually related items closely grouped in a network and which have a central generating node.

Macro-cluster refers to a network generated from one of the four major components of the top-level structure of the scientific report.

Sub-cluster refers to groups of conceptually related items grouped in a network not generated from a major component of the top-level structure of a scientific report.

Above Average Readers

In this study this term refers to those subjects whose scores in the PAT comprehension test ranked them in the top 16% when compared to the grade related norms for this state.

Below Average Readers

In this study this term refers to those subjects whose scores in the PAT comprehension test ranked them in the bottom 16% when compared to the grade related norms for this state.

Average Readers

In this study this term refers to those subjects whose scores in the PAT comprehension test ranked them with the 68% of scores occurring either side of the mean when compared to the grade related norms for this state.

Fluency

Reading fluency is equated in this study with the subjects' relative score in the PAT comprehension test. High score = high fluency, low score = low fluency.

Whole Language Reading Theorists

Those reading theorists who subscribe to the view that language and the various language modes are learned in wholes through inductive generalization rather than in parts.

CHAPTER 2

Literature Review

This study is based on theories of language learning derived from psycholinguistics. Psycholinguistic theories ascribe an active role to the reader in the reading process and advocate teaching strategies which stress the holistic nature of language learning. (Smith 1973, pp. 1-14; Sloan & Latham 1979, pp. 1-8; Goodman 1973, pp. 23-24, 1982, pp. 1-2; Cambourne 1988, pp. 202-207)

The search for an adequate description of the reading process, has caused whole language reading theorists to draw in a large measure upon the findings of cognitive psychology. As a result, schema theory, as a model of human knowledge, has become the driving force behind many investigations into the reading process.

An important theme of the last eighteen years of reading comprehension research is that the meaning which the reader makes is the product of the interaction between text-based information and pre-existing knowledge.

The literature relevant to this study is summarised under five broad areas:

(1) Schema theory.

(2) Schema-Theoretic View of Reading Comprehension

(3) Schema Theory: Implications for Teaching Reading Comprehension

(4) Developments in Text Analysis

(5) The Use of Semantic Networks to Represent Associative Memory Structures

Schema Theory

Schema theory is basically a theory about knowledge and how information is stored in the long term memory. It is a theory about how knowledge is represented and about how the representation facilitates the use of that knowledge in particular ways. Schema theories depict all knowledge as being packaged into units. These units are the schemata. Embedded in these packets of knowledge is, in addition to the knowledge itself, information about how the knowledge is to be used. (Neisser 1976, p. 111)

A schema, is a data structure for representing information stored in the memory. Individuals have schemata which represent all the information they have accumulated throughout their lives. This information includes; concepts (concrete and abstract), actions, events, perceptions (images, smells, tastes etc) and emotions. It also includes action and event sequences.

Many concepts, events, actions, perceptions and emotions are related in a schema and many schema are related in cognitive maps. (Klix 1984, p. 13-24; Rumelhart 1980, pp. 33-37, 1984, pp. 2-3, Neisser 1976, pp. 107-23)

It is generally asserted that all information including information about the self, can only be acquired through the use of appropriately tuned schema. Conversely, all information that is acquired modifies a schema. Thus the schema always includes the perceiver as well as the environment. (Neisser 1976, p. 126)

A schema also contains a network of interrelationships that are believed to normally exist among the various parts of that schema. Schema theory embodies a prototype theory of meaning. Meanings are encoded in terms of the typical or normal situations which instantiate that schema. (Rumelhart 1980, p. 33-37, 1984, p. 2-3; Anderson & Pearson 1984, p. 260)

Schema-Theoretic View of Reading Comprehension

During reading, relevant content and text schema in the head of the reader interact with the text data received from visual sources and function as guides to comprehension. The degree of comprehension of a text can be considered in terms of the creation, modification, and elaboration of relevant schema. That is, the degree of comprehension of a text by a reader is a reflection of the extent to which the information (including emotion) conveyed by a text is represented in these cognitive structures. Comprehension is also effected by the extent of the interrelationships among and within the cognitive structures. Strategies and relationships must exist which allow the efficient exploitation of available background knowledge when required.

Reading effectiveness is therefore a reflection of the degree to which the written text reflects the psychological text. The closer the match the greater the ease of reading. Meaning break-down in the reading process may arise from either text or reader factors. Text factors relate to the poor construction of the text. Poor construction can occur either at superordinate[1] (e.g. writer's purpose unclear), macropropositional[2] (e.g. illogical ordering of propositions in a paragraph), or micropropositional[3] level (eg the inappropriate use of anaphora and cataphora). (Chapman 1983, pp. 49-53; Meyer & Rice

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[1] whole text
[2] paragraph
[3] sentence

1984, pp. 325-326)

Reader factors relate to motivation and the background knowledge residing in the long-term memory which children bring to the reading act. These include; an understanding of the nature of the reading act and the purpose for reading a particular text, knowledge of the conventions of the written language and the structures of text; and content knowledge. (Baker & Brown 1984, p. 354, Johnston 1983, pp. 16-18)

Anderson and Pearson (1984, p. 28) report three important research findings which link poor reading performance and the children's background knowledge (or schema):

1. Poor readers are likely to have gaps in knowledge. Since what a person already knows is a principal determiner of what he can comprehend the less he knows the less he is likely to comprehend.

2. Poor readers are likely to have an impoverished understanding of the relationships among the facts they do know about a topic. Arbitrary information is a source of confusion, slow learning, slow processing and unsatisfactory reasoning.

3. Poor readers are unlikely to make the inferences required to integrate the information given to them in a text into a coherent overall

representation.

Investigations carried out by de Groot (reported in Bransford 1979, p. 37) , and Taylor and Sammuals (reported in Shannon 1985, p. 429) using novice and chess masters showed that memory was not triggered by recall but rather by the meaningfulness of knowing the strategy. It would appear that the same is true in reading recall; those who know the author's organisational plan and use it are able to recall more.

Good readers are characterised by their ability to see structure and organisation. This enables them to get directly to ideas which the author is trying to present, distinguishing the important from the unimportant. Morris asserts that many children who copy out their school projects do so because they are unable to distinguish the main points from the details and so are unable to get to the point of organising their answers. (Morris 1984: 166)

A reader's schema has an effect on memory in addition to an effect on learning. Available data supports a hypothesis that the reader's schema is also a structure that facilitates the planned retrieval of text information from memory and permits the reconstruction of elements that were not learned or have been forgotten. (Anderson & Pearson 1984, pp. 279-

285)

Meyer (1984 : 117) reports three basic research findings which have emerged from the examination of the relationship between content structure of prose and what people remember after reading it:

1. Macropropositions which are located high in the content structure are recalled and retained better than micropropositions which are located at the lower levels.

2. Students who are able to identify and use top-level text structures remember more from reading than those who do not.

3. Students can be taught to identify the top-level structures of different text types and this training increases their comprehension of text.

Research also indicates a link between knowledge of text structures and recall of expository text which reflect differences in text processing strategies used by text structure aware students and not aware students. Readers who are not aware may employ a strategy of serial and discrete encoding of textual information with a random retrieval of ideas. Aware readers link large chunks of information in a cohesive whole. These relations signal particular text structures. (Richgels et al 1987, pp. 177-196)

Schema Theory: Implications for Teaching Reading Comprehension

Comprehension has been traditionally taught as a sequence of subskills such as follows:

1. The reader notes facts and important details.
2. The reader grasps main ideas.
3. The reader follows text relationships such as consequences, cause and effect, and compare and contrast.

However, the research into reading comprehnsion indicates that the order of instruction should be reversed if the goal is the utilization of a structure strategy and high recall. Instead, readers should be taught how to identify and use the different text organisation structures. The information bound by the superordinate text structure is the main idea. Thus, utilizing text structure will not only point readers directly to the main ideas but also show readers the relationship between these ideas. (Meyer 1984, p. 176)

The basis of reading and language development lies in providing students with many experiences both real and vicarious which will add to their existing knowledge and understanding of the world within which they live. As well as enhancing their cognitive taught organisational structures which they can use purposefully to regulate their language use. Becoming a good reader depends on teachers who insist that students think about the interconnections among ideas that they have read. Text structure provides a vehicle for exploring these connections. (Baker & Brown 1984, p. 354; Morris 1984, p. 166; Cambourne 1988, p. 197)

Children should be systematically taught the top-level structure for different texts. (Meyer 1984, Morris 1984, Sloan and Latham 1989) Children could then apply their knowledge of top-level text structures in four ways:

1. As an advance organizer. An understanding of the major components of a particular text type allows the reader to make predictions about the categories of information she can expect to read. The categories then provide a basis for the chunking the new information. The reader's schema for text structure is activated to help in the interpretation of new information. (Shannon 1985, p. 426; Cook & Mayer 1988, p. 448; Thanos 1989, p. 2)
2. As an organisational device. Even if the information in a text is presented in a

haphazard fashion, knowledge of the ideal text construction will allow the reader to reorganise the information according to his in-head structures. (Meyer 1984, p. 117; Ohlhausen & Roller 1988, p. 72)

3. As a retrieval mechanism. Text structure can provide a framework for the planned retrieval or reconstruction of information from the long term memory. (Kent 1984, p. 235; Anderson & Pearson 1984, p. 279-285; Cook & Mayer 1988, p. 449; Thanos 1989, p. 2)
4. As a communication mechanism. Text structure provides a basis for effective communication. The various frameworks provide structures for writing and speaking. (Cambourne 1988, p. 197-199; Thanos 1989, p.2)

Developments in Text Analysis

Kintsch and van Dijk have developed a model which shows the importance of structure in comprehension and production processes. They claim that readers possess schema that represent their knowledge of conventionalized texts such as stories, arguments and psychological reports. When available, these schema drive macro-rules, which act on the micropropositions of the material read to formulate a macrostructure, or gist for the material. As it is impossible for a reader to recall everything from a passage, a macrostructure is formed representing information a reader perceives as being important. It is the macrostructure, not the original text , that the reader remembers. Later, when attempting to recall the material, the reader uses the macrostructure to reproduce the text. (Kintsch and van Dijk 1978, pp. 363 -394)

Although Kintsch and van Dijk have mostly worked with narrative text, their work forms the basis from which many expository studies evolved. Meyer explored the different patterns of organisation in expository text. She classified expository text into five top-level patterns: problem/solution, antecedent/consequent, comparison, description and collection (including sequence). (Meyer 1984, pp. 114-116)

Meyer reversed the order proposed by Kintsch and van Dijk. Meyer expects the reader first to identify the structure used by the author and then employ it during reading to relate the details to each other. (Shannon 1985, p. 427)

Various prose analysis systems were generated in the eighties. However the Kintsch and Meyer systems have been most widely applied and have been used to analyse a wide range of material. The application of the Kintsch and Meyer systems to research has made it possible to predict which ideas will be recalled and how long subjects will need to study text. Specifying the structure has also permitted theorizing about how readers process text. (Richgels et al. 1987, Ohlhausen & Roller 1988)

Limitations of Current Systems of Prose Analysis

However, the systems proposed by Meyer and others are limited in their application as they generally represent categories of text rather than specific text structures. A category such as problem/solution can generate a number of different text structures depending on content and writer's purpose. An awareness of the purpose of the text (that is, to pose a problem and to propose a solution to that problem) may provide a reader with some direction in processing that text. A reader may even be able to generate a macrostructure for a particular text which will facilitate the encoding and retrieval of the information contained in that text. However it is a one-off situation. The structure generated is applicable to the text read but is not necessarily generalizable to other texts. Each problem / solution can generate its own specific structure.

It may be possible for children to develop some connections across texts which generate some generalizable text-structures as a result of repeated exposure to the categories of expository text proposed by Meyer. However, research carried out by Garner and Gillingham (1987, p. 258) into primary school children's knowledge of text structure seems to indicate that, in primary school at least, this is unlikely to be the case. Their research have led them to conclude that text structure is an area that requires direct instruction in upper-primary and secondary language classrooms.

The lack of structures which are generalizable and applicable to other texts also means that children are not given an organisational schema which can be applied to processing badly written text.

It is also difficult to derive a clear model for teaching text structure from the categories of text proposed by Meyer.

Sloan and Latham working in the field of text-type activated writing may have overcome the difficulties of the lack of specificity of the text categories proposed by Meyer. They have identified five categories of text (see figure 1): narration, seriation, prescription, description, assertion. From their

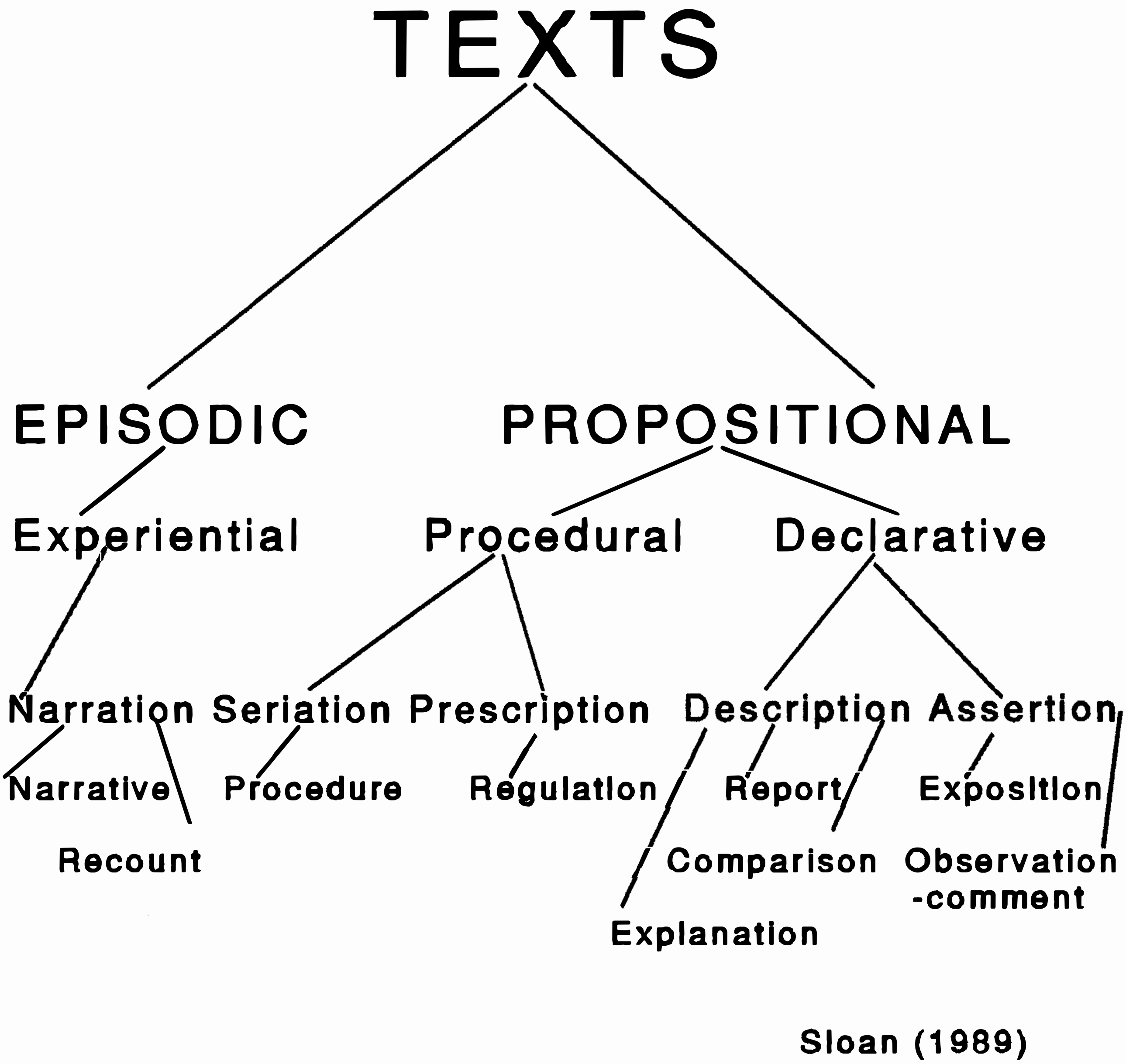

Figure 1 **Text-Memory Relational Hierarchies**

categories of text they have generated nine basic text types: narrative, recount, procedure, regulation, report, comparison, explanation, exposition (generalisation and persuasion), observation/comment. For each of the basic types they have also produced a framework which reflects a generalizable macrostructure for each type of text. (Sloan & Latham 1989, p. 1-4)

The frameworks proposed by Sloan and Latham provide a format for teaching reading and writing and a means by which children can develop into independent readers and writers. An understanding of different text structures assists children's writing as the internalised frameworks provide structures which can be applied to different writing purposes. The frameworks also provide a structure that is generalizable to most texts of the same type. Knowledge of these frameworks should assist children in the processing of unfamiliar content in reading.

The Use of Semantic Networks to Represent Associative Memory Structures

In the last decade semantic mapping has become a popular technique for both teaching children the relationships amongst concepts in content area teaching (Pearson & Gallagher 1983, p. 329; Morris 1984, pp. 163 -164) and as a research tool to explore the effects that the teaching of semantic mapping has on the children's ability to find the relationships among the facts that they are reading. (Berkowitz 1986; Dewitz, Carr & Patberg 1987)

Pearson and Gallagher (1983, p. 329) report that students who do mapping are forced to make connections among ideas even when the author has not explicitly stated these connections. Although the transfer effects to recall have been modest, studies consistently favour the mapping strategy over simpler more traditional study techniques, such as reading, rereading, taking notes and so on.

Pearson and Johnson (1978, p. 25-47) assert that semantic maps can be used to represent knowledge about events and concepts in a graphic form. They claim that knowledge of words can be thought of as being stored in semantic maps. These maps represent the kind of knowledge which is stored plus the linkages and the relationships between the knowledge units. Pearson and Johnson identify four important relations: *class* -a cat is a mammal; *example* - a cat is exemplified by a Siamese; *attribute* - cats have whiskers, they meow; *related concepts* - dogs share certain attributes and relations with cats but differ in others.

Klix and others have also argued that semantic memory is stored by association and have used semantic maps or networks to represent the way in which conceptual features are systematically stored in the long term memory. (Klix 1980, p. 11-24; Klix, Hoffman & van der Meer 1982, pp. 1-13; Sloan 1983, pp. 11-18)

In a study conducted by Sloan (1983) subjects were asked to produce their associations to a stimulus word by writing down their response and showing how their responses were connected by drawing lines between them. Although the associative networks generated by the subjects are not identical to the far more complex and larger structures of the brain, it was asserted by Sloan in this study that they were representative of those associative structures in the brain in terms of how the information was stored, i.e., "related and organised, and also representative in terms of the neurological structures which form the brain." (Sloan 1983, p.6)

All assessment of reading performance is indirect in that the reading process cannot actually seen. Neither can the interior structure of the long-term memory be seen. This structure can only be constructed from the observation of individuals performing tasks which may possibly represent the way in which the memory stores information. Research into memory operations seems to support the proposition that semantic mapping can be used to provide a reasonable representation of the way individuals link their knowledge about a particular concept.

The present study adopted a variation of the methodology used by Sloan (1983) in that children were asked to show the association between a list of words and phrases and their relationship to a central topic by writing down their responses and showing how these responses were connected by drawing lines between them.

CHAPTER 3

Assumptions, Research Questions and Hypotheses

Assumptions

This research study is founded on two broad assumptions:

1. Children's exposure to narrative text structures, in primary school, does not adequately prepare them to deal with many of the expository texts used in high schools.
2. The primacy of non-visual over visual information in the process of reading comprehension. Reading involves the construction of new knowledge out of old knowledge. Comprehension involves the use of prior schema to construct new schema. Without existing knowledge of both content and processes (including metacognitive processes which facilitate the application of that background knowledge to reading) a complex object, such as a text, would be meaningless. Central to teaching reading comprehension is the building of appropriate schema which readers can activate and access during reading.

Current data indicates that the development of appropriate text schema are crucial to children's progress in reading comprehension and recall. However, the generalizability of the frameworks developed for analysing expository text remain unproven. If the analysis systems are either so complex or so intuitive that only their originators can apply them, then obviously they are of little use. Likewise the most suitable method or methods for teaching of top-level expository text structure to children are still to be determined.

Sloan (1983) investigated the effects of priming using a single untreated reading of a specially selected text prior to the generation of a diagram depicting the association of features contained in the text. Sloan reported that priming involving related reading did not result in significant changes in the complexity of the memory structures that were activated. This led Sloan to suggest that the levels of structure of an individual's semantic memory may be so well set that they would not be changed by selected reading provided over a short time period. (Sloan 1983, pp.276-280)

However, this study sought to show that it was possible to effect a change on structures residing in the long-term memory through the explicit teaching of a top-level expository text structure.

This study also forms part of the research required to determine the usefulness of the frameworks, representing the top-level structures of various expository text types, developed by Sloan and Latham.

The top-level structure used in this particular investigation is that of the scientific report. Sloan and Latham assert that the framework for a simple scientific report consists of four major components; classification, description, location, and dynamics. (see figure 2)

Research Questions and Hypotheses

In the following sections, complexity refers to the number of text items correctly assigned in homogeneous macro-clusters or sub-clusters reflecting the top-level structure of a report.

Four major research questions were posed:

1. Is there a correlation between PAT reading comprehension performance and the varying levels of complexity shown in the sematic associations subjects are able to generate in their graphic representations of the given data related to a central topic.

This research question generated the following hypothesis:

H1. There will be a substantial positive correlation (r >.50, p <.05) between the raw scores

THE SCIENTIFIC REPORT

1. CLASSIFICATION
   What is it?
   What sort of animal is it?
   What group does it belong to ?

2. DESCRIPTION
   What does it look like?
   What size is it?
   What weight is it?
   What colour is it?
   Other physical features?

3. LOCATION
   Where does it live?
   Which countries?
   Which regions?
   What habitats is it found in?

4. DYNAMICS
   How does it move?
   How fast does it move?
   How does it hunt?
   How does it protect itself?
   How does it gather food?
   How does it reproduce?

5. CONCLUSION
   A concluding comment may be included which stresses a special or unique feature of the animal. This feature usually belongs outside the four previous categories and may be opinion, i.e. not scientific .

Figure 2 The Top-Level Structure of a Scientific Report obtained in the PAT reading comprehension test and the total number of items correctly assigned in homogeneous macro-clusters or sub-clusters for subjects in both the experimental and control group prior to treatment.

2. What short-term effects[4] will the explicit teaching of the top-level structure of a scientific report through writing, have on the complexity of the semantic associations subjects are able to generate in their graphic representations of given topic data.

This research question generated seven hypotheses:

H2 The mean (x) number of complex clusters produced by the subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) number of complex clusters produced by the subjects in the control condition after treatment.

H3 The mean (x) total scores of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) total scores of the subjects in the control condition after treatment.

H4 The mean (x) scores for the classification macro-clusters of subjects in the experimental condition will be significantly greater ($p < .05$) than

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[4] Determined by an analysis of the data generated by Test 2.

the mean (x) scores for the classification macro-cluster of the subjects in the control condition after treatment.

<u>H5</u> The mean (x) scores for the description macro-cluster of subjects in the experimental condition will be significantly greater (p < .05) than the mean (x) scores for the description macro-cluster of the subjects in the control condition after treatment.

<u>H6</u> The mean (x) scores for the location macro-cluster of subjects in the experimental condition will be significantly greater (p < .05) than the mean (x) scores for the location macro-cluster of the subjects in the control condition after treatment.

<u>H7</u> The mean (x) scores for the dynamics macro-cluster of subjects in the experimental condition will be significantly greater (p < .05) than the mean (x) scores for the dynamics macro-cluster of the subjects in the control condition after treatment.

<u>H8</u> The mean (x) scores for the individual items of subjects in the experimental condition will be significantly greater (p < .05) than the mean (x) scores for the individual items of the subjects in the control condition after treatment.

<u>3. Will any changes to the complexity in the semantic</u>

associations subjects are able to generate in their graphic representations of the given topic data be maintained over time[5] (i.e. indicate long term changes to the structure of the semantic memory).

This research question also generated seven hypotheses:

H9 The mean (x) number of complex clusters produced by the subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) number of complex clusters produced by the subjects in the control condition after treatment.

H10 The mean (x) total scores of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) total scores of the subjects in the control condition after treatment.

H11 The mean (x) scores for the classification macro-clusters of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) scores for the classification macro-cluster of the subjects in the control condition after treatment.

H12 The mean (x) scores for the description

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5 Determined by an analysis of the data generated by Test 3.

macro-cluster of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) scores for the description macro-cluster of the subjects in the control condition after treatment.

H13 The mean (x) scores for the location macro-cluster of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) scores for the location macro-cluster of the subjects in the control condition after treatment.

H14 The mean (x) scores for the dynamics macro-cluster of subjects in the experimental condition will be significantly greater ($p < .05$) than the mean (x) scores for the dynamics macro-cluster of the subjects in the control condition after treatment.

H15 The mean (x) scores for the individual items of subjects in the experimental condition will be significantly ($p < .05$) greater than the mean (x) scores for the individual items of the subjects in the control condition after treatment.

4. Is there a relationship between the effectiveness of the treatment and reading fluency?

This research question generated a further six hypotheses:

H16 The treatment will result in significant immediate increases ($\underline{p}$ < .05) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by below average readers in the experimental condition.

<u>H17</u> The treatment will result in significant immediate increases ($\underline{p}$ < .05) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by average readers in the experimental condition.

<u>H18</u> The treatment will result in significant immediate increases ($\underline{p}$ < .05) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by above average readers in the experimental condition.

<u>H19</u> The treatment will result in significant long-term increases ($\underline{p}$ < .05) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by below average readers in the experimental condition.

<u>H20</u> The treatment will result in significant long-term increases ($\underline{p}$ < .05) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by average readers in the experimental condition.

<u>H21</u> The treatment will result in significant

long-term increases ($p < .05$) in the mean ($\bar{x}$) number of items correctly assigned in homogeneous macro-clusters or sub-clusters by above average readers in the experimental condition.

CHAPTER 4

Design of the Study

Population

The research population originally consisted of sixty five year seven children who attend Amaroo Primary School in Collie in the south west of Western Australia. However, absences due to illness, during the conduct of the research meant that only fifty children consistently attended sufficient testing and teaching sessions to be included in the results of the study.

Methods

The research design was quasi-experimental (see figure 3). Two existing classes were used to provide the control and experimental groups so as to minimize the disruption to the normal operations of the school.

As it was not possible to use randomized groups, a pre-test consisting of form A of the PAT comprehension test, was administered to both groups. The data collected from the pre-test was analysed using a t-test in order to determine if there were any significant differences between the two groups.

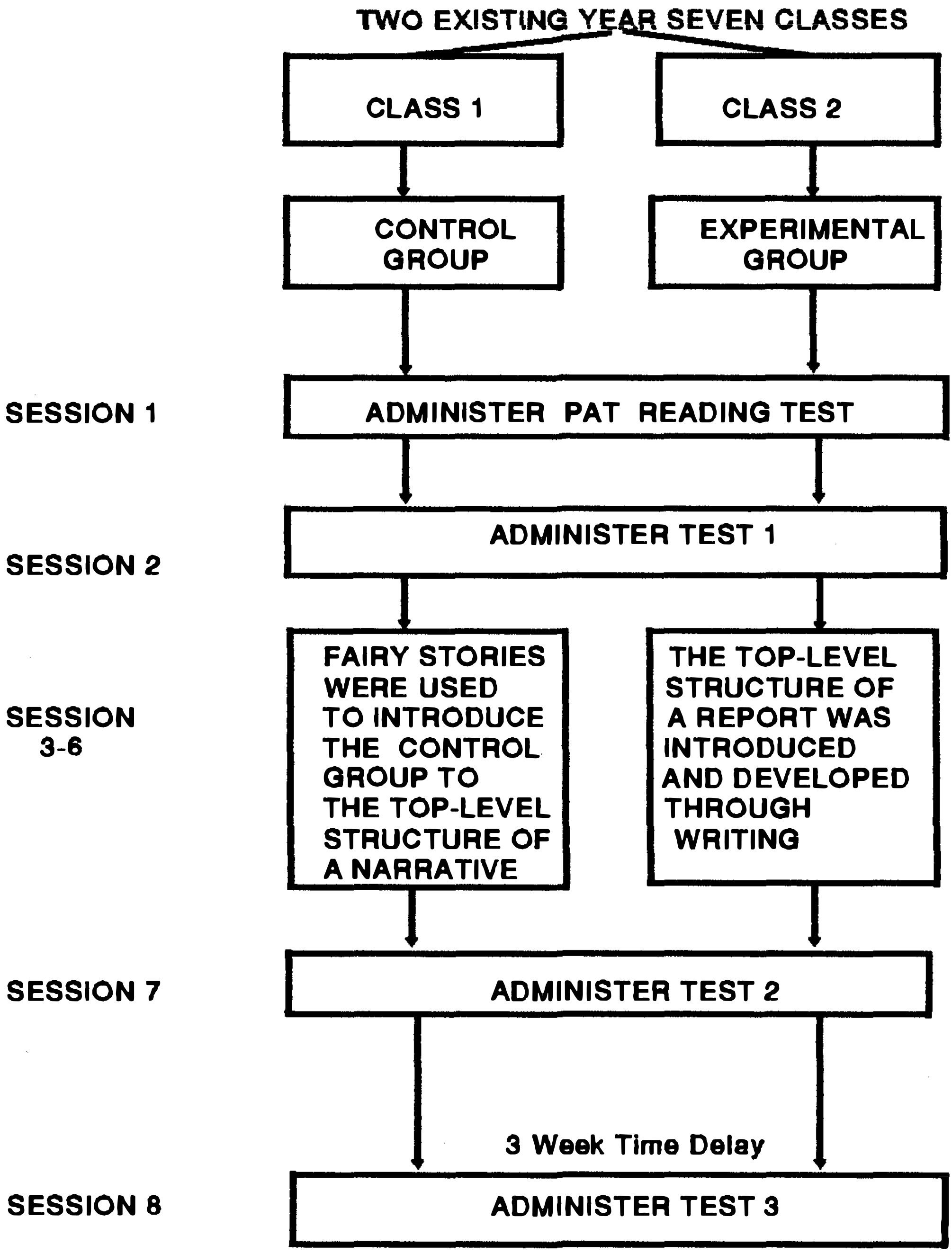

Figure 3 Research Design

In the second session , Test 1 (see Appendix B) was administered to the experimental and control groups. The children's responses were analysed to establish their understanding of the various relationships that exist amongst the different text items with which they were presented. This analysis is discussed in chapter 5.

The results from Test 1 were also analysed using a t-test to see if there was any significant difference between the performance of the two groups prior to the administration of the treatment.

The experimental group were then taught the top-level structure of a scientific report using the procedure outlined below.

Lesson 1

(1) Presentation of models (appendix A) of a scientific report.

(2) Discovery learning of the components of a scientific report.

(3) Categorisation of the components to reflect the report top-level structure.

Lesson 2

(1) Revision of the components of the top-level structure of a report.

(2) Joint composition of a report using a topic

familiar to all children. For example, a household pet.

Lesson 3

Framework sheets reflecting the top-level structure of a report and containing headings and question prompters were used by the children to take notes from library books and other materials on an animal of interest to them.

Lesson 4

Children used the notes made in the previous lesson to produce written discourse which reflected the top-level structure of a scientific report.

To avoid possible contamination of the data due to the Hawthorne effect, four teaching sessions were also conducted with the control group. Fairy stories were used to introduce the control group to the top-level text structure of a narrative (see figure 3). The lesson sequence for the control group was as follows:

Lesson 1

(1) A well known fairy story was used to introduce the children to the top-level structure of a narrative.

(2) Children were given one fairy story each from

THE NARRATIVE

1. SETTING

   Who?
   When?
   Where?

2. INITIATING EVENT

   What began the action?
   How was the main person involved?

3. COMPLICATION

   How did the conflict or problem develop?

4. RESOLUTION

   How did the main character(s) solve the conflict or problem?

Figure 4 The Top-Level Structure of the Narrative a selection of six. Children individually read their stories and noted the various parts of their story which reflected the different structural components of a narrative.

(3) Children formed discussion groups with others who read the same story and discussed their findings and arrived at a consensus about where the different components of the top-level structure of a narrative could be found in their story.

(4) Groups reported back to the whole class.

<u>Lesson 2</u>

(1) Revise top-level structure of the Narrative.

(2) Teacher read Goldilocks and the Three Bears to the class.

(3) Children isolated top-level structure of the story (see figure 4).

(4) Children individually read Goldie Locks by Barry Carrozi.

(5) Class discussion on what aspects of the top-level structure of the original story the author changed and other ways the author could have changed the story by varying aspects of the top-level structure.

GOLDILOCKS AND THE THREE BEARS

SETTING

WHO - mother bear, father bear, and baby bear

WHEN - unknown past (fairy story)

WHERE- forest

INITIATING EVENT

Bears take a pre-breakfast constitutional walk because their porridge is too hot to be eaten immediately.

COMPLICATION

Goldilocks turns up at the bears' house whilst they are gone and enters uninvited.

Subsequent Events

1. Goldilocks eats baby bear's porridge and breaks his chair.
2. Goldilocks goes upstairs.
3. Goldilocks goes to sleep in baby bear's bed after trying the other bears' beds.
4. Bears turn up and find house in disarray.
5. Bears discover Goldilocks in bed asleep.

RESOLUTION

Goldilocks wakes up to find the bears peering at her, gets a big fright and runs away never to be seen by the bears again.

Figure 5 The main components of the top-level structure of Goldilocks and the three bears.

Lesson 3

Children took the fairy story they analysed in lesson 1 and rewrote it, varying aspects of the original top-level structure such as the setting etc. to produce a story which significantly differed from the original.

Lesson 4

(1) Children re-formed the discussion groups from lesson 1 and read their stories to their respective groups.

(2) Each group chose the most innovative story from their group. These stories were then presented to the whole class.

(3) The class discussed what aspects of the top-level structure of the fairy story were varied from the original.

The treatment phase culminated with the re-testing of the control and experimental groups, using Test 2 (see appendix B) thirteen days after the administration of the original test. The time lapse should have been of a sufficient length to minimize the effects of any learning which may have resulted from the completion of Test 1.

Three weeks later the children were again tested using a test similar in construction to Test 1 and Test

2. However, the lexical items in Test 3 (see appendix B) were downgraded, and the children's understanding of these items was established through questioning prior to the administration of the test.

Instrumentation

PAT Test - Comprehension Part 6, Form A.

The progressive achievement comprehension test purports to measure children's comprehension during silent reading. The raw scores or derived scores such as percentiles and stanines can be used to rank individuals in a group. Raw scores can also be converted and used to determine an individuals rank within the state. Grade related norms were produced for each state after testing approximately 18,000 children from years 3-9 in both private and public schools across Australia in 1970.

In the PAT comprehension test year seven children are asked to read 8 passages of prose consisting of narrative, expository and descriptive text. After the completion of each passage they are asked 5 multiple choice questions which purport to measure their factual and inferential comprehension of the material they have just read.

Part 6 of Form A of the PAT Reading Comprehension test was administered to both the experimental and control group to provide baseline data with which to compare the relative homogeneity of two groups prior to treatment. The PAT test was also used to establish levels of performance which could be compared to achievement levels after treatment.

Reliability The reliability coefficient of part 6 between parallel forms A and B of the Progressive Achievement comprehension test = .89 . The standard error of measurement = 2.9

Validity Correlations between PAT Comprehension A and other reading tests are as follows:

1.	PAT Vocabulary A	.84
2.	Otis Intermediate A	.79
3.	ACER Intermediate D	.69

Test 1 ,Test 2 and Test 3

The data collection phase of the project required the development of an instrument which could be used to assess long term changes to children's semantic memory as as a result of the explicit teaching of the top-level structure of a scientific report through a specific writing strategy.

The instrument developed consisted of three tests (a pre-test, a post test and a post-post test which was administered after a time delay). Each test contained 42 randomly ordered text items, made up of key words and phrases, related to a central topic and reflecting the four major components of the top-level structure of a report.

Children were asked to make links between the topic and the key words and phrases, which showed the relationship between the key words and phrases. The children's responses were measured by the extent to which their clustering of text items reflected the macrostructure of a report.

The test instrument required the children to display the associations they made between the different text items in a graphic form. This particular method of assessment was chosen as it was felt that it was a legitimate means of assessing changes to the children's memory structures. It was also felt that the task was sufficiently different from the treatment so as to provide a valid basis from which to measure the level of abstraction of the constant structural patterns observed by experimental group subjects in the models of scientific reports provided in the treatment sessions.

To ensure comparability between the three tests the following considerations were taken into account in their design:

1. They dealt with the same subject area.
2. The children were unlikely to have substantial prior knowledge of any of the three topics.
3. They contained the same number of text items relating to each element of the report structure (4 classification, 14 description, 11 location, 13 dynamics).

However, Test 1 and Test 2 differ from test 3 in some respects. Test 1 and Test 2 were designed to approximate the kinds of information that can be found in a text such as an encyclopaedia or science text. It could normally be expected that that a group of children reading the same text would reflect varying levels of comprehension of the content of that text. Thus, the children's graphic representations of the relationships amongst the information contained in Test 1 and Test 2 may have been influenced by their knowledge of content as well as their knowledge of text structure. However , it will be seen later that there is no significant difference between the control group's results in tests 1, 2 and 3. Similarly, there was no significant difference in the the experimental group's results in test 2 and 3.

In spite of the possible influence of a second variable the researcher decided to persist with the use of Test 1 and Test 2 using this format. It was the researcher's belief that the teaching of the top-level text structure for a report would result not only in changes to the experimental group's text organisation schema but also increase children's content knowledge.

Test 3 was used to explore the effects of children's text structure schema in isolation from their content schema. The lexical items contained in test 3 were deliberately downgraded to facilitate the children's understanding of the content. Children were also asked to read through the items contained in Test 3 prior to the test and the meanings of any words not understood were explained. Test 3 was administered three weeks after Test 2 and was used to detect any long term changes in the children's schema for text organisation.

Test 1 and Test 2 were trialed at a metropolitan primary school prior to the study. A class of 29 year seven students were randomly allocated to two groups (a group of fifteen and a group of fourteen). One group was given Test 1 and the other group Test 2. The trial was used to practise and refine the presentation of the test and the instructions which accompany the test and to provide an opportunity to develop formats for the presentation and analysis of the data produced by the tests.

The trial was also used to train an independent scorer. The independent scorer was then used to score the children's responses to test 1, 2 and 3 in the study using predetermined criteria. An expert in the field of text structure was also asked to score a sample of children's responses in the three tests according to the same criteria in order to validate the independent scorer's ratings.

Analysis of Data

The diagrams produced in Test 1, Test 2 and Test 3 were classified into categories ranging from linear to complex (see figure 6). Diagrams were assigned to a particular category if 60% or more of the items in the diagram reflected that category type. 60% was chosen as it was felt that this reflected the deliberate use of a particular strategy for organising information by the subject rather than a chance occurrence.

The responses were then analysed to determine the extent to which the children's clustering of text items reflected the macrostructure of a report. Items were scored as correctly assigned if either they were grouped in a macro-cluster containing 75% or more of the other items belonging to one of the four components comprising the macrostructure of a report or if they

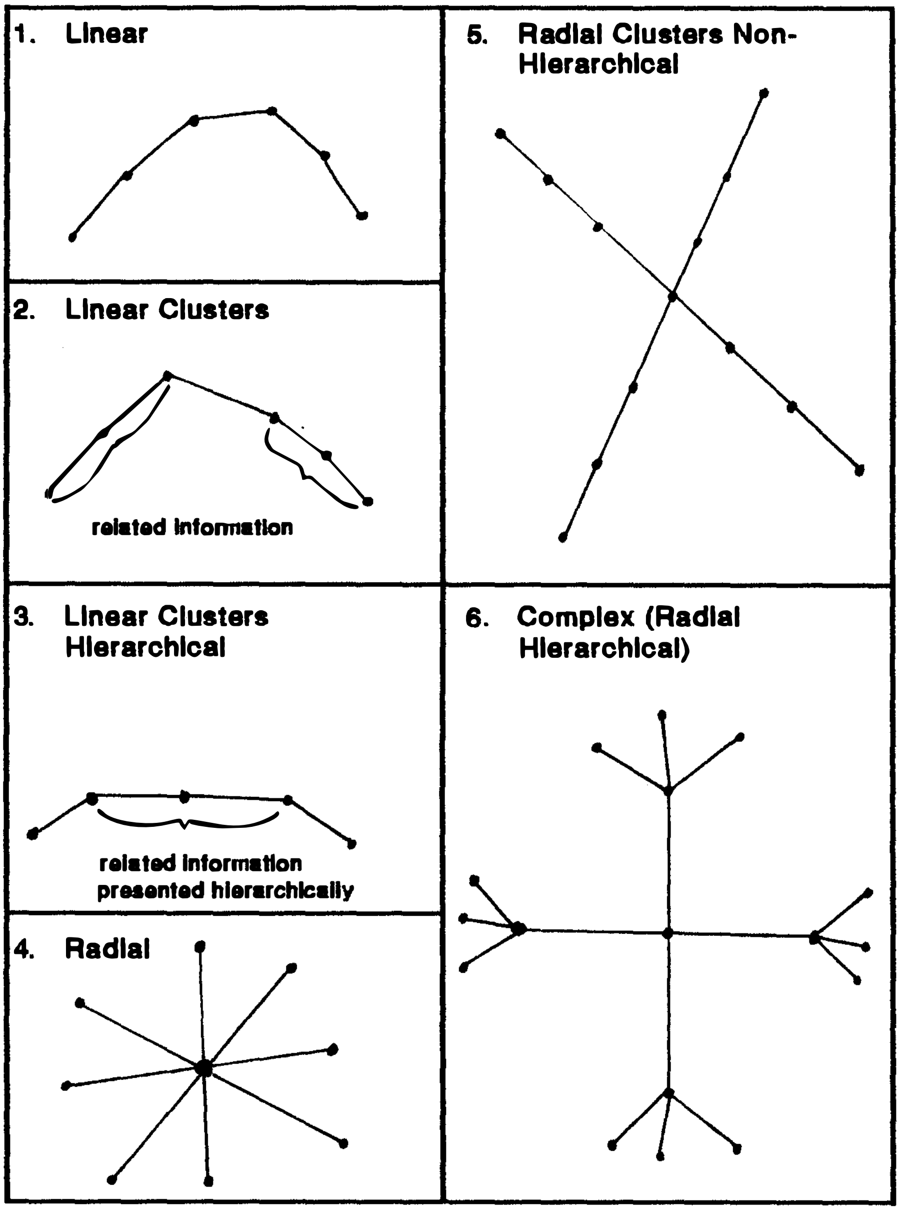

Figure 6 Diagram types.

were grouped with 75% or more of the other items belonging to an appropriate sub-cluster within a component.

Originally, the figure of 80% was considered for scoring as this figure represents the level usually equated with mastery. However, the classification component of the three tests only contains four items. This would have required participants in the study to cluster all four items of the classification component together in order to be scored as correct. Therefore to allow some margin of error the lesser figure of 75% was decided upon.

A comparison was then made between the experimental and control groups' results in Test 2 to determine the efficacy or otherwise, of the treatment using a t-test.

Further comparisons were carried using a t-tests on the experimental and control groups' results in Test 3 to determine if there have been any long term changes to the subjects in experimental group, schema for text structure.

The results of the pre-test were used in combination with the data collected from the research instrument to establish if there is any correlation between the children's performance in the PAT reading comprehension test and the varying levels of complexity shown in the semantic associations (figure 7 shows an example of a complex semantic association) the children were able to generate in response to Test 1; and to determine if there is any correlation between the children's level of performance in the PAT reading comprehension test and the differing effects of the treatment.

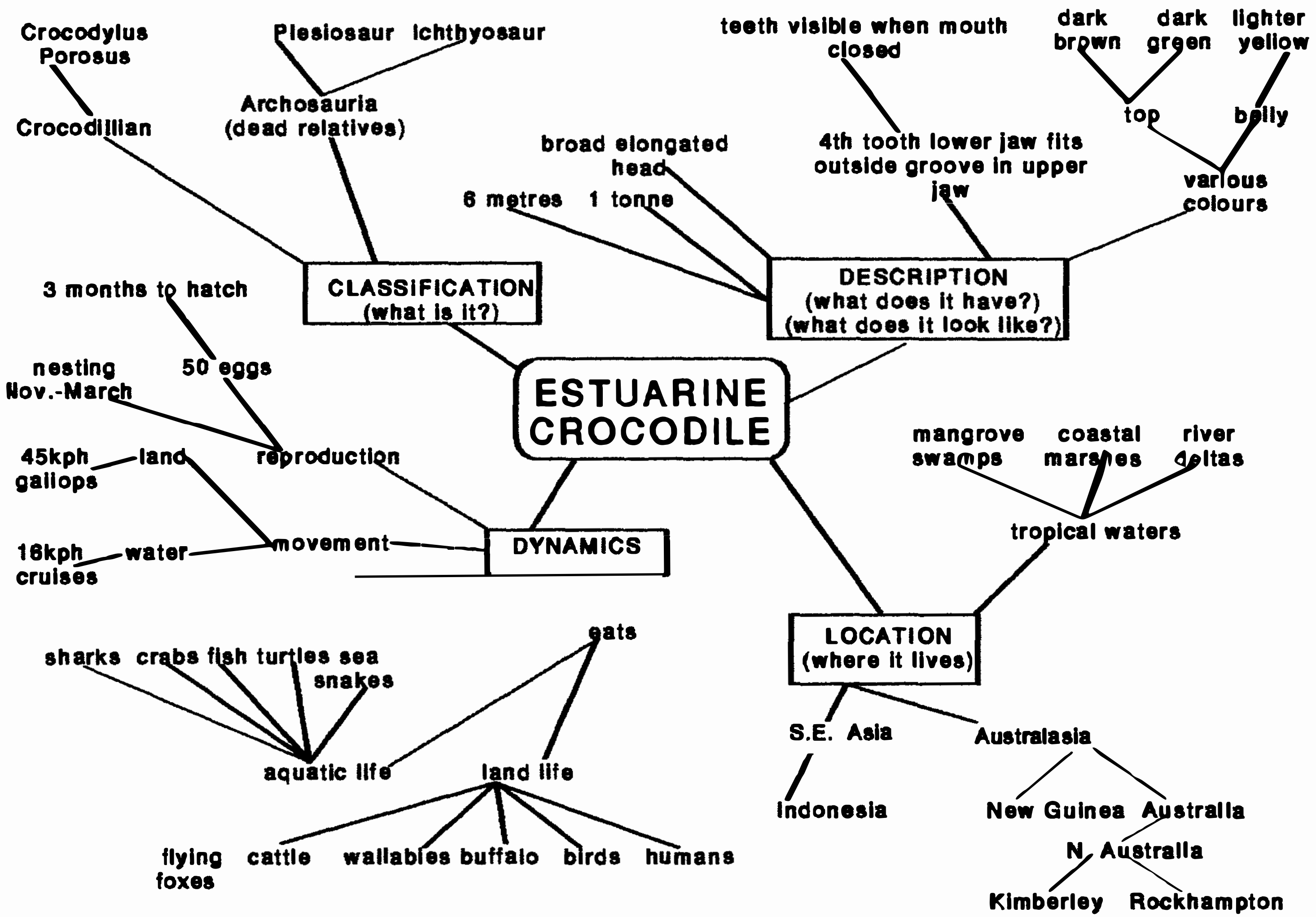

Figure 7 Hierarchical Semantic Network for an Estuarine Crocodile

CHAPTER 5

Findings

Experimental and Control Groups Compared: Pre-Treatment

As it was not possible to allocate students randomly to groups , a SAS system t-test procedure was used to analyse the experimental and control groups' results in the PAT reading comprehension test and in test 1 in order to determine if there is any significant difference in the performance level of the two groups prior to the treatment.

Table 1 shows that there is no significant difference ($p > .05$) between the experimental and control groups as indicated by their performance in the PAT reading comprehension test Form B, prior to the commencement of the testing and treatment sessions.

Similarly, Tables 2, 3, 4, 5 and 6 show that there was no significant difference between the performance of the two groups by total ($p > .05$), by macro-cluster ($p >.05$) or by individual test items ($p > .05$) in test 1.

The results from these two tests would appear to indicate that the individuals comprising both the experimental and control groups, represent a similar sample of the population reflecting a similar distribution of performance levels.

Table 1

Control and Experimental Group Average PAT Raw Score

Control (n=25)		Experimental (n=25)			
X	SD	X	SD	T	P
23.68	8.74	22.84	9.45	0.3260	0.7458

Table 2

Control and Experimental Group Scores by Macro-cluster and Total

Test 1

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
Clas.	0.28	0.97	0.28	0.28	0.0000	1.0000
Des.	5.24	5.76	5.44	5.78	-0.1224	0.9031
Loc.	6.24	4.05	5.76	4.00	0.4212	0.6755
Dyn.	4.44	3.69	4.92	3.46	-0.4737	0.6378
Total	16.2	9.62	16.4	9.21	-0.0751	0.9475

Table 3

Control and Experimental Group Individual Item Scores

Test 1, Classification Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
1	0.8	0.28	0.8	0.28	0.0000	1.0000
2	0.04	0.2	0.08	0.28	-0.5858	0.5609
3	0.08	0.28	0.04	0.20	0.5855	0.5609
4	0.08	0.28	0.08	0.28	0.0000	1.0000

Table 4

Control and Experimental Group Individual Item Scores

Test 1, Description Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
5	0.36	0.48	0.28	0.45	0.5963	0.5538
6	0.36	0.48	0.32	0.47	0.2928	0.7710
7	0.40	0.50	0.36	0.48	0.2857	0.7763
8	0.36	0.48	0.32	0.47	0.2928	0.7710
9	0.44	0.50	0.52	0.50	-0.5565	0.5805
10	0.40	0.50	0.52	0.50	-0.8402	0.4050
11	0.44	0.50	0.40	0.50	0.2810	0.7799
12	0.40	0.50	0.40	0.50	0.0000	1.0000
13	0.36	0.48	0.44	0.50	-0.5676	0.5730
14	0.32	0.47	0.44	0.50	-0.8630	0.3924
15	0.44	0.50	0.44	0.50	0.0000	1.0000
16	0.44	0.50	0.36	0.48	0.5676	0.5730
17	0.32	0.47	0.40	0.50	-0.5794	0.5651
18	0.20	0.40	0.24	0.43	-0.3349	0.7392

Table 5

Control and Experimental Group Individual Item Scores

Test 1, Location Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
19	0.68	0.47	0.76	0.43	-0.6197	0.5384
20	0.72	0.45	0.76	0.43	-0.3162	0.7532
21	0.80	0.40	0.76	0.43	0.3349	0.7392
22	0.80	0.40	0.72	0.45	0.6518	0.5177
23	0.52	0.50	0.52	0.50	0.0000	1.0000
24	0.52	0.50	0.44	0.50	0.5565	0.5805
25	0.52	0.50	0.40	0.50	0.8402	0.4050
26	0.52	0.50	0.44	0.50	0.5565	0.5805
27	0.52	0.50	0.44	0.50	0.5565	0.5805
28	0.52	0.50	0.44	0.50	0.5565	0.5805
29	0.12	0.33	0.08	0.27	0.4629	0.6455

Table 6

Control and Experimental Group Individual Item Scores

Test 1, Dynamics Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\overline{X}$	SD	$\overline{X}$	SD	T	P
30	0.24	0.43	0.28	0.45	-0.3162	0.7532
31	0.24	0.43	0.28	0.45	-0.3162	0.7532
32	0.08	0.27	0.12	0.33	-0.4629	0.6455
33	0.24	0.43	0.12	0.33	1.0954	0.2788
34	0.24	0.43	0.12	0.33	1.0954	0.2788
35	0.12	0.33	0.04	0.20	1.0328	0.3069
36	0.20	0.40	0.12	0.33	0.7605	0.4507
37	0.52	0.50	0.76	0.43	-1.7889	0.0799
38	0.52	0.50	0.76	0.43	-1.7889	0.0799
39	0.52	0.50	0.76	0.43	-1.7889	0.0799
40	0.52	0.59	0.52	0.59	0.0000	1.0000
41	0.48	0.50	0.52	0.50	-0.2774	0.7827
42	0.52	0.50	0.52	0.50	0.0000	1.0000

The lack of significant difference between the experimental and control groups obviates the need to carry out an analysis of covariance in comparing the two groups results in spite of the quasi-experimental nature of the original experimental design.

Reading Comprehension Performance and Complexity of Associations.

This study sought to validate the findings of other researchers (Sloan 1983, Anderson & Pearson 1984) who pointed to a positive relationship between reading performance and the complexity of the relationships subjects were able to generate amongst data relating to a topic.

The combined results of both the control and experimental groups in the PAT reading comprehension test were compared (using Spearman's rank-order coefficient) with the the data collected from Test 1 (see appendix D) to establish if there was any correlation between the children's level of performance in the PAT reading comprehension test and the complexity of the relationships they were able to show in their organisation of the textual items contained in Test 1.

The hypothesis (H1) predicting a substantial positive correlation between reading performance and complexity of relationships shown in their graphic representations of given data relating to a central topic was supported ($\underline{r} = .51$, $\underline{p} < .01$). This meant that more fluent readers were able to assign correctly textual items to appropriate macro-clusters and subclusters with greater frequency than less fluent readers. Evidence for this interpretation can be found in the data in Table 7 which shows that above average readers correctly clustered an average of 22.45 items as compared with 16.46 items and 5.86 items respectively for the average and below average readers.

Diagram Complexity, Text-Schema and the Effects of Treatment

This study hypothesised that the treatment would enable the experimental group to show more complex relationships amongst the data they were provided with in Test 2 and Test 3 than the control group.

The diagrams produced by the children were classified according to type (see figure 8) ranging from linear to complex. In test 1 a total of 4 (2 experimental, 2 control) out of 50 diagrams produced were classified as complex.

Whereas the number of complex diagrams and the of homogeneous hierarchical clusters remained relatively stable throughout the testing for the control group,

Table 7

Average Score in Test 1 by PAT Category

PAT	n	M	SD
1	7	5.86	7.90
2	32	16.46	8.46
3	11	22.45	6.97

Note : maximum score = 42

PAT 1 = below average
PAT 2 = average
PAT 3 = above average

Table 8

Classification of Diagrams Experimental and Control Group

Diagram Type	Test 1 Ex.	Test 1 Con.	Test 2 Ex.	Test 2 Con.	Test 3 Ex.	Test 3 Con.
1	1	2	0	1	0	0
2	8	5	1	2	0	3
3	1	0	0	0	0	1
4	0	0	1	2	1	2
5	13	16	4	17	6	18
6	2	2	19	2	18	2

there were marked changes (see table 9) to the types of diagrams produced by the experimental group. The data was analysed using a t-test for non-independent samples. The results of an analysis of the total number of complex clusters produced disclosed a significant effect for the control group in the post test administered the day after the conclusion of the treatment. (t = 9.29 df = 24, $p < .001$)

This result supported the hypotheses (H2) which predicted that the subjects in the experimental group would be able to generate a significantly greater number of complex clusters in their graphic representations of the associations amongst given data than the control group after treatment.

The fact that the data shows a significant increase in the number of diagrams showing complex relationships organised around the top-level structure of a scientific report points to the fact that not only was the top-level structure of the scientific report internalised but that children from the experimental group were actively applying the internalised text-schema for a report to the organisation of new information.

The follow up test (Test 3) was conducted three weeks after the post test. In the two and a half weeks

Table 9

Total Number of Complex Hierarchical Clusters

	Test 1	Test 2	Test 3
Experimental	7	84	78
Control	8	7	8

prior to Test 3 the children had been on end of term vacation. The test was administered to both the experimental and control groups in the first period on the first day of the new school term. Not only did the test come as a complete surprise to the children but also there was no opportunity for rehearsal. An analysis of the total number of complex clusters generated in the the delayed test indicates a significant ($\underline{t}$ = 6.57 df = 24, $\underline{p}$ < .001.) continuing effect for the experimental group as a result of the treatment.

The results for the experimental group in the test administered after a time delay indicates that the treatment given to the experimental group resulted in a long-term change to their schema for text structure. The subjects in the experimental group continued to apply the structure abstracted from the treatment to the organisation of the data contained in the test thus producing a significantly, on average, greater number of complex clusters than the subjects in the control group. This result supported the hypothesis (H9) that the treatment would result in long term changes to the level of complexity of the clusters produced by the experimental group.

Effects of Treatment on Diagram Complexity: Immediately After Treatment

The results of a SAS t-test procedure on the children's use of the top-level structure of a scientific report immediately after the conclusion of the treatment were significant. Table 10 presents the control and experimental groups' scores in Test 2. The control and experimental group averaged scores of 17.12 and 29.76 out of 42 respectively in the post-test. The experimental group's total score indicates significant ($t = -3.3660$ df = 24, $p < .001$) gains in comparison to the control group as a result of treatment thus supporting hypothesis (H) 3 which predicted this outcome.

Similarly, a breakdown of the score shows significant ($p < .01$) gains by the experimental group in three out of the four macro-clusters supporting hypotheses (H) 4, 5 and 7 which predicted significant gains by the experimental group in the mean number of items correctly assigned to each of the macro-clusters representing the four components that comprise the top-level structure of the report. The exception is the location macro-cluster in which there was a gain by the experimental group in comparison to the control group but it was not statistically significant (t =

Table 10

Control and Experimental Group Scores by Macro-cluster and Total

Test 2

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
Clas.	0.4	1.11	1.64	1.91	-2.7990	$p<.01$
Des.	4.96	6.12	10.60	5.30	-3.4811	$p<.01$
Loc.	6.12	4.83	8.20	4.24	-1.6171	0.1124
Dyn.	5.64	4.37	9.32	4.60	-2.8955	$p<.01$
Total	17.12	11.44	29.76	12.77	-3.7660	$p<.001$

-1.6171, $p = 0.1124$). Thus, the hypothesis (H6) which predicted significant ($p < .05$) gains in the mean number of items assigned by the experimental group to the location macro-cluster after treatment is rejected.

Table 13 shows the eleven items that comprise the location macro-cluster. Whilst, the experimental group on average, consistently scored higher than the control group in each of these items, statistically (i.e. $p > .05$) there is no significant difference between the experimental and control groups' scores in each item.

Similarly, table 14 shows that even though the dynamics macro-cluster showed a significant overall difference between the experimental and control groups (see table 8), 8 of the 13 items showed no significant ($p > .05$) difference when considered individually. Therefore, the hypothesis (H8), which predicted a significant increase in all the mean scores in the number individual test items correctly assigned by the subjects in the experimental group immediately after treatment, is rejected.

Effects of Treatment on Diagram Complexity: Over Time

The patterns discerned in Test 2 in relation the location and dynamics macro-cluster were repeated in Test 3.

Table 11

Control and Experimental Group Individual Item Scores

Test 2, Classification Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
1	0.08	0.27	0.36	0.48	-2.4879	$p<.05$
2	0.08	0.27	0.40	0.50	-2.7974	$p<.01$
3	0.12	0.33	0.44	0.50	-2.6423	$p<.05$
4	0.12	0.33	0.44	0.50	-2.6423	$p<.05$

Table 12

Control and Experimental Group Individual Item Scores

Test 2, Description Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
5	0.32	0.47	0.68	0.47	-2.6734	$p<.05$
6	0.36	0.48	0.80	0.40	-3.4499	$p<.01$
7	0.36	0.48	0.80	0.40	-3.4499	$p<.01$
8	0.32	0.47	0.72	0.45	-3.0266	$p<.01$
9	0.28	0.45	0.80	0.40	-4.2364	$p<.001$
10	0.28	0.45	0.64	0.48	-2.6833	$p<.05$
11	0.36	0.48	0.76	0.43	-3.0500	$p<.01$
12	0.36	0.48	0.80	0.40	-3.4499	$p<.01$
13	0.32	0.47	0.80	0.40	-3.8268	$p<.001$
14	0.32	0.47	0.76	0.43	-3.4082	$p<.01$
15	0.32	0.47	0.80	0.40	-3.8268	$p<.001$
16	0.32	0.47	0.60	0.50	-2.0278	$p<.05$
17	0.52	0.50	0.84	0.37	-2.5298	$p<.05$
18	0.52	0.50	0.80	0.40	-2.1433	$p<.05$

Table 13

Control and Experimental Group Individual Item Scores

Test 2, Location Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
19	0.64	0.48	0.80	0.40	-1.2545	0.2157
20	0.56	0.50	0.76	0.43	-1.4963	0.1411
21	0.28	0.45	0.44	0.50	-1.1711	0.2473
22	0.56	0.50	0.80	0.40	-1.8443	0.0713
23	0.60	0.50	0.72	0.45	-0.8847	0.3808
24	0.60	0.50	0.80	0.40	-1.5492	0.1279
25	0.60	0.50	0.80	0.40	-1.5492	0.1279
26	0.56	0.50	0.80	0.40	-1.8443	0.0713
27	0.60	0.50	0.80	0.40	-1.5492	0.1279
28	0.48	0.50	0.68	0.47	-1.4335	0.1582
29	0.64	0.48	0.80	0.40	-1.2545	0.2157

Table 14

Control and Experimental Group Individual Item Scores

Test 2, Dynamics Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
30	0.32	0.69	0.68	0.47	-2.1463	$p<.05$
31	0.32	0.69	0.60	0.50	-1.6423	0.1071
32	0.24	0.66	0.60	0.50	-2.1669	$p<.05$
33	0.24	0.66	0.60	0.50	-2.1669	$p<.05$
34	0.24	0.66	0.60	0.50	-2.1669	$p<.05$
35	0.12	0.33	0.64	0.48	-4.3948	$p<.001$
36	0.68	0.47	0.88	0.33	-1.7235	0.0912
37	0.68	0.47	0.88	0.33	-1.7235	0.0912
38	0.68	0.47	0.84	0.37	-1.3212	0.1927
39	0.68	0.47	0.88	0.33	-1.7235	0.0912
40	0.48	0.50	0.68	0.47	-1.4335	0.1582
41	0.48	0.50	0.72	0.45	-1.7504	0.0864
42	0.48	0.50	0.72	0.45	-1.7504	0.0864

Table 18 shows the eleven items that comprise the location macro-cluster in Test 3. Again, whilst the experimental group on average, consistently scored higher than the control group in each of these items, statistically (i.e. $p < .05$) there is no significant difference between either the experimental and control groups' mean total scores or their mean individual test item scores in all but one item. Consequently, the hypothesis (H13), which predicted a significant increase mean number of items correctly assigned by the experimental group to the location macro-cluster after a time delay between treatment and testing, is rejected.

Similarly, table 19 shows that even though the dynamics macro-cluster showed a significant overall difference between the experimental and control groups (see table 15), 8 of the 13 items showed no significant ($p > .05$) difference when considered individually. Therefore, the hypothesis (H15), which predicted a significant increase in all the mean scores in the number individual test items correctly assigned by the subjects in the experimental group immediately after a delay, is also rejected.

An explanation for the lack of significant change in the location item scores after treatment may be

Table 15

Control and Experimental Group Scores by Macro-cluster and Total

Test 3

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
Clas.	0.52	1.12	1.84	1.97	-2.9083	$p<.01$
Des.	5.76	6.24	11.40	5.14	-3.4838	$p<.01$
Loc.	8.40	2.92	9.16	3.51	-0.8298	0.4108
Dyn.	4.44	3.11	7.88	5.43	-2.7472	$p<.01$
Total	19.12	8.92	30.28	12.41	-3.6505	$p<.001$

Table 16

Control and Experimental Group Individual Item Scores

Test 3, Classification Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
1	0.16	0.37	0.44	0.10	-2.2229	$p<.05$
2	0.00	0.00	0.48	0.50	-4.7068	$p<.001$
3	0.16	0.37	0.48	0.50	-2.5298	$p<.05$
4	0.20	0.40	0.44	0.50	-1.8443	0.0713

Table 17

Control and Experimental Group Individual Item Scores

Test 3, Description Macro-cluster

	Control ($\underline{n}$=25)		Experimental ($\underline{n}$=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
5	0.32	0.47	0.76	0.43	-3.4082	$p<.01$
6	0.36	0.48	0.76	0.43	-3.0500	$p<.01$
7	0.36	0.48	0.72	0.45	-2.6833	$p<.05$
8	0.40	0.50	0.80	0.40	-3.0984	$p<.01$
9	0.48	0.50	0.84	0.37	-2.8460	$p<.01$
10	0.48	0.50	0.84	0.37	-2.8460	$p<.01$
11	0.44	0.50	0.84	0.37	-3.1755	$p<.01$
12	0.40	0.50	0.84	0.37	-3.5228	$p<.001$
13	0.40	0.50	0.80	0.40	-3.0984	$p<.01$
14	0.44	0.50	0.84	0.37	-3.1755	$p<.01$
15	0.40	0.50	0.84	0.37	-3.5228	$p<.001$
16	0.36	0.48	0.84	0.37	-3.8933	$p<.001$
17	0.48	0.50	0.84	0.37	-2.8460	$p<.01$
18	0.44	0.50	0.84	0.37	-3.1755	$p<.01$

Table 18

Control and Experimental Group Individual Item Scores

Test 3, Location Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
19	0.96	0.20	0.88	0.33	1.0328	0.3069
20	0.96	0.20	0.88	0.33	1.0328	0.3069
21	0.96	0.20	0.88	0.33	1.0328	0.3069
22	0.92	0.27	0.88	0.33	0.4629	0.6455
23	0.96	0.20	0.88	0.33	1.0328	0.3069
24	0.92	0.27	0.84	0.37	0.8593	0.3944
25	0.60	0.50	0.80	0.40	-1.5492	0.1279
26	0.60	0.50	0.84	0.37	-1.9215	0.0606
27	0.60	0.50	0.84	0.37	-1.9215	0.0606
28	0.60	0.50	0.88	0.33	-2.3333	$p<.05$
29	0.32	0.47	0.56	0.50	-1.7261	0.0908

Table 19

Control and Experimental Group Individual Item Scores

Test 3, Dynamics Macro-cluster

	Control (n=25)		Experimental (n=25)			
Item	$\bar{X}$	SD	$\bar{X}$	SD	T	P
30	0.20	0.40	0.56	0.50	-2.7665	$p<.01$
31	0.20	0.40	0.44	0.50	-1.8443	0.0713
32	0.16	0.37	0.56	0.50	-3.1755	$p<.01$
33	0.16	0.37	0.52	0.50	-2.8460	$p<.01$
34	0.08	0.27	0.52	0.50	-3.7916	$p<.001$
35	0.08	0.27	0.44	0.50	-3.1177	$p<.01$
36	0.60	0.50	0.76	0.43	-1.260	0.2337
37	0.56	0.50	0.76	0.43	-1.4963	0.1411
38	0.60	0.50	0.76	0.43	-1.2600	0.2337
39	0.60	0.50	0.76	0.43	-1.2600	0.2337
40	0.40	0.50	0.60	0.50	-1.4142	0.1638
41	0.40	0.50	0.60	0.50	-1.4142	0.1638
42	0.40	0.50	0.60	0.50	-1.4142	0.1638

found by examining the data from all three tests. Both experimental and control groups correctly assigned more than 50% items in the location macro-cluster to an appropriate macro-cluster or sub-cluster prior to treatment. The percentage of correctly assigned items in the location macro-cluster represents a much higher proportion than any of the other three macro-clusters. Similar results are shown by the control group over all three tests (see tables 2, 10 and 15). The probable cause of the lack of significant difference in the data relating to the location macro-cluster, arises out of the fact the subjects from the experimental and control group were already performing relatively well with this component of the top-level structure of a scientific report prior to the treatment. This left less opportunity for post-testing to show statistically significant changes.

Discussion

The results of this study show that not only have children already internalised some of the structural patterns related to location but they are also able to apply this understanding to show the interconnections amongst ideas that they have read.

These results are also noteworthy in that they indicate that, by seventh grade, children seem not only to display some structure awareness but also to differ in their level of awareness of different structures that constitute the macrostructure of a report. This may signify that some of the structures contained within components of a report may be more easily learned than others. Conversely, it may indicate that the connection between these items has been made more explicit in the children's prior learning experiences.

A difference was also shown in some of the items in the dynamics macro-cluster. In Test 1 both the experimental and control group, and in Test 2 and Test 3 the control group, tended to group the items relating to diet together in a sub-cluster. The relationship between some of the items may have been more easily understood because of the use of signals such as the word eats.

Long Term Changes to Text Structure Schema

An analysis of the data collected in Test 3 was conducted using a SAS system t-test procedure. The mean total scores for test three appear in Table 15. The control and experimental group averaged scores of 19.12 (*SD* = 8.92) and 30.28 (*SD* = 12.41) out of 42 respectively in the delayed test. This compared with mean scores of 17.12 (*SD* = 11.44) and 29.76 (*SD* = 12.77) in the post test. The marginal increase in mean scores between Test 2 and Test 3 can be attributed to the down-graded nature of the lexical items used in Test 3 and the modified test procedures. However, a comparison of the mean scores and the standard deviations of the two tests indicate a similar distribution. Therefore, it can be argued that there is no significant difference between the two test results.

The experimental group's mean total score in Test 3 shows significant ($\underline{t}$ = -3.6505 df = 24, $\underline{p}$ < .001) gains which have been maintained over a time, as a result of treatment. Similarly, a breakdown of the score shows significant ($\underline{p}$ < .01) gains, maintained over time, by the experimental group in the classification, description and dynamics macro-clusters. The exception, as with Test 2, was the location macro-cluster.

These results support hypotheses H10, H11, H12 and H14 which predicted that the subjects in the experimental condition would achieve significantly higher mean total scores and significantly higher mean scores in each of the classification, description and dynamics macro-clusters in comparison to the mean scores of the subjects in the control condition.

The fact that the gains made by the experimental group were sustained over a three week break (most of which were holidays) points to a significant long term memory effect in the experimental group. This effect involved changes to the experimental subjects' text structure schema. Subjects from the experimental group were able to retain, recall and apply a structure strategy based on the top-level structure of a report, learned through writing, to the organisation of the data, related to a central topic, contained in Test 3.

Reading Fluency and the Effectiveness Treatment

Duncan's multiple range test was used to determine if the effectiveness of the treatment on the experimental group over the short term and the long term, was influenced by prior reading fluency. The level of reading fluency was equated with the experimental subjects' performance in the PAT reading comprehension test.

This study hypothesised that the treatment would result in the subjects in the experimental group achieving significant immediate (post-test) rises in the mean number of items correctly assigned to homogeneous macro-clusters or sub-clusters for all categories of reading fluency.

Table 20 shows the average scores of the subjects

Table 20

Experimental Group Total Score by Test and PAT Test Category.

	Test 1 (N = 25)		Test 2		Test 3			
PAT	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	F	P
1	4.6*	9.2	12.0*	11.6	13.0*	9.4	1.03	0.3873
2	19.4	7.2	32.8*	7.5	32.4*	9.2	13.54	$p < .01$
3	19.2	4.9	38.4*	6.9	41.2*	1.3	28.61	$p < .01$

Note : maximum score = 42

* indicates scores which are not significantly different within a PAT category

PAT 1 (n = 5) = below average

PAT 2 (n = 15) = average

PAT 3 (n = 5) = above average

in the experimental group by PAT category and by test. All categories of reading fluency show immediate (post test) increases in the mean number of items correctly assigned. However, whereas the increases for average and above average readers are significant (p <.01) the increases achieved by below average readers are not statistically significant (p = 0.3873). Thus, the hypotheses H17 and H18 which predicted significant increases for average and above average readers respectively, have been supported and the hypothesis H16 which predicted significant increases for below average readers has been rejected.

This study also hypothesised that the significant rises in the mean number of items correctly assigned would be maintained over time, by all categories of reading fluency. Again, the increases maintained by average and above average readers in the delayed test are significant (p <.01) the increases achieved by below average readers are not statistically significant (p = 0.3873). Thus, the hypotheses H20 and H21 which predicted the maintenance over time of significant increases for average and above average readers respectively, have been supported and the hypothesis H19 which predicted the maintenance over time of significant increases for below average readers has been rejected.

Limitations of Method of Analysis

The findings in relation to the effectiveness of the treatment particularly for the above average and below average readers should be treated with caution. Both groups were comprised of only small numbers (5 in each) limiting the usefulness of parametric analysis. For example, the lack of significant results produced by the treatment for below average readers may be caused by the particular composition of the group analysed rather than by some inadequacy of the treatment. In particular, the mean scores of the below average group in all three tests, were effected by the score of one subject who continually scored zero. However, observations of this subject in a variety of situations could lead to the conclusion that the scores were the reflection of a general motivation problem rather an ineffective teaching strategy.

Discussion and Implications

This study supported the research findings of Sloan (1983, p. 267) which concluded that fluent readers differed significantly from less fluent readers in their ability to generate diagrams showing complex semantic relationships. The diagrams generated were thought by Sloan to represent in a very simplified form, the associative semantic memory structures of the subjects of the study. Thus fluent readers differed from less fluent readers in the complexity of their associative semantic memory structures.

Sloan also investigated the effects of priming using a single untreated reading of a specially selected text prior to the generation of a diagram depicting the association of features contained in the text. Sloan reported that priming involving related reading did not result in significant changes in the complexity of the memory structures that were activated. This led Sloan to suggest that the levels of structure of an individual's semantic memory may be so well set that they would not be changed by selected reading provided over a short time period. (Sloan 1983, pp. 276-280)

Significance of Study

However, this investigation into the influence of teaching a top-level expository text structure through writing on the organisation and enhancing of the existing structures of readers showed that it was possible to effect a change on structures residing in the long-term memory and that the change would persist over time. The worth of this study lies in that it showed that it was possible to encourage the development of structural schemata through the use a specific teaching writing strategy.

The study also showed the potential usefulness of the teaching of top-level text structure through writing. The strategy worked with both average and with above average readers. The experimental group data related to below average readers shows changes to the complexity of the associations represented, although the changes were not significant. However, the lack of statistically significant results may have been related to the size of the group rather than to the effectiveness of the strategy.

Limitations of Study and Recommendations for Further Research

This study was limited to the memory effects of the teaching of the top-level structure of a scientific report through writing. Similar research needs to be carried out on the memory effects of teaching other top-level expository text structures using the same basic writing strategy.

Further research also needs to be undertaken to explore the effect that the internalization of the top-level structures of various expository text-types has on the retention and recall of information read; in text that adheres to the top-level structure of the particular text type under consideration; and in text in which the information is presented in a more haphazard format.

The present study is also limited in that it cannot clearly distinguish between the effects of the treatment which involves the explicit teaching of the top-level structure of a scientific report using highly structured texts and the possible memory effects that may have arisen simply from the exposure of subjects to the highly structured texts themselves. In spite of this limitation it is the author's opinion that the explicit teaching of the top-level structure would have considerably enhanced any organisational changes to the subjects semantic memory that may have resulted from their exposure to structured texts. However, the validation of claim requires carrying out of further research. An outline of a research design which could be adopted to test this claim appears in Appendix G.

APPENDICES

Appendix A.

Models Used to Introduce the Top-Level Structure of a Report

<u>The Cane Toad</u>

The Cane toad is a member of an ancient class of animals known as Amphibia. It is a true toad belonging to the family Bufondae. The Cane toad's scientific name is Bufo marinus.

Growing to over 20 centimetres long a mature Cane toad is large enough to cover a small dinner plate. The Cane toad has a short snout and a large protruding gland situated at the base of each eardrum. Its skin is bumpy and warty and is either grey or various shades of brown on top and is a pale yellow underneath. The Cane toad also has a front-hinged tongue similar to that of frogs.

Originally a native of Central and South America the Cane toad was introduced to Queensland from Brazil in 1935. The Cane toad appears to be able to tolerate a wide range of habitats from tropical to arid. Its present distribution extends from Cape York Peninsula to Coffs Harbour in New South Wales and is steadily moving West of the Great Dividing Range.

Cane toads are mainly insectivorous but they also consume some vegetation. It captures insects by wrapping its tongue around its prey.

The toad is able to protect itself from many of the natural enemies of frogs such as snakes and birds by spraying a lethal poison from its glands. Potential predators have learned to leave the Cane toad alone.

Like other amphibians Cane toads are able to live on land but are dependent on water availability for breeding. Cane toads breed twice a year and lay thousands of eggs in long chains wherever water is available.

There is now a thriving cane toad industry in Australia. Hundreds of thousands of these animals are used in medical research and in science laboratories. Cargoes of frozen cane toads are exported overseas as a source of leather.

The Leathery Turtle

The Leathery turtle is a reptile and one of the seven species of marine turtle. Its scientific name is Dermochelys coriacea.

Attaining a length of 3 metres and a weight of 725 kilograms, the Leathery turtle is the largest of the marine turtles. However, the leathery turtle differs from the other species of marine turtle in that it lacks the bony plates which protect the back and underside of other turtles. Instead the body is covered by a thick leathery skin, strengthened by small embedded bones and twelve longtitudinal ridges. In young Leathery turtles these ridges are white, whilst the adult turtles are uniformly dark brown. The leathery turtle also has large forelimbs without claws and a beak-shaped mouth.

The Leathery turtle roams all around the world's tropical and temperate oceans. In Australia, the turtle's range extends down the eastern seaboard to the southern coasts of New South Wales.

The Leathery turtle is exclusively carnivorous and preys on fish, molluscs, crustaceans and jellyfish. Molluscs and crustaceans are crushed by the turtle's beak prior to being eaten.

Like other Marine turtles, female Leathery turtles must come ashore to nest. A clutch of approximately one hundred large eggs are laid in holes dug by the turtle in a sandy beach.

Owing to the lightness of its armour and its enormous flippers the Leathery turtle is the fastest swimmer of all the Marine Turtles.

Giant Salamander

The Giant salamander is an amphibian. It is one of three species of salamander and its scientific name is Megalobatrachus japonicus.

Reaching a length of 1.6 metres the Giant Salamander is the largest living Amphibian. Its head and body are flattened and skin folds are present along its sides. Its tail is also laterally flattened. When young the Giant salamander's head region bears three pairs of gills, but a partial metamorphosis takes place and the external gills are absorbed when it reaches its adult stage. The eyes of the Giant salamander lack eyelids and unlike other amphibians its larval teeth are retained in adulthood.

The Giant salamander lives in cool swift streams in Japan.

It is carnivorous but instead of pursuing its prey the salamander waits until its prey is within reach and seizes it with a swift lateral movement of the head. Prey consists of fish smaller salamanders, crayfish and other vertebrates.

Being aquatic and lacking external gills the Giant salamander has to surface at intervals to breathe.

Breeding takes place in late summer and the eggs form a string as they emerge to be externally fertilized.

The Giant salamander is considered a great delicacy by the Japanese. They can be captured by fishing, using fish frogs or large worms as bait. The bait has to be brought near to the animal for a bite to take place. The point of the baited hook is forced into the end of a wooden rod and then, using the end of a wooden rod, the baited hook is directed to the spot where the salamander may be lurking.

The Estuarine Crocodile

The Estuarine crocodile is a reptile and its scientific name is Crocodylus porosus. Along with Alligators, Gharials and Caimans, the Estuarine crocodile belongs to a group called the Crocodilians. Crocodilians are the nearest living relatives of a group of aquatic dinosaurs known as Archosauria.

The Estuarine crocodile is the largest of all the crocodiles. It can reach a length of six metres and can weigh a tonne. Males tend to be longer than females and both have broad elongated heads. They vary in colour from; black, dark brown or dark green on top and are a lighter yellow on the belly.

An Estuarine crocodile's teeth can be seen even when its mouth is closed. The large fourth tooth in the crocodile's lower jaw fits into a groove on the outside of the upper jaw.

Estuarine crocodiles are found in tropical waters ranging from India, through South East Asia and New Guinea to northern Australia. Within Australia they are found in an area stretching from the Kimberley Region in Western Australia to Rockhampton in Queensland. They live in mangrove swamps, coastal marshes and river deltas, where the mangrove trees grow close together in the river mud and tall grass covers the riverbank.

At sea the Estuarine crocodile feeds on fish, crabs, turtles and sea snakes. Even sharks are eaten by large crocodiles. In rivers the Estuarine crocodile not only feeds on aquatic life but also snatches quarry from the riverbank. Wallabies, buffalo, cattle, birds, flying foxes and, occasionally, humans are taken.

Crocodiles can move surprisingly quickly. When frightened or disturbed a crocodile may break into a gallop or a sprint to the safety of the water. Galloping crocodiles have been timed at speeds of 45 kilometres per hour. In the water crocodiles can cruise at speeds of about 16 kilometres an hour.

Nesting season for Estuarine crocodiles occurs from November to March. When her eggs are ready to be laid the female crocodile builds a nest out of leaves and soil on a suitable river bank. The mother lays up to fifty eggs and often stays nearby to protect them. After three months in the warm soil the babies chip their way out of the eggs.

Having endured changing conditions for millions of years the Estuarine crocodile now faces its greatest threat - people. The number of this species in Australia may be as low as a few thousand. Consequently, the Australian Government has banned all traffic in crocodiles and their remains. Their numbers are now reported to be increasing.

Appendix B

Testing Instruments

MUSKRAT

EATS SNAILS
POWERFUL FRONT TEETH
SHORT HEAD
EATS WATER PLANTS
WEBBED FEET USED TO SWIM
LAKES
TAIL LENGTH 20-25CM
EXCELLENT DIVER
MATES APRIL-MAY
RIVERS
OODNARTA ZIBETHICA
IN BURROWS
MOVES AWKWARDLY ON LAND
EUROPE
1 - 2 YOUNG PER LITTER
THICK HEAD
FRESHWATER
PRODUCES ONE LITTER PER YEAR
RESTS DURING THE DAY
SKIN FOLD OVER INNER EAR
BOGS
SWAMPS
U.S.A.
MAMMAL
CANADA
TAIL USED TO STEER IN THE WATER
EXCELLENT SWIMMER
SHINY FUR
SALTWATER
HEAD DIRECTLY CONNECTED TO BODY
CAN REACH THE SIZE OF A WILD RABBIT
THICKSET BODY
EATS FARM PRODUCE
STREAMS
DARK BROWN TO CHESTNUT BROWN
WEBBED TOES ON BACK FEET
WEIGHT 600-1500 GMS
FLATTENED TAIL
OMNIVORE
RELATED TO RATS AND MICE
FEEDS DURING THE NIGHT
BODY LENGTH 30-36CM

Test 2

TAPIR

EATS FRESH SPROUTS
VARIETY OF COLOURS
SHORT EARS
EATS SMALL BRANCHES
VERY FAST RUNNER
MOUNTAINS OF PERU
BODY LENGTH 180-250CM
EATS LEAVES
MATES ANY TIME DURING THE YEAR
LOWLANDS OF CENTRAL AMERICA
TAPIRUS TERRISTRIS
LOWLANDS OF BRAZIL
EATS AQUATIC PLANTS
CENTRAL AMERICA
2 LITTERS PER YEAR
BULKY RUMP
TROPICAL RAINFORRESTS
PRODUCES 1 YOUNG PER LITTER
RESTS DURING THE DAY
SHORT HAIR
ANDES
MALAYA
SOUTH AMERICA
MAMMAL
SOUTH EAST ASIA
EXCELLENT SWIMMER
TRUNK USED TO PULL FOOD FROM TREES
FLAT HEAD
NEAR WATER
FAT TAIL
CAN REACH THE SIZE OF A LARGE PIG
MOVABLE TRUNK
FLEES WHEN THREATENED
SUMATRA
SHORT TRUNK
3 TOES ON BACK FEET
WEIGHT 225-300KG
4 TOES ON FRONT FEET
RELATED TO THE RHINOCEROUS
HERBIVORE
FEEDS DURING THE NIGHT
BODY HEIGHT 75-120CM

Test 3

BILBY

EATS INSECTS
BLUE GREY
LONG EARS
EATS MICE
STANDS ON BACK LEGS
IN BURROWS
BODY LENGTH 22-27 CM
MATES ONCE A YEAR
EATS GRASS SEEDS
NORTHERN TERRITORY
MARSUPIAL
BUSH
CARRIES BABY IN A POUCH
PINK NOSE
DRY AREAS
HAS ONE BABY AT A TIME
SLEEPS DURING THE DAY
LONG FUR
WESTERN AUSTRALIA
GRASSY AREAS
ALICE SPRINGS
OMNIVORE (MEAT AND PLANT EATER)
DOESN'T MOVE FAR FROM BURROW
NORTHERN NEW SOUTH WALES
HOPS ON BACK LEGS
SOFT FUR
DESERT
LONG NOSE
TAIL BLACK AND WHITE
ABOUT THE SIZE OF A CAT
HIDES IN BURROW FOR PROTECTION
NEAR RELATIVE OF THE BANDICOOT
WEIGHS 1.5 - 2.5 KG
LONG TAIL
NORTHERN VICTORIA
RABBIT-LIKE EARS
AN ANIMAL
MOVES AND FEEDS DURING THE NIGHT
POINTED NOSE
EATS ANTS
AUSTRALIA
SILKY FUR

Appendix C

Test Instructions

Test 1 and Test 2

This is not a test. It is an experiment to show the different ways in which children organize information. There is no right answer. The right answer is the one that is right for you. When told to do so you will work quietly and on your own to complete the given activity.

On your desk you have two pieces of paper:

(1) An A4 piece of paper which contains a list of words and phrases relating to an animal such as might appear in an article in an encyclopaedia or science book.

(2) A blank sheet of A3 paper.

When told to do so, I want you to read through the items relating to your animal two or three times. Then draw a diagram on your blank sheet of paper which uses lines to show how the words or phrases about your animal are related or linked together.

Your diagram should include the name of your animal. However, before you write the name of your animal on your paper, think about what your diagram is going to look like so you know whereabouts on your paper to place its name.

To help you with the presentation of your diagram place each word or phrase in a circle or a square.

eg.

bigger than an elephant

Test 3

As above. However, prior to the children commencing the drawing of their diagrams ask the children if there are any words contained on the sheet whose meaning they do not understand. Explain the meaning of these words to the entire class and check they have understood.

e.g. A marsupial is a mammal which carries its babies in a pouch like a kangaroo or a Koala.

Appendix D

Data Collection Tables

Experimental Group

EXPERIMENTAL TEST 1
(>75%)

IDENTIFICATION CODE	TEST	CLASSIFICATION	Omnivore	Mammal	Related to rats and mice	Oodnarta zibethica	DESCRIPTION	Can reach size of rabbit	Thickset body	Body Length 30-36cm	Weight 600-1500gms	*Shiny fur	*Dark - chestnut brown	Tail length 20-25cms	Flattened tail	*Head directly con. to body	*Short head	*Thick head	*Skinfold over inner ear	*Powerful front teeth	Webbed toes on back feet	LOCATION	Northern Hemisphere	Europe	Canada	USA	*Saltwater	*Freshwater	*Swamps	*Streams	*Rivers	*Lakes	In burrows on banks	DYNAMICS	Feeds during the night	Rests during the day	*Moves awkwardly on land	*Excellent swimmer	*Excellent diver	*Webbed feet used to swim	*Tail used to steer	Eats water plants	Eats snails	Eats farm produce	*Mates April-May	*Produces 1 litter/year	*1-2 young/litter
201	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	2	2	2
202	1		2	2	2	2		2	2	2	2	1	1	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
203	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2
204	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	1		1	1	2	2	2	2	2	1	1	1	1	1	1
205	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	1	1	1
208	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	1	1	1
207	1		2	2	2	2		1	2	1	1	1	1	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	2	1	1	1	1	1	1	1
208	1		1	1	2	1		1	1	1	1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	1	1	1	1	1	1		2	2	2	1	1	1	1	1	1	1	1	1	1
209	1		2	2	2	2		2	2	2	2	1	1	1	1	1	1	1	2	1	2		1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	1	1	2	2	2	1	1	1
210	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	1	1	1
211	1		2	2	2	2		2	1	1	1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	2	1	1	1	1	1		2	2	2	2	2	2	2	1	1	1	2	2	2
212	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2
213	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2
214	1		2	2	2	2		1	1	1	1	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	1	1	1	1	1	1
215	1		2	2	2	2		2	2	2	2	1	1	2	2	1	1	1	1	1	2		1	1	1	1	2	2	2	2	2	2	2		1	1	2	2	2	2	2	1	1	1	1	1	1
218	1		2	2	2	2		1	1	1	2	1	1	1	1	1	1	1	1	2	1		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	1	1	1
217	1		2	2	2	2		2	2	2	2	1	1	1	1	1	1	1	2	1	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2
218	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	1	1	1
219	1		2	2	2	2		2	2	2	2	1	1	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
220	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
221	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		1	1	2	2	2	2	2	1	1	1	2	2	2
222	1		1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	2	1	1	1	1	1	1	1
223	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	2	2	2	2	2	2	2		1	1	2	2	2	2	2	1	1	1	1	1	1
224	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
225	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2

EXPERIMENTAL TEST 2

(>75%)

IDENTIFICATION CODE	TEST	CLASSIFICATION	Herbivore	Mammal	Related to the rhino	Tapirus terristris	DESCRIPTION	Reach size large pigt	Body height 75-120cm	Body length 180-250cm	weight 225-300kg	Fat tail	Bulky rump	*Short hair	*Variety of colours	Flat head	Short ears	Short trunk	Movable trunk	*4 toes on front feet	*3 toes on back feet	LOCATION	South East Asia	Malaya	Sumatra	*Central America	*Lowlands of Central America	South America	Lowlands of Brazil	Mountains of Peru	Andes	*Near water	Tropical rainforest	DYNAMICS	Feeds during the night	Rests during the day	*Excellent swimmer	*Very fast runner	*Flees when threatened	Trunk get food from trees	Eats aquatic plants	Eats leaves	Eats small branches	Eats fresh sprouts	*Mates any time in the year	1 young per litter	2litters per year
201	2		2	1	1	1		1	1	1	1	1	1	1	1	1	1	1	2	1	1		1	1	1	1	2	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
202	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2
203	2		2	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	2	1	2	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
204	2		1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	2	1	1	1	1	2	1	1
205	2		1	1	1	1		2	1	1	1	1	2	1	1	1	1	1	2	1	1		1	2	2	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
206	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	2	1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
207	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	1	1		1	1	2	1	1	1	1	1	1	2	1		2	2	2	2	2	2	1	1	1	1	2	2	2
208	2		2	2	2	2		2	1	1	1	1	2	1	1	1	1	1	1	1	1		1	1	2	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
209	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	2	1	1	1	1	1	1	1	1	1	1	1
210	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	2	1	1	1	1	1	1	1	1		1	1	2	1	2	1	1	1	1	1	1	1	1
211	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	2	1	1	1	1	1	1	1	1		1	1	1	2	1	1	1	1	1	1	1	1	1
212	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	2	2	2	2	1	1	1	1	1	2	2	2
213	2		1	1	1	1		1	1	1	1	1	2	1	1	1	1	1	2	1	1		2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	2	1	1	1	1
214	2		2	2	2	2		1	1	1	1	1	2	1	1	1	1	1	2	1	1		1	1	2	1	1	1	1	1	1	1	1		2	2	2	2	2	1	1	1	1	1	1	1	1
215	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	2	1	1	1	1	1	1	1
216	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	2	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
217	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	2	1	1	1	1	1	1	2	1		1	1	1	1	1	1	1	1	1	1	1	1	1
218	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
219	2		2	2	2	2		1	1	1	2	1	1	1	2	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
220	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	2	1		2	2	2	2	2	2	1	1	1	1	2	2	2
221	2		1	2	1	1		2	1	1	2	1	1	1	1	1	2	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	1	1	1
222	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
223	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1
224	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
225	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2

EXPERIMENTAL TEST 3 (>75%) IDE TIFICATION COD	E T	L SSIFICATION	nl al	lvore	ted to Bandicoot	uplal	CRIPTION	ch alze lof a ra lt	ha ...	Body lengt ..	*Blue grey	*Soft fur	*long furll	*Silky fur	Long nose	Pointed nose	Pink nose	*long tall	*Tall black and white	*Long ears	Rabbit like ears	LOCATION	Australia	Western Australia	Northern Ter tory	Northern NSW	Northern lstoria	Alice Springs	*Dry Areas	*Desert	*Grassy areas	*Bush	*In burro s	DYNAMI S	Feeds during the night	Rests during the day	*Hops on ck legs	*Stands on ack legs	Doesn't ove far fro u	Hides in urrow	*Eats insects	*Eats ants	*Eats grass seeds	*Eats mice	Mat s any ti e in the year	I ba y at a t e	Baby carried in pouch
201																																															
202																																															
203									2																																						
204																																															
206																																															
																2	2																														
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219																																															
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224																																															
																											2																				

Appendix E

Data Collection Tables

Control Group

CONTROL TEST 1
(>75%)

IDENTIFICATION CODE	TEST	CLASSIFICATION	Omnivore	Mammal	Related to rats and mice	Ondnarta zibethica	DESCRIPTION	Can reach size of rabbit	Thickset body	Body Length 30-36cm	Weight 600-1500gms	*Shiny fur	*Dark - chestnut brown	Tail length 20-25cms	Flattened tail	*Head directly con. to body	*Short head	*Thick head	*Skinfold over inner ear	*Powerful front teeth	Webbed toes on back feet	LOCATION	Northern Hemisphere	Europe	Canada	USA	*Saltwater	*Freshwater	*Swamps	*Streams	*Rivers	*Lakes	In burrows on banks	DYNAMICS	Feeds during the night	Rests during the day	*Moves awkwardly on land	*Excellent swimmer	*Excellent diver	*Webbed feet used to swim	*Tail used to steer	Eats water plants	Eats snails	Eats farm produce	*Mates April-May	*Produces 1 litter/year	*1-2 young/litter
101	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	2	1		1	1	1	1	2	2	2	2	2	2	2		1	1	2	2	2	2	2	1	1	1	1	1	1
102	1		2	2	2	2		1	1	1	1	1	2	1	1	1	1	1	1	1	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	1	1	1
103	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	1	2	1	1	1	1	1	2	1
104	1		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	1	1	1
105	1		2	2	2	2		1	1	1	1	1	1	1	2	2	2	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	2	1	1	1	1	1	1	1
106	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	1	1	1
107	1		2	2	2	2		2	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	1	1	1	1	1	1
108	1		2	2	2	2		2	2	2	2	1	1	2	2	2	2	2	2	2	2		2	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	2	2	2
109	1		2	2	2	2		2	2	2	2	2	2	1	1	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	1	1	1	1	2	2	2	1	1	1
110	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	2	1	1	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
111	1		1	1	1	1		1	2	1	1	2	2	2	2	2	2	2	2	2	2		1	1	1	1	2	2	2	2	2	2	2		2	2	2	1	1	1	1	1	1	1	1	1	1
112	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2
113	1		1	2	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	2	2	2
114	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	1	1	1
115	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
116	1		2	2	2	2		2	2	2	2	2	2	2	2	1	1	1	1	1	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	1	1	1
117	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	1	1	1	1	1	1	1	1	1	2		1	1	2	1	1	2	2	1	1	1	1	1	1
118	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		1	2	1	1	2	2	2	2	2	2	2		2	2	2	1	1	1	1	2	2	2	2	2	2
119	1		2	2	2	2		2	2	2	2	2	3	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	2
120	1		2	2	2	2		2	2	2	2	1	1	1	1	2	1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
121	1		2	2	2	2		1	1	1	1	1	1	1	1	1	2	1	1	2	1		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2
122	1		2	2	2	2		1	1	1	1	1	1	1	1	1	2	1	1	2	2		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	2	2	2
123	1		2	2	2	2		2	2	2	2	2	3	2	2	2	2	2	2	2	2		2	1	1	1	2	2	2	2	2	2	2		1	1	2	2	2	2	2	2	2	2	2	2	2
124	1		2	2	2	2		1	1	1	2	1	1	1	1	1	1	1	1	1	2		2	2	2	2	1	1	1	1	1	1	2		1	1	2	2	2	2	2	2	2	2	1	1	1
125	1		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	1	1	1	2	2	2

CONTROL TEST 2
(>75%)

IDENTIFICATION CODE	TEST	CLASSIFICATION	Herbivore	Mammal	Related to the rhino	Tapirus terristris	DESCRIPTION	Reach size large pigt	Body height 75-120cm	Body length 180-250cm	weight 225-300kg	Fat tail	Bulky rump	*Short hair	*Variety of colour	Flat head	Short ears	Short trunk	Movable trunk	*4 toes on front feet	*2 toes on back feet
101	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
102	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
103	2		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
104	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
105	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
106	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
107	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
108	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
109	2		2	2	2	2		1	1	1	1	2	2	2	2	2	2	2	2	2	2
110	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
111	2		2	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
112	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
113	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
114	2		1	2	1	1		2	2	2	2	2	2	1	1	2	2	2	2	1	1
115	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
116	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
117	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	1	1
118	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
119	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
120	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	1	1
121	2		2	2	2	2		2	1	1	1	2	2	1	1	1	1	1	1	1	1
122	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
123	2		2	2	2	2		1	1	1	2	1	1	1	1	1	1	1	1	1	1
124	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	1	1
125	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	1	1
Tot.																					

IDENTIFICATION CODE	LOCATION	South East Asia	Malaya	Sumatra	*Central America	*Lowlands of Central America	South America	Lowlands of Brazil	Mountains of Peru	Andes	*Near warter	Tropical rainforest	DYNAMICS	Feeds during the night	Rests during the day	*Excellent swimmer	*Very fast runner	*Flees when threatened	Trunk get food from trees	Eats aquatic plants	Eats leaves	Eats small branches	Eats fresh sprouts	*Mates any time in the year	1 young per litter	2litters per year	TOTAL (10
101		1	1	1	1	1	1	1	1	1	1	1		1	1	2	2	2	2	2	2	2	2	1	1	1	
102		1	1	2	1	1	1	1	2	1	1	1		2	2	1	1	1	2	2	2	2	2	1	1	1	
103		1	1	2	2	1	1	1	1	1	1	1		2	2	1	1	1	2	2	2	2	2	2	2	2	
104		1	1	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	1	1	1	
105		1	1	2	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
106		1	1	2	1	1	1	1	1	1	2	1		2	2	2	2	2	2	2	2	2	2	2	2	2	
107		1	1	1	1	1	1	1	1	1	2	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
108		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	
109		1	1	2	1	1	1	1	1	1	2	1		2	2	2	2	2	2	1	1	1	1	1	1	1	
110		1	1	1	1	1	1	1	1	1	2	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
111		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	
112		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	
113		1	1	2	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	1	1	1	
114		2	2	2	2	2	2	2	2	2	1	1		1	1	2	2	2	1	1	1	1	1	1	1	1	
115		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	
116		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	1	1	1	
117		2	2	2	2	2	2	2	2	2	2	2		1	1	2	2	2	2	1	1	1	1	1	1	1	
118		1	2	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
119		1	2	2	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
120		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	1	1	1	
121		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
122		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	1	1	1	
123		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	1	1	1	1	1	2	2	2	
124		1	1	2	1	1	1	1	1	1	1	1		1	1	2	2	2	2	1	1	1	1	2	2	2	
125		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	1	1	1	
Tot.																											

CONTROL TEST 3
(>75%)

IDENTIFICATION CODE	TEST	CLASSIFICATION	Animal	Omnivore	Related to Bandicoot	Marsupial	DESCRIPTION	Reach size of a rabbit	Weighs ...	Body length...	*Blue grey	*Soft fur	*long fur	*Silky fur	Long nose	Pointed nose	Pink nose	*long tail	*Tail black and white	*Long ears	Rabbit like ears
101	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
102	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
103	2		1	2	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
104	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
105	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
108	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
107	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
108	2		2	2	2	2		2	2	2	2	2	2	2	1	1	1	2	2	1	1
109	2		2	2	2	2		2	2	2	1	1	1	1	2	2	2	2	2	2	2
110	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
111	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
112	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
113	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
114	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
115	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
118	2		1	2	1	1		2	2	2	2	2	2	2	2	2	1	1	2	2	2
117	2		1	2	1	1		1	1	1	2	1	1	1	2	2	2	2	2	1	1
118	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
119	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
120	2		2	2	2	2		1	1	1	1	1	1	1	1	1	1	1	1	1	1
121	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
122	2		2	2	2	2		2	1	1	2	1	1	1	1	1	1	1	1	1	1
123	2		2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
124	2		2	2	2	2		2	2	2	1	1	1	1	1	1	1	2	2	1	1
125	2		1	2	1	1		2	2	2	1	1	1	1	1	1	1	1	1	1	1
Tot.																					

IDENTIFICATION CODE	LOCATION	Australia	Western Australia	Northern Territory	Northern NSW	Northern Victoria	Alice Springs	*Dry Areas	*Desert	*Grassy areas	*Bush	*In burrows	DYNAMICS	Feeds during the night	Rests during the day	*Hops on back legs	*Stands on back legs	Doesn't move far from bur.	Hides in burrow	*Eats insects	*Eats ants	*Eats grass seeds	*Eats mice	Mates any time in the year	1 baby at a time	Baby carried in pouch	TOTAL
101		1	1	1	1	1	1	1	1	1	1	1		1	1	2	2	2	2	1	1	1	1	1	1	1	
102		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	1	1	1	
103		1	1	1	2	1	1	2	2	2	2	2		1	1	1	1	1	1	2	2	2	2	1	1	1	
104		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	
105		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
108		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
107		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
108		1	1	1	1	1	1	1	1	1	1	1		2	2	1	1	2	2	1	1	1	1	2	2	2	
109		1	1	1	1	1	1	1	1	1	1	2		1	1	1	1	2	2	2	2	2	2	1	1	1	
110		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	2	2	2	
111		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	1	1	1	1	1	1	2	2	2	
112		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	
113		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	1	1	1	
114		1	1	1	1	1	1	1	1	1	1	1		1	1	2	2	2	2	1	1	1	1	1	1	1	
115		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	
118		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	1	1	1	
117		1	1	1	1	1	1	2	2	2	2	2		1	1	1	1	2	2	1	1	1	1	1	1	1	
118		2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	
119		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
120		1	1	1	1	1	1	1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	2	2	2	
121		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	1	1	1	
122		1	1	1	1	1	2	2	2	2	2	2		2	2	2	2	2	2	1	2	1	1	1	1	1	
123		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
124		1	1	1	1	1	1	2	2	2	2	2		2	2	2	2	2	2	1	1	1	1	2	2	2	
125		1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	2	2	1	1	1	1	1	1	1	
Tot.																											

Appendix F

Control and Experimental Group Individual PAT Raw Scores and Individual Total Scores Test 1

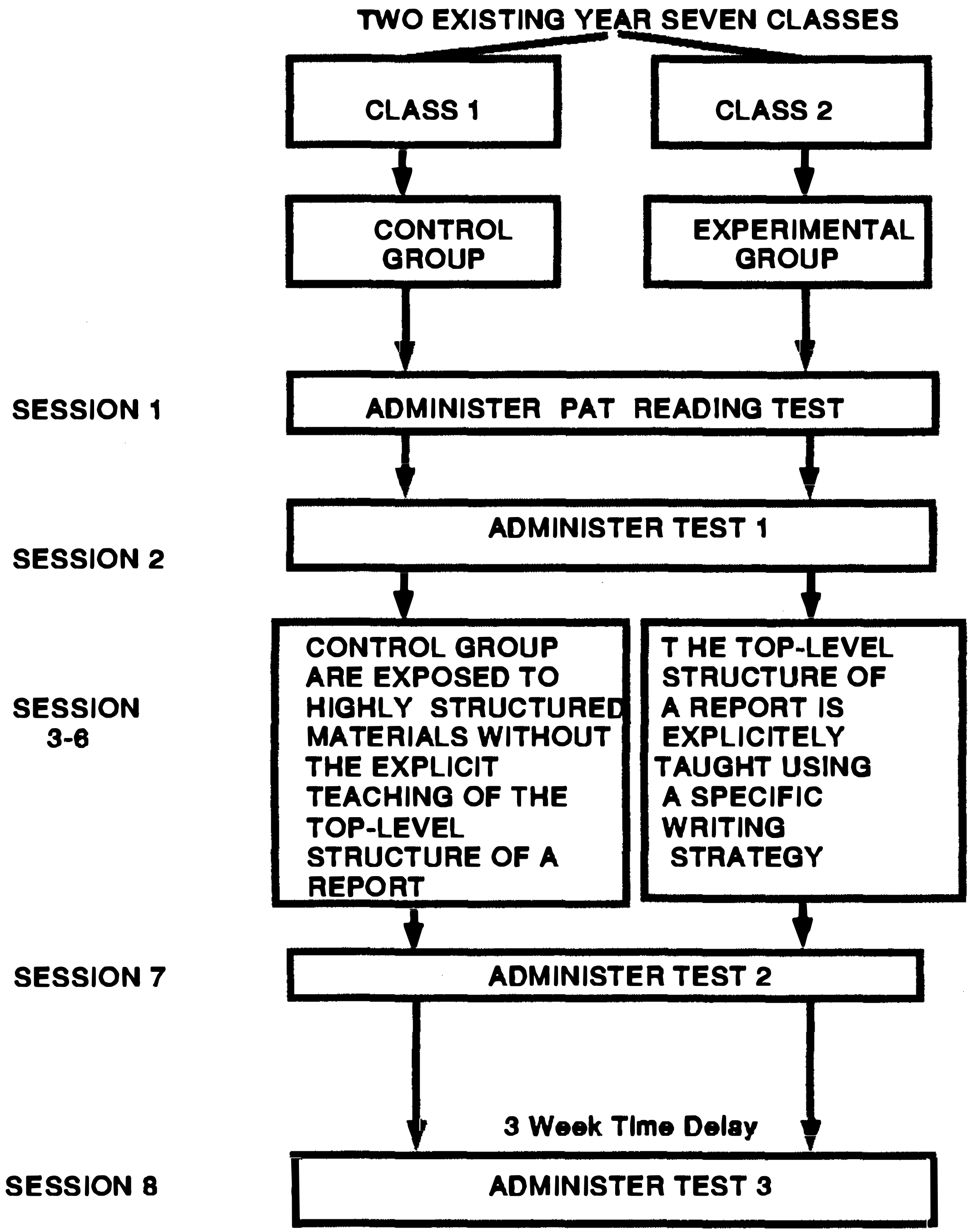
IDENTIFICATION	PAT (Raw scoe)	PAT (Category)	TEST 1
101	25	2	25
102	44	3	22
103	40	3	35
104	32	3	20
105	35	3	34
106	20	2	7
107	18	2	30
108	14	1	11
109	20	2	19
110	18	2	3
111	26	2	21
112	27	2	11
113	18	2	16
114	30	3	16
115	16	2	0
116	31	3	21
117	27	2	20
118	10	1	7
119	27	2	3
120	23	2	8
121	16	2	12
122	13	1	24
123	16	2	5
124	31	3	23
125	15	2	12

CONTROL GROUP SCORES

IDENTIFICATION	PAT (Raw scoe)	PAT (Category)	TEST 1
201	25	2	27
202	12	1	0
203	28	2	21
204	35	3	19
205	14	2	21
206	28	2	16
207	17	2	27
208	29	2	26
209	26	2	28
210	22	2	12
211	25	2	7
212	25	2	21
213	20	2	7
214	10	1	21
215	36	3	19
216	29	2	28
217	27	2	15
218	35	3	20
219	10	1	2
220	3	1	0
221	20	2	15
222	33	3	26
223	32	3	12
224	3	1	0
225	17	2	20

EXPERIMENTAL GROUP SCORES

Appendix G


TWO EXISTING YEAR SEVEN CLASSES
CLASS 1
CLASS 2
CONTROL GROUP
EXPERIMENTAL GROUP
SESSION 1
ADMINISTER PAT READING TEST
SESSION 2
ADMINISTER TEST 1
SESSION 3-6
CONTROL GROUP ARE EXPOSED TO HIGHLY STRUCTURED MATERIALS WITHOUT THE EXPLICIT TEACHING OF THE TOP-LEVEL STRUCTURE OF A REPORT
T HE TOP-LEVEL STRUCTURE OF A REPORT IS EXPLICITELY TAUGHT USING A SPECIFIC WRITING STRATEGY
SESSION 7
ADMINISTER TEST 2
3 Week Time Delay
SESSION 8
ADMINISTER TEST 3

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