

1992

The Effect of Word Processing on the Revising/Editing Strategies of Primary ESL Writers

L. John Oliver
Edith Cowan University

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**THE EFFECT OF WORD PROCESSING ON THE
REVISING/EDITING STRATEGIES OF
PRIMARY ESL WRITERS**

BY

L. John Oliver (BAEd)

**A Thesis Submitted in Partial Fulfilment of the Requirements
for the Award of**

Bachelor of Education with Honours

**at the Faculty of Education,
Department of Communications Education,
Edith Cowan University.**

Date of Submission: 14/12/1992.

Edith Cowan University

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Abstract

The focus of this study was on the effect of word processing on the revising and editing strategies of primary ESL writers. Six year 5/6 'intensive' ESL students completed a number of written tasks, using both computer and conventional 'pen and paper' methods. Their handwritten and word processed work was analysed and compared in terms of the frequency, nature and extent of changes made. Statistical analysis of these data, as well as audio-taped verbal protocols, interviews, and observational notes, was used to determine the effect(s) of word processing on the revising/editing strategies of these students. Of the four major revision categories examined, three were found to be different both qualitatively and quantitatively (at a statistically significant level), in the word processing condition, when compared to the 'pen and paper' writing condition with the same subjects. These subjects were found to produce more large-scale meaningful revisions when word processing, in comparison to their pen and paper work. In contrast with this, 'surface' changes (or non-meaningful revisions) outnumbered all other changes made to text in the pen and paper condition.

DECLARATION

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.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the support and guidance provided by Mr Bernie Hird, Research Supervisor for this study. His ongoing encouragement and advice have been invaluable.

Acknowledgement should also be made of the generous support of Total Peripherals (who supplied, free of charge, the IBM-compatible computers required for the study) without whom this research would have been impossible. The support of Microsoft Australia is also acknowledged - who kindly permitted the use of multiple copies of Word for Windows, Windows 3.1 and Dos 5, for the purposes of the study. The use of this software was essential in conducting the research.

The author would like to acknowledge the assistance and advice of Dr. Amanda Blackmore with the statistical and quantitative aspects of the study.

Special thanks are also due to the Principal and staff of Highgate Primary School - and most of all, to the students themselves. The author thanks the children for their efforts and wishes them all the best in their future endeavours.

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CHAPTER ONE

Introduction

1.1 Background to the Study

There has been a large amount of research into the use of computers in the writing classroom over the last decade. Most of this research has dealt with native English speakers (Bean, 1983; Bridwell, Nancarrow & Ross; 1984; Curtis, 1988; Hawisher, 1987, 1991). The use of word processing software specifically with ESL writers did not receive much attention until the late 1980s (Benesch, 1987; Johnson, 1986; Neu & Scarcella, 1990; Pennington, 1990).

The results of much of this research have conflicted (Pennington, 1990). Some researchers found that the use of word processing software enhanced the revising and editing strategies of their subjects (Bean, 1983; Bridwell et al., 1984; Curtis, 1988; Hyland, 1990). Others found that word processing did not qualitatively or quantitatively improve the revising or editing strategies of their writers (Collier, 1983; Daiute, 1986).

Many factors have been identified that may have influenced the results of some of these studies: including subjects' abilities and attitudes, the setting of the study and the time span involved (Pennington, 1990).

1.2 Significance of the Study

The significance of the present study is best summed up in the following:

...Computer-based technologies are changing our notions of literacy and changing how students learn....the tools we use change us - and so as new educational uses are developed for computers, the very concepts of text that we have held until now are changing, and will continue to change (Anderson, 1991, p. 50).

What Anderson is referring to is the 'new literacy' (Hyland, 1990). The inference is that, "...word processing is a new creative environment which demands a radically different approach to writing....to make effective use of the medium" (Hyland, 1990, p. 335).

The point had been made as far back as 1984 that methodology was not keeping up with the new technology of word processing. Bridwell et al. (1984) found that there had been few significant changes in writing instruction in response to the new technology (p. 381).

In 1992 there were few schools in the Perth metropolitan area where microcomputers were not being utilised in some way, but little is actually known about their effect(s) on learners. There is a need for relevant research that will inform the pedagogical strategies of professional educators in classroom computer use. The classroom instruction of primary ESL writers in computer-aided writing that does occur, is currently not based on such research. This is due to the fact that there have been no such studies in the local primary ESL context (to the knowledge of this writer).

There is a need for research that will help us understand Hyland's 'new literacy'. The present study is intended to address this need: albeit in terms of a specific focus (revision strategies) and student population (primary ESL writers).

Revision is both central, and crucial to, the 'new literacy'. Many researchers see revision as central to the writing process (Beach et al., 1984; Heuring, 1985; Curtis, 1988). Curtis (1988) goes further in saying that, "...*writing is revising*, and the computer's function is to provide a tool for easy revision and a pleasurable motivation for its practice..." (p. 342 [italics added]).

Revising behaviour is a useful indicator for measuring the impact of word processing on primary ESL writers. This assumption is made on the basis of Heuring's observation that the, "...revising capabilities of ES/FL writers (English as a Second Language/English as a Foreign Language) correspond roughly to developmental stages. Proficiency in revising appears to reflect a writer's progress in the second language" (1985, p. 79).

1.3 The Purpose of the Study

The main purpose of this study is to identify how the use of word processing software as a writing 'tool' affects the revising strategies of primary ESL writers. The term, 'revising', is used here in its broadest sense, "...to refer to the writing objective of searching for and making changes" (Heuring, 1985, p. 20).

A secondary and more general purpose of this study is to identify any affective or cognitive influences that the use of the word processing software may have on the subjects as writers.

1.4 Statement of Research Questions

- (1) In what way does the use of word processing software influence the primary ESL writer's:
 - (a) revision strategies?
 - (b) editing strategies?
 - (c) attitudes towards the writing process and him/herself as a writer?

Subsidiary Question

- (1) How do primary ESL writers react to using the word processing software/computer and what differences do they perceive?

1.5 Operational Definitions

The terms and definitions in this section are derived from the theoretical models of Heuring (1985) and Flower and Hayes (Flower et al., 1986) shown in Figures 2.1, 2.2, 3.1 and 3.2. Most of the operational definitions have been taken from the work of David Heuring (1985) and modified as considered appropriate for the present study. A separate section (Section 1.5.1) deals with the terms used throughout the study for the classification of specific revision types.

The Writing Process:

This term refers to the total writing process: beginning with the initial impulse to write something and ending when the writer has finished the work and no longer needs, wants, or is able, to make further changes (Heuring, 1985).

The Writing Situation:

According to Heuring (1985) and Flower and Hayes (cited by Faigley & Skinner, 1982), the writing situation has three major components: the Long-Term Memory (LTM), the Composing Processes, and the Task Environment (See Figures 2.1 and 2.2).

The Long-Term Memory Component (LTM):

The long-term memory (LTM) consists of learned strategies (such as 'brainstorming') and internalised knowledge (such as personal writing style): much of which was probably acquired in a language other than English (Heuring, 1985).

The Composing Processes Component:

The composing component is the 'operational apparatus' of the writing process. It depicts the cognitive activities involved in composing and consists of three major processes: planning, transcribing and reviewing. The composing component also illustrates the interactive and recursive nature of the writing process (Heuring, 1985) (see Figure 2.3).

The composing processes themselves are, "...the cognitive activities a writer engages in to facilitate the generation of ideas from the brain, the transfer of these ideas onto paper, and the subsequent *improvement* of these ideas" (Heuring, 1985, p. 17 [italics added]). No more than one composing process can be engaged in at any one time, but any process can interrupt another. Although these processes are cognitive operations (and thus unseen), they can be *inferred* from the analysis of writing behaviours.

Revision:

For the purposes of this study, the term 'revision', has two specific meanings. In its broadest sense, 'revision' refers to any change made to a text. In terms of the specific classification of changes made to text, it also refers to meaning-altering (or 'Text-base') changes at the microstructure (sentence level or below) or macrostructure (above the sentence level) level (see Figure 4.1). To avoid confusion, where the first definition is intended, the generic term 'revision' will be used 'as is'. Where a *specific type of revision* is referred to, it will either be:

1. referred to as an instance of 'editing' or 'non-meaningful revision' (in the case of non-meaningful changes) or specifically categorised according to the Faigley and Witte taxonomy, or
2. referred to as an instance of 'meaningful revision' (in the case of meaningful changes) or specifically categorised according to the Faigley and Witte taxonomy.

All 'non-meaningful revisions' then, can also be referred to as instances of:

Editing:

'Editing' refers to any change to the text that does not alter its meaning: what Faigley and Witte (1981, 1984) would call a 'surface' change.

The classification of revision types is referred to in Section 4.3.1 (the description of instruments). Revision consists of both a cognitive and physical activity. It normally occurs when three things happen: a writer decides that something he/she has written is inappropriate, decides how to change it and finally, physically makes the change. To revise successfully, a writer relies on the revision strategies that he/she has developed over time or (with ESL writers), has transferred from the L1 (Heuring, 1985).

It should also be noted that while revision may in fact be the primary activity during the third phase of a prewrite/write/rewrite composing model (See Figure 2.1), it can also play a mediating role during the production of text (or 'writing stage') and, in a sense, it also occurs in the writer's head before he/she even picks up a pen: at the planning or 'prewriting stage' (Heuring, 1985). In other words, it is not 'locked in' to one specific stage of a linear writing/composing model. It is (like writing itself) a *recursive* process. Revision is made possible by two reviewing sub-processes (see Figure 2.3). These are:

Crystallising:

A composing process that this writer found necessary to isolate and identify specifically (as did Heuring, 1985), was that of *crystallising* (See Figure 3.1). This involves the activity of re-examining what has been previously written in order to develop the content further. Heuring (1985) defines crystallising as, "...a process in which writers reexamine [Sic] the text produced so far in order to stimulate further idea generating, organizing, and goal setting" (p. 26).

Evaluating:

In evaluating, the writer examines what has been written in order to determine if improvements are necessary. In other words, "...a writer checks to see whether the transcribing process has accurately approximated the intentions resulting from the planning process" (Heuring, 1985, p. 26).

1.5.1 Classification of revision changes

A revision is any change made to a text: it may or may not affect its meaning. For the purposes of this study, all specific instances of revision will be coded according to the Faigley and Witte (1981) taxonomy described in Section 4.3.1. According to the taxonomy (see Figure 4.2), there are two major revision types:

Surface Changes:

These are changes to the text that do not affect its meaning. They can be either:

Formal Changes:

- spelling,
- tense, number and modality,
- abbreviation,
- punctuation,
- format (indenting, layout, etc.)
- *word combining**,
- *capitalisation**,

(* Note: The last two categories of formal changes have been added to take into account changes made by subjects in the present study. *Word combining* refers to the *incorrect* combining of words into single morphological units. *Capitalisation* changes occurred so frequently (independent of punctuation marks) that they warranted separate classification.)

or **Meaning-Preserving Changes:**

Additions:

An addition brings something to the 'surface' that could have been inferred anyway: for example, "*You need a car*" => "*You need a car to get there*".

Deletions:

A deletion does the opposite. The reader now has to infer what was (previously) explicit: for example, "*You must pay to go in*" => "*You must pay*".

Substitutions:

A substitution involves the exchanging of words (or longer units) that, "...represent the same concept" (Faigley & Witte, 1981, p. 403). For example, "*What an interesting person!*" => "*What an interesting individual!*".

Permutations:

A permutation involves the rearrangement of a piece of discourse (in terms of its word/phrase order) or its rearrangement combined with a substitution. For example, "*At home, Handel is often played*" => "*Handel, at home, is often played*" OR "*At home, Handel is often played*" => "*Handel, at home, is often performed*".

Distributions:

A distribution occurs when, "...material in one text segment is passed into more than one segment. A change where a writer revises what has been compressed into a single unit so that it falls into more than one unit is a distributional change (*I figured after walking so far the least it could do would be to provide a relaxing*

dinner since I was hungry. => I figured the least it owed me was a good meal. All that walking made me hungry.)" (Faigley & Witte, 1981, p. 403).

Consolidations:

A consolidation does the opposite. Elements in two or more units are, "...consolidated into one unit (*And there you find Hamilton's Pool. It has cool green water surrounded by 50-foot cliffs and lush vegetation.* => *And there you find Hamilton's Pool: cool green water surrounded by 50-foot cliffs and lush vegetation*)...consolidations are the primary revision operation in sentence-combining exercises" (Faigley & Witte, 1981, p. 403).

The second major category of revision is:

Text-Base Changes:

These are changes to text that affect its meaning. There are two types:

Microstructure Changes:

Meaning-preserving, microstructure and macrostructure changes all share the same six sub-categories of revision types. The difference is that for one of the six sub-categories of revision types to be a microstructure or macrostructure revision, it must also involve a

change in *meaning*. Thus, an *addition* to the text can be a meaning-preserving, microstructure or macrostructure revision.

The difference between microstructure and macrostructure revisions is one of degree rather than kind. A microstructure change involves a *meaningful change* to the text at the level of the sentence or below.

Macrostructure Changes:

A macrostructure change involves a *meaningful change* to the text above the level of the sentence. Some of these changes can be quite extensive: involving paragraphs or entire pages of text.

There will always be certain revisions that are open to more than one classification. In all cases, the most important criterion in the classification of revision changes to text is whether or not the revision changes the *meaning* of the text, or not.

CHAPTER TWO

Review of Literature

2.1 General Literature

2.1.1 Revision research with native and non-native English speakers

Comparatively little research has dealt with the revision processes of non-native English speakers (Heuring, 1985; Urzua, 1987). What research there is, indicates that the findings of writing research in the first language (L1) are also applicable to the second language (L2) because the writing processes in both are fundamentally the same (Cumming, 1989; Heuring, 1985; Urzua, 1987).

The findings of specific ESL revising (and word processing) research (Heuring, 1985; Phinney, 1989; Urzua, 1987) are compatible with those of L1 studies. This not only indicates that non-native writers have a similar writing process to that of native writers: it also shows this process to be *recursive* rather than linear (Phinney, 1989).

Most revision research has focussed on native English speakers (Beach & Eaton, 1984; Daiute, 1986; Faigley & Skinner, 1982; Faigley & Witte, 1981, 1984; Flower & Hayes, 1986; Witte, 1981) .

A number of interesting findings have emerged from research on revising in the L1 and L2. Revision is a complex process, influenced by several factors including: writing topic, intended audience and purpose, and the

text that a writer has already produced. One of the most important influences on revising is dissonance. This is defined as, "...the writer's sense of incongruity between what was intended and what was executed" (Faigley & Skinner, 1982, p. 23). The resolution of this dissonance represents a large part of the revising process.

Faigley and Witte (1984) see revision as a recursive process where writers attend to different concerns at different times. Although meaningful revision is a complex process, it is one that young primary school writers are capable of performing (Calkins, 1979; Sowers, 1979; Graves, 1979 - all cited in Faigley & Skinner, 1982).

Faigley and Skinner (1982) noted that primary school children (from Year 1 onwards) are capable of making extensive meaningful revisions: as opposed to simply editing for mechanical errors.

Some researchers have found that effective meaningful revision results in writing of a higher quality (Calkins, 1980; Beach & Eaton, 1984). Although an analysis of the relationship between meaningful revision and writing 'quality' is beyond the scope of the present study, this relationship, and its potential impact on the findings, will be considered in the conclusions chapter.

2.1.2 Similarities and differences: L1 and L2 composing and revising

In her study, Raimes (1987) used think-aloud protocols to compare the composing strategies of adult L1 and L2 writers. She found them to be similar: consisting of the same processes of idea generation, planning,

organising, writing, meaningful revising and editing. She also found that the difficulties of her ESL writers were not so much due to L2/L1 'interference' as they were to the constraints of the writing task itself. These included such factors as time, topic and audience. Raimes' ESL students tended to do less 'premature editing' (unnecessary editing) however, and orally rehearsed more (their meaningful revisions before committing them to paper). This oral 'rehearsing' usually involved the trying of alternative wording and phrasing to express new or different ideas: which would then be incorporated into the text in the form of meaningful revisions.

In a review of ESL composing research, Silva (1989) found that adult ESL writers used revision mainly to work out and clarify ideas. Their revising behaviours focussed more on meaningful revision rather than on editing (or 'surface' changes).

One other noteworthy difference that does seem to exist between the composing processes of L1 and L2 writers is the process Heuring (1985) refers to as 'translating'. In the L1 context, this term refers to the transforming of ideas into actual written text. The translating process that Heuring (1985) discusses however, is only available to second or multilanguage speakers. It is the process of recoding ideas from one language into another before encoding them into the written form.

Despite some differences, the overall composing processes of L1 and L2 writers are remarkably similar. The composing process of both L1 and L2 writers is seen by numerous researchers as consisting of the interaction of the writer's long term memory, task environment, and writing processes (Flower, L., Hayes, J. R., Carey, L., Schriver, K. & Stratman, J., 1986; Bridwell, L.S., et al., 1984; Faigley & Skinner, 1982; Heuring, 1985).

These components of the composing process are represented in Flower and Hayes' composing model (Figure 2.1) and Heuring's composing process model (Figure 2.2). Flower and Hayes' composing model and Heuring's composing processes component (Figure 3.1) both characterise the writing process as an interaction between the sub-processes of planning, transcribing (or 'translating') and reviewing. What the L1 model of Flower and Hayes and the L2 models of Heuring do then, is to illustrate a composing process that is common to both L1 and L2 writers (notwithstanding the differences already mentioned), and that can be broken down into the following components, processes and sub-processes:

1. the writer's long term memory:
 - knowledge of topic,
 - knowledge of audience,
 - writing plans,
2. the task environment:
 - the rhetorical problem,
 - (topic, audience, exigency),
 - text produced so far,

3. the writing processes:

- planning,
(and its sub-processes of
generating ideas, organising ideas
and goal setting),
- translating,
- reviewing,
(and its sub-processes of
evaluating, revising, and
crystallising).

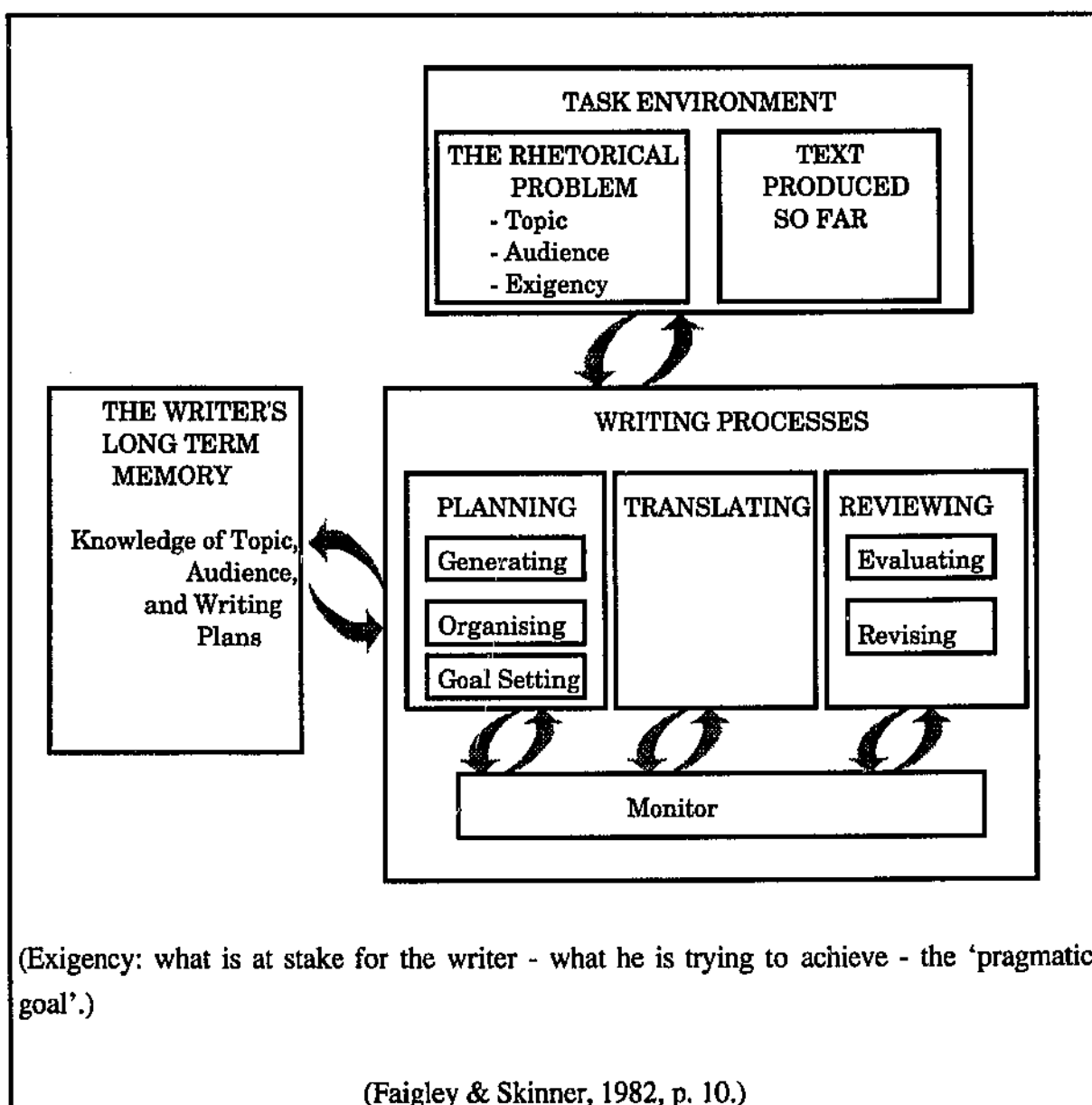
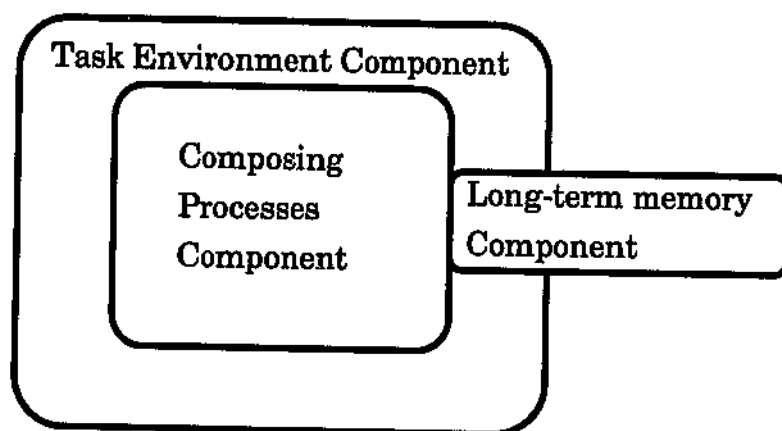


Figure 2.1: Flower and Hayes' Model of Composing



Heuring (1985) modified the L1 writing model to take into account the unique translating process that only second language writers have. There are three components to his model: the long-term memory (LTM), the composing processes and the task environment.

* **The LTM (or long-term memory)** consists of internalised knowledge often acquired in another language.

* **The Composing Processes Component** consists of the three major composing processes: planning, transcribing, and reviewing.

* **The Task Environment** refers to anything that influences the performance of the task, including such intangibles as: topic, intended audience and purpose - in addition to the text that a writer has already produced.

(Heuring, 1985, p. 22.)

Figure 2.2: Heuring's Writing Process Model

2.2 Literature on Methodology

In the studies reviewed, two main methods have been used for the analysis of revision. In some studies, the 'think-aloud' protocols of subjects have been tape-recorded and analysed (Raines 1985, 1987; Swarts, H., Flower, L.S., & Hayes, J. R., 1984). In other studies, a taxonomy of revision types has been used to analyse and code revision changes made to text.

The most frequently used method for categorising and recording revisions (by both L1 and L2 writers) is Faigley and Witte's taxonomy of revision changes (Faigley & Witte, 1981; Faigley & Skinner, 1982; Faigley, 1981; Faigley & Witte, 1984; Daiute, 1986; Harris, 1985; Hawisher, 1987; Heuring, 1985).

Faigley and Witte's taxonomy is considered the most accurate and comprehensive way of classifying revision changes to text (Heuring, 1985; Raines, 1985, 1987; Pennington, 1990; Daiute, 1986). Heuring (1985) recommends that future ESL composing research use the Faigley and Witte classification as a standard method for evaluating revisions.

Where the Faigley and Witte taxonomy has been used, inter-rater reliability has been established by the use of up to five independent coders and each revision category has been checked for agreement by at least one other researcher. Inter-rater percentage agreements achieved have typically ranged between 75% (Daiute, 1986) and 85% (Lutz, 1987).

In some cases a taxonomy of revision changes has been used in conjunction with think-aloud protocols (Heuring, 1985; Raimes, 1985, 1987). This provides additional information that may be useful in categorising potentially ambiguous changes. There are two schools of thought regarding the use of think-aloud protocols in composing research.

On the one hand, some researchers express the concern that the use of think-aloud procedures may affect the naturalness of a writing situation. Despite this, many believe that the amount of otherwise unobtainable information that these protocols provide about the cognitive aspects of the writing process, makes the risk of altering the writing process worthwhile (Heuring, 1985; Raimes, 1985, 1987; Bridwell et al., 1984; Cumming, 1989).

On the other hand, researchers such as Ericsson and Simon (1980) believe that there is no evidence that the use of think-aloud protocols affects the nature of the composing process (with the possible exception of slowing it down slightly). The point was made by researchers such as Raimes (1985, 1987) and Heuring (1985) however, that they were careful to avoid imposing any additional cognitive demands on their subjects. For example, the subjects in Raimes' study (1987) were asked to 'think aloud' while composing but were not asked to explain or analyse their writing behaviours further.

Regarding the use of think-aloud protocols in conjunction with revision classification schemes, Faigley and Witte (1981) have made the point that studies employing more than one methodology are necessary to research effectively the complex multidimensional nature of revision.

2.3 Literature on Previous Findings

Those studies that have dealt with revising and word processing, generally focussed on the L1 writer (Bean, 1983; Bridwell et al., 1984; Collier, 1983; Curtis, 1988; Hawisher, 1987, 1991). There was a range of findings, and these sometimes conflicted. These studies utilised a variety of data collection and analysis methods.

In studies such as Bean's (1983), interviews with his L1 adult subjects and observation of their writing sessions, were the main sources of data. In Collier's (1983) study, he analysed and recorded the verbal protocols of his L1 adult subjects and used a simplified version of the Faigley and Witte taxonomy of revision changes to analyse changes to text (for multiple drafts from each subject). Hawisher (1987) also analysed her L1 adult subjects' written work using the Faigley and Witte taxonomy and an analytical scale of 'writing quality'.

Several studies found that word processing was easier and more efficient, and that more text was produced using the computer than with pencil and paper (Bean, 1983; Bridwell et al., 1984; Sudol, 1990; Anderson, 1991; Selfe, 1985). Most of these studies dealt with L1 adult writers and used verbal protocols and/or the Faigley and Witte taxonomy to analyse the subjects' writing and revising. The duration of these studies varied from a few weeks to 6 months or longer.

Some researchers (Bridwell et al., 1984) found that meaningful revising could be done more quickly and easily using the computer. However, it was also found that writing became less coherent without sufficient guidance in the use of the word processing software.

Not only was more text produced using the computer, but also fewer grammatical and syntactic errors tended to pass undetected when compared with conventional pen and paper writing (Bean, 1983; Anderson, 1991). Anderson (1991) commented on the ease with which spelling errors in particular, were detected and corrected, using the computer. It is interesting that this was achieved without the use of the software's built-in 'spellchecker'.

The point was also made that word processing technology that allows for the flexible handling of text does not in itself encourage meaningful revision (Sudol, 1990; Pennington, 1990). Pennington (1990) points out that the advantages of word processing are only advantages if they are used! She found that her subjects needed specific instruction in how to use the revising features of the software.

Another factor that has been considered by at least one researcher is the writing proficiency of the subjects themselves. Collier (1983) found that while word processing was a major advantage to the 'superior' writer, it was of only moderate value for the 'average' writer.

Taking Collier's (1983) rather arbitrary distinction between 'superior' and 'average' writers into account however, the fact remains that he and numerous other researchers have found word processing to have positive

effects on the composing of student writers (Collier, 1983; Selfe, 1985; Womble, 1985; Bean, 1983; Curtis, 1988).

Of the studies reviewed by the writer, few (Harris, 1985; Hawisher, 1987) found that computers had any substantial adverse effect(s) on meaningful revision. These studies indicated that writers made fewer meaningful revisions (and less comprehensive ones) on the computer (when compared to pen and paper composing). In one case (Hawisher, 1987), it was found that some writers used the computer to *avoid* meaningful revision and it was hypothesised that they could do this because using the computer meant they did not have to retype and reread their entire papers.

The most comprehensive review of previous research into the effects of word processing on student writers, was made by Pennington (1990). The review addresses a number of the points made in this chapter and lists potential benefits and disadvantages of the use of computers with student writers (Pennington, 1990).

Among the advantages of word processing, Pennington (1990) lists:

- more time spent on writing,
- longer compositions,
- increased experimentation with language,
- increased number and types of meaningful revisions,
- more discourse-level meaningful revision,
- fewer surface errors,
- reduced writing apprehension and improved attitudes towards writing.

Pennington (1990) also lists several disadvantages of word processing that were reported in previous word processing research:

- premature completion of work,
- local rather than global revision,
- attention directed primarily to surface features,
- focus on structure at the expense of content,
- focus on quantity at the expense of quality.

While these advantages and disadvantages appear to conflict, it should be noted that a number of variables in these studies had the potential to influence the findings. These include differences in:

- subjects (individual differences),
- teachers/researchers (attitudes),
- time-span (short/long period?),
- training (with software/hardware),
- instructional format (genre interventionist? language experience approach?),
- software ('user-friendliness'),
- effectiveness measures (how the effectiveness of word processing was measured).

Of the variables identified, 'effectiveness measures' is the only one that seems reasonably consistent in the studies looked at by the present writer. In most word processing and revision research, some form of revision taxonomy has been used to analyse revision changes (usually Faigley and Witte's). This has sometimes (but not always) been accompanied by the use of verbal protocol analysis. Apart from this however, the studies looked at involve a wide range of different subjects (adult writers, 'basic' writers, 'advanced' writers, L1 and L2 student writers), settings, time-

spans, instructional methods, software and hardware. It is possible that any of these variable factors could explain the diverse findings in word processing research.

These variables were all identified by Pennington (1990) in her review of word processing research and are listed in full (with advantages and disadvantages of word processing) in Appendices 2 to 4. Pennington's (1990) article is significant in that it is the only one of those reviewed that makes any real attempt at explaining the differences in research findings between the different studies.

Conclusion

Despite conflicting results in some areas, the majority of previous research findings indicate that the use of computers is beneficial in the writing process of student writers. The specific benefits (and their relative importance) as well as the nature of potential problems, are all issues on which the studies reviewed differ.

2.4 Specific Studies Similar to the Current Study

The use of word processing software specifically with ESL writers did not receive much attention until the late 1980s (Benesch, 1987; Johnson, 1986; Neu & Scarcella, 1990; Pennington, 1990; Pennington & Brock, 1989; Phinney, 1989, 1990; Piper, 1987).

Of the word processing studies reviewed, only one was conducted with primary school ESL writers. Johnson (1986) examined the use of word processing in the context of a language experience approach. Her subjects were Year 1 and 2 Spanish-speaking primary ESL writers selected from a primary ESL class she was teaching at the time. Johnson used a naturalistic approach in her study and it is important to note that the possible effect(s) of teacher input on the composing and revising of her subjects, was not controlled.

The study focussed on the effects of word processing on the composing processes and attitudes of the subjects over a 13-week period. Johnson made use of observation, interviews, and holistic analysis of word processed texts as her main data collection methods.

Johnson found that her LEP (limited English proficiency) students who used word processing tended to write longer stories, edited more frequently, and performed more extensive meaningful revisions than their pen and paper counterparts. She also found that her LEP subjects who used word processing expressed more confidence in themselves as writers and more positive attitudes towards the writing process.

Johnson (1986) noted that her subjects found error correction easier, were less worried about making mistakes and found their work more easily legible. The findings of Johnson's study indicate that the use of word processing as a writing tool has significant advantages over writing with pencil and paper, in the case of LEP students. These findings are particularly relevant to the present study.

Overall, Johnson's (1986) LEP writers tended to experiment more with language on the word processor (when compared to pen and paper composing). Her research would appear to support her claim that the computer is a powerful writing 'tool' in the ESL classroom - more powerful and versatile than the more conventional methods.

Johnson (1986) also claims that, "Integrating word processing into the curriculum may help ESL students express their ideas more freely...experiment with language, edit and revise their writing, and develop a stronger self-concept" (p. 119). Johnson based these claims on her in-class observations of, and discussions with, the children in her 13-week study. No formal instrumentation appears to have been used. It is the intention of the present study (at least in part) to test these claims made by Johnson.

The findings of Johnson are of considerable educational significance and therefore worth investigating within the local primary ESL context. This should be done using today's software and hardware. It is possible that the changes in word processing (and computer) technology since 1986, will contribute to even more significant findings in the present study.

One needs to bear in mind that the 'software' and 'hardware' technology of 1986 is now obsolete when compared to that currently available. More powerful computers, the availability of 'user friendly' graphical user interfaces (GUIs) and word processing software that enables most commands to be executed by 'pointing and clicking' with a 'mouse' (no longer requiring the memorisation and typing of commands), are all factors that highlight the need for research that utilises the technology as it is *now*.

CHAPTER THREE

Conceptual Framework

The conceptual framework for the present study will be considered on two 'levels'. Firstly, it will be considered in terms of the total writing process. Secondly, it will be considered in terms of the specific focus of the study - revision. This is necessary because it is not possible to consider revision in isolation from the writing process. The revising process is only possible when it co-occurs as one of many interacting processes and sub-processes in the writing process.

3.1 The Writing Process

The work of researchers such as Flower and Hayes (Flower, et al., 1986) has given us a clearer insight into the complexity of composing processes and the nature of revision. Their cognitive process model of composing clearly shows that revision is one of several interacting processes in composing (see Figure 2.1). This theoretical model is based on data obtained from several years of collection and analysis of think-aloud protocols. This same model was the basis for Heuring's (1985) L2 writing process model (Figure 2.2) and his composing processes component (Figure 3.1). It is on the basis of Heuring's composing processes component model (Figure 3.1) that the theoretical and philosophical assumptions about the writing process are made. This model then, provides the overall conceptual framework for the study.

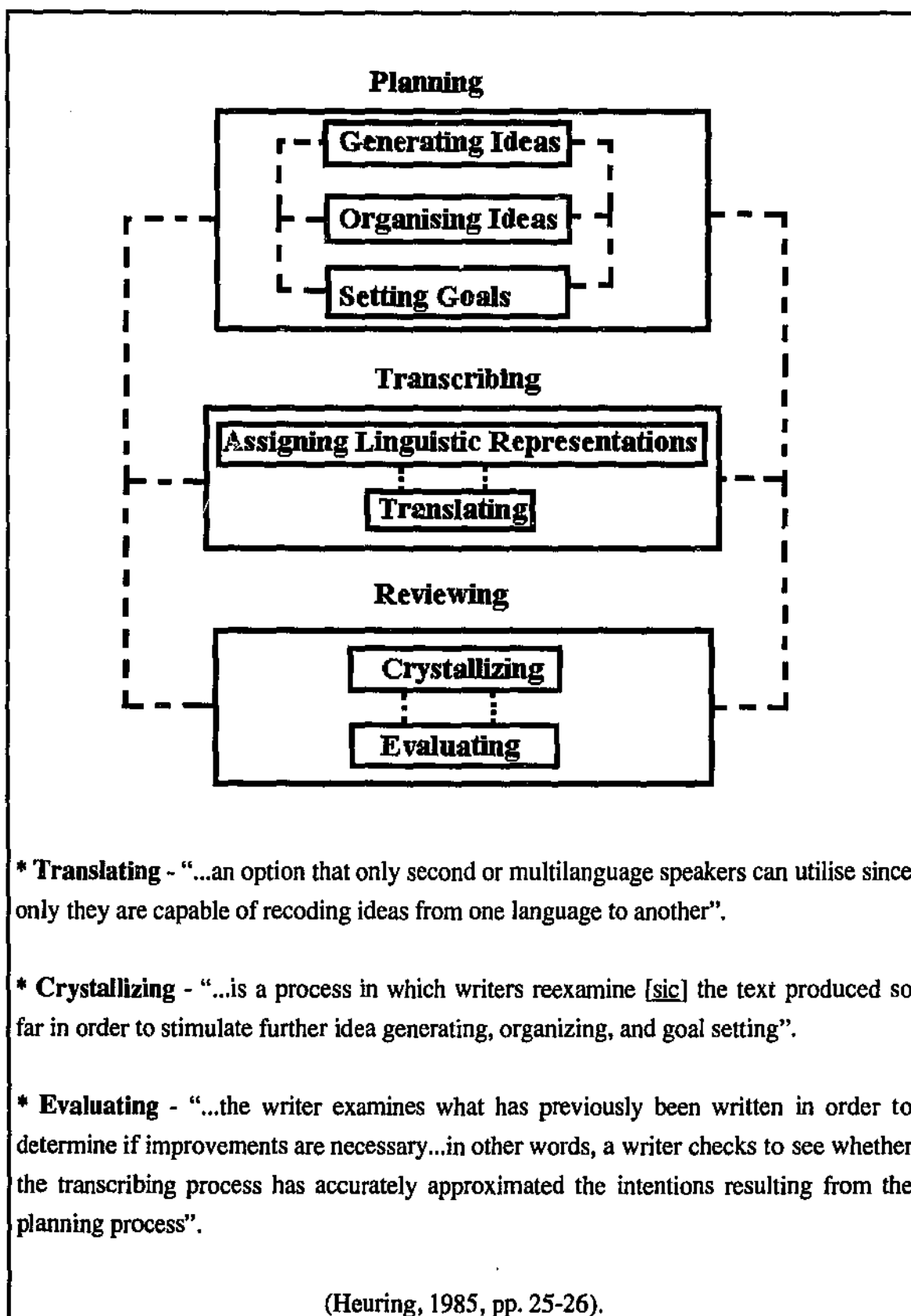


Figure 3.1: Heuring's Composing Processes Component

The assumptions made in the present study are:

1. that Heuring's (1985) model is an accurate and functional representation of the writing process and specific composing processes and sub-processes of the ESL writer,
2. that this has been (and can be) established through elicitation and analysis of written work and verbal protocols,
3. that Flower and Hayes' model of the revising process (Flower et al., 1986) is an accurate representation of the complex cognitive processes involved in revision (Heuring's 'reviewing' component) and a suitable basis for a 'theory of revision' as described by them (See Figure 3.2),
4. that Heuring's composing processes component model can be used to assist the researcher in identifying the different components of the writing process and in describing any relationships that he infers as the result of his research,
5. that the Faigley and Witte categories of revision changes to text (while not always mutually exclusive) are discrete categories, forming part of a rational taxonomy, that is an appropriate instrument for the analysis of the revising behaviours of primary ESL writers (see Section 1.5.1),
6. that the use of verbal 'think aloud' protocols is an appropriate and valid means for eliciting information on revising and composing behaviours that will not *significantly* impact on the writing of the primary ESL writer.

While Heuring's composing processes component model (Figure 3.1) forms the overall conceptual framework for this study, the specific conceptual framework for 'revision' is provided by Flower and Hayes' cognitive processes in revision model (see Figure 3.2). This model provides the specific 'paradigm of revision' to which the study will refer.

Figure 2.2 clearly shows that the writing process can be seen as the interaction of three component parts: the task environment, the long-term memory and the composing processes (these are all defined in the definitions section of Chapter 1). Leaving the other two components aside, the composing processes component (Figure 3.1) can be seen as three interactive processes: planning, transcribing and reviewing. The specific focus of this study is on the reviewing process.

3.2 Revision

The reviewing process (and its sub-processes of crystallising and evaluating) is what makes revision possible. As noted previously, revision combines both a cognitive and physical activity. It is perhaps best thought of as the observable writing behaviour associated with the cognitive process (and sub-processes) of reviewing (see Figure 3.1).

In terms of revision, Figure 3.2 provides the most comprehensive paradigm that this writer has seen. While Heuring's composing processes component model forms the conceptual framework for the writing process, Flower and Hayes' cognitive processes model of revision (Figure 3.2) provides the conceptual framework for revision: the specific focus of the study.

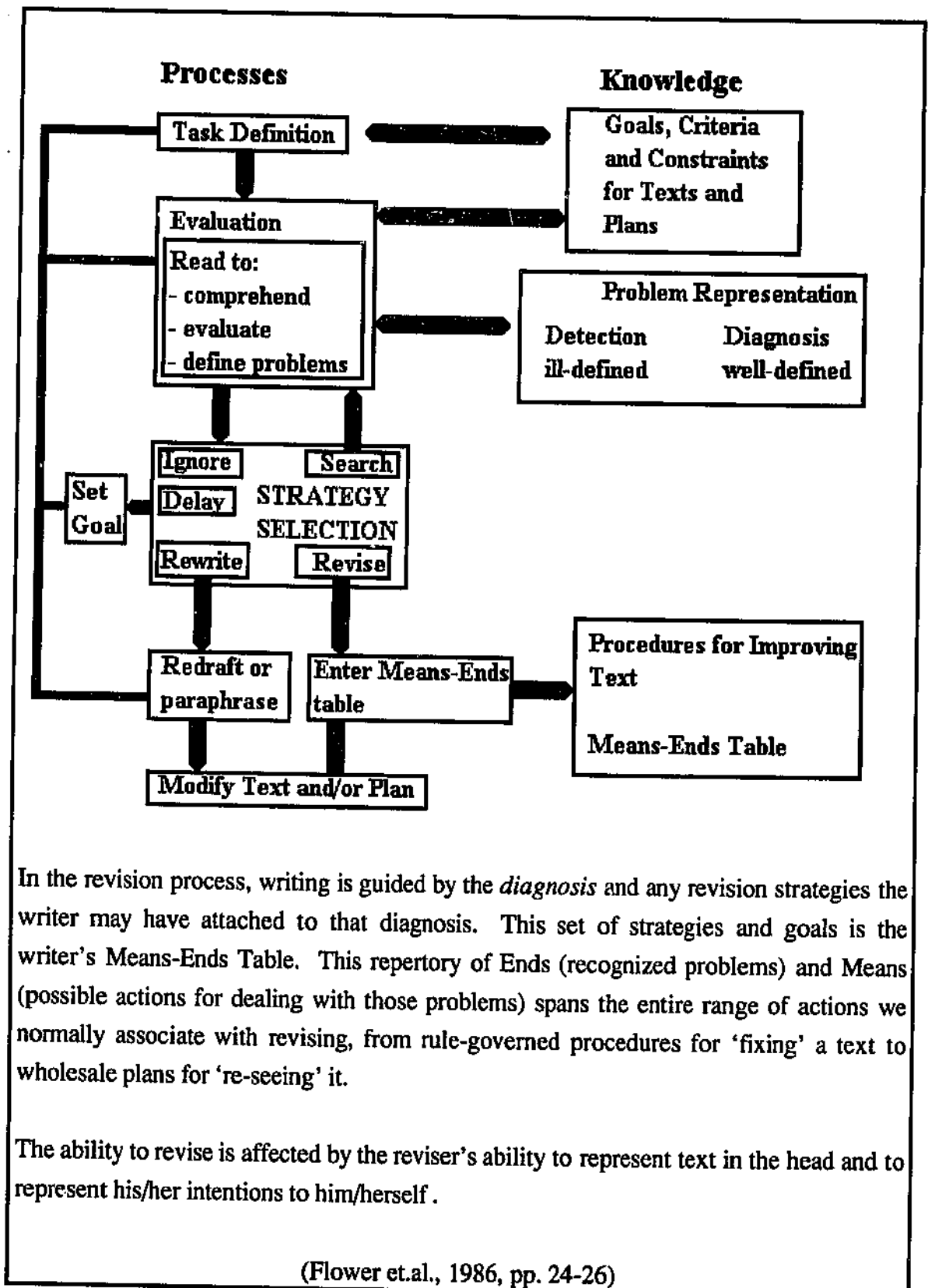


Figure 3.2: Cognitive Processes in Revision

CHAPTER FOUR

Method of Investigation

4.1 Design of the Study

This is an experimental design in which all subjects received both treatment (word processing) and control (pen and paper) conditions (thus acting as their own 'controls'). Ordering effects were controlled by giving half of the subjects the treatment condition followed by the control condition, and half of the subjects the control condition followed by the treatment condition.

Over a 10 week period, the 6 subjects selected (having been randomly assigned to 2 groups of 3 subjects each) were exposed to two 90 minute writing sessions per week. For the first 5 weeks of the study, Group 1 did all their writing and revising on the word processor (WP), and Group 2 did all their writing and revising using the more conventional pen and paper (P&P) method (see Figure 4.1). Both groups were required to 'think aloud' while composing. At the beginning of Week 6 of the study, the groups swapped over (treatments).

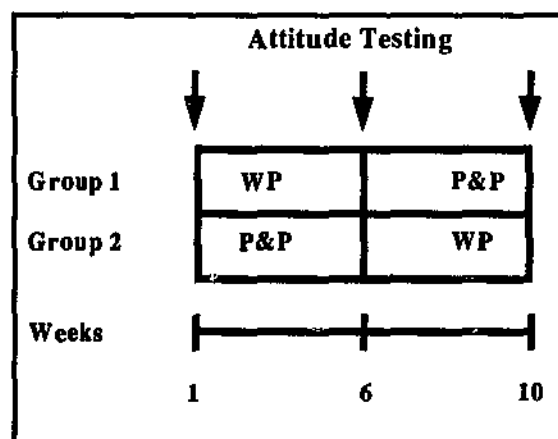


Figure 4.1: The Research Design

At the beginning of Week 1, the word processing group received 2 hours of instruction (per subject) in word processing while 'thinking aloud' and the pen and paper group received 2 hours of instruction (per subject) in 'thinking aloud' while writing. This process was repeated at the beginning of Week 6 when both groups swapped over.

Part of the instruction in Weeks 1 and 6 was on revising and editing strategies. Groups 1 and 2 both received instruction in the categories of revision operations identified by Faigley and Witte (see Figure 4.2).

4.2 Sample Used

The 6 subjects for this study were selected from one 'intensive' year 5/6 ESL classroom. 'Intensive' refers to the fact that as new arrivals to this country, the children are all given 12 months of 'intensive' language instruction with a specialist ESL teacher. Where required, they are also withdrawn from the class for additional small group and one-to-one language instruction.

The children in this class were between 10 and 11 years old. All were non-native English speakers: most of whom had come to Australia within the last 12 months. The subjects were selected (with the classroom teacher's assistance) on the basis of two criteria:

- (1) that they had some basic familiarity with using the computer, and
- (2) that their oral and written language proficiency was sufficient for them to participate in the study (a number of class members being recent arrivals to this country).

Gender was not a focus of this study. Due to the small sample size (a constraint imposed by the limited availability of computer hardware), it would have been unwise to attempt to draw conclusions about gender differences in composing/revising behaviours.

The 6 subjects selected were randomly assigned to either Group 1 (Subjects 'A', 'B' and 'C') or Group 2 (Subjects 'D', 'E' and 'F'). The following table provides relevant subject background information.

Table 4.1

The Subjects

Subject:	Nationality:	MT: (mother tongue)	Age: (as of Sept. 1992)	Sex:	Length of time in Australia: (as of Sept. 1992)
A	Salvadorean	Spanish	11 yrs 6 mths	male	11 months
B	Chinese	Mandarin	11 yrs 1 mth	male	11 months
C	Salvadorean	Spanish	10 yrs 6 mths	female	9 months
D	Vietnamese	Vietnamese	11 yrs 3 mths	male	9 months
E	Vietnamese	Vietnamese	11 yrs 7 mths	female	1 yr 3 mths
F	Vietnamese	Vietnamese	11 yrs 3 mths	female	6 months

4.3 Description of Instruments and Equipment Used

4.3.1 Instruments

Faigley and Witte's Taxonomy of Revision Changes

The instrument used to analyse the revision changes in the written and word processed samples collected, was Faigley and Witte's taxonomy of revision changes (see Figure 4.2). This taxonomy distinguishes text changes as being either changes that do not affect the meaning of a text ('Surface Changes' or instances of 'editing') or changes that do affect the meaning of a text ('Text-Base Changes' or 'meaningful revisions') (Faigley & Skinner, 1982).

Faigley and Witte's taxonomy categorises six main types of revision operations: additions, deletions, substitutions, permutations, distributions and consolidations. These six operations can affect meaning at the 'Microstructure' or 'Macrostructure' level, or not affect meaning at all (see Section 1.5.1).

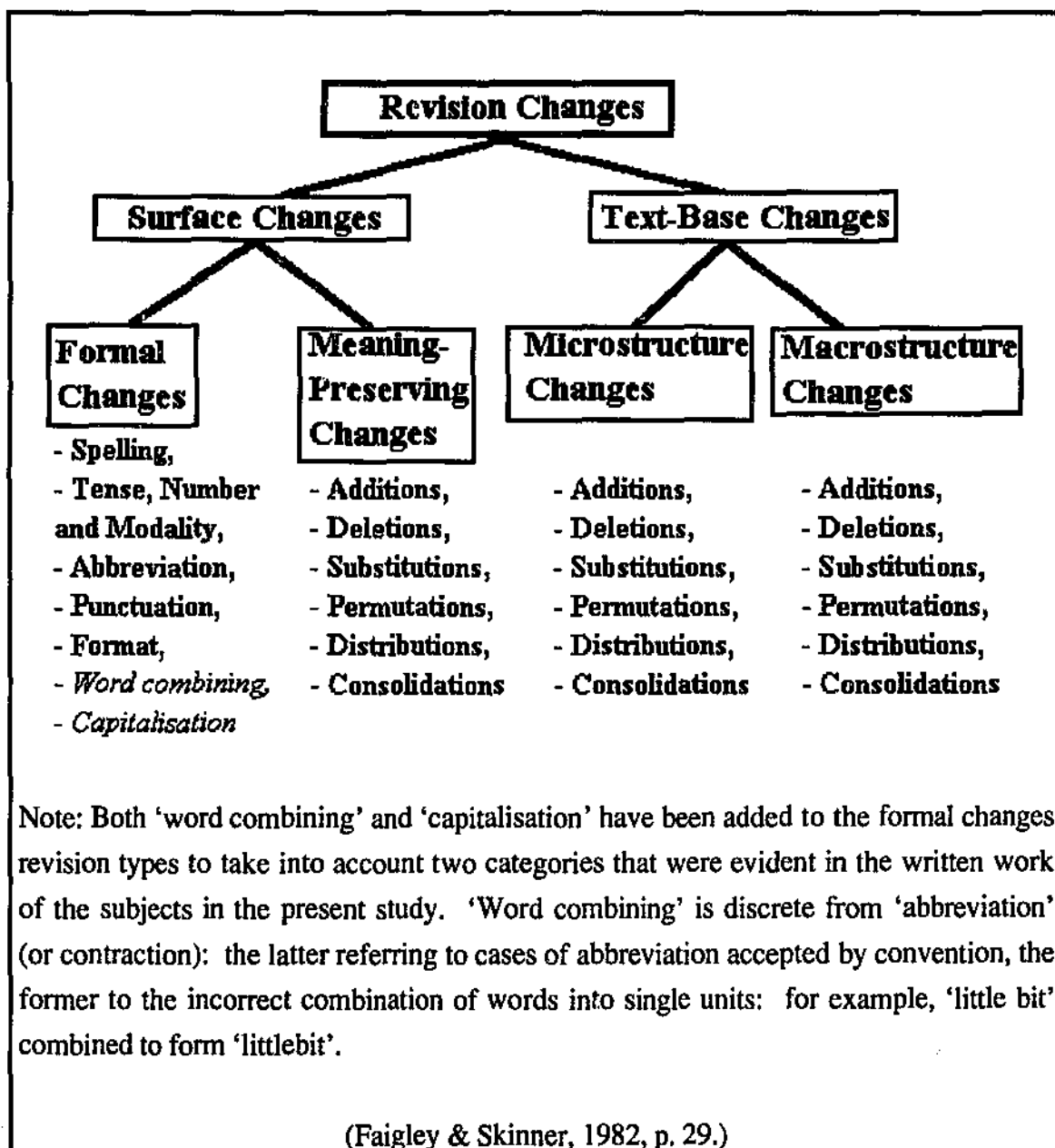


Figure 4.2: Faigley and Witte's Taxonomy of Revision Changes

'Macrostructure' changes affect the **summary** of a text while 'microstructure' changes still affect meaning, but are 'localised'. For example, a microstructure change would affect the meaning of a phrase or sentence, but not the whole piece of discourse (Faigley, 1981). For the purposes of this study (as noted in Section 1.5.1), all meaningful changes *above the sentence level* were classified as *macrostructure changes* and all

meaningful changes *at or below the sentence level* were classified as *microstructure changes*.

Instances of 'editing' are what Faigley and Witte would term, 'formal changes' (Faigley, 1981). These changes can be to:

- spelling,
- tense, number and modality,
- abbreviation,
- punctuation, or
- format.

It is possible that some formal changes could also be interpreted as text-base changes at the microstructure level. For the duration of the present study, formal changes were recorded as such by the researcher only when they *did not affect meaning*. It is important to realise that the seven original categories of formal changes (and the additional two added by the researcher to describe revisions made by subjects in the present study) are *surface* changes to the text. If a specific instance of revision has changed the *meaning* of the text in any way, it must be coded as a text-base change (even if it is in the form of a spelling or punctuation change).

In terms of reliability, Faigley and Witte (1984) identify this ambiguity as one of the problems that may occur in using their taxonomy to analyse text revisions. They have specifically identified *excessive text complexity* and *differing rater definitions* of revision types: noting that, "...researchers using our taxonomy will have to arrive at some consensus on how to distinguish potentially ambiguous changes" (Faigley & Witte, 1984, p. 102).

Verbal (Think-Aloud) Protocol Analysis

'Think-aloud' protocols were audio-taped throughout the duration of the study and used to give a more complete picture of the revising behaviours observed. These were what Swarts et al. (1984) refer to as 'introspective protocols'. While writing or word processing, the subjects were asked to 'think aloud' into the tape recorders provided. They were not asked to further explain or comment on their composing processes.

Attitude Survey

Attitudinal changes in the subjects towards themselves as writers and the writing process, were recorded in a pre-, mid- and post-study attitude survey consisting of 12 question items (see Appendix 1). This survey was piloted with a Year 6 L1 class in a metropolitan primary school, prior to commencing the study, to obtain a measure of its construct validity (the construct here being the writer's attitude towards him/herself as a writer and towards the writing process).

Unstructured Interview

An unstructured interview was also conducted with each of the subjects, at the conclusion of the study. This interview was intended to provide insight into the overall reactions of the subjects to the use of the word processor as a writing tool. Subjects were asked to describe how the processes of composing on the computer and composing with pen and paper, differed for them.

Observation Schedule

Researcher observation was the main qualitative instrument. The researcher was present at all writing sessions. Interesting or unusual observations were recorded in a simple schedule similar to the one in the following table. These observations were generally limited to those behaviours (specifically meaningful revision and editing) that related to the subjects' composing processes.

Table 4.2

Observation Schedule (Composing Processes - Revision)

Date:		Faigley & Witte classification: Observation:
Time:		
Subject:		
Group:		

4.3.2 Equipment

Hardware and Software

The computers used in this study were three Total Peripherals IBM-compatible 486SX personal computers. These machines were chosen because they were capable of running the type of software required in the study: Microsoft Windows 3.1 (a GUI or 'graphical user interface' software package) and Microsoft Word for Windows 2.00 (a word processing package).

The reason for selecting this type of software is that it gives young writers a colourful and easy to operate graphical word processing environment, in which most commands can be executed by simply clicking the mouse. Word for Windows, like all Windows word processing packages, is a menu- and mouse-driven package that although intended for adults, has proven (in the present research) to be equally suitable for primary ESL writers as well.

Since the subjects in this study demonstrated no significant difficulties in mastering the word processing/computer technology and given the limited amount of word processing instruction that was practicable for each child, it seems unlikely that 'learning the technology' was a major distraction for them.

4.4 Data Collection Procedures

Prior to the start of the study, all 6 subjects completed the attitude survey (Appendix 1). The survey was administered on three separate occasions: at the beginning of the study (Week 1), at the 'changeover' (Week 6) and at the conclusion of the study (Week 10).

For the 10 weeks of the study, the subjects were given a single writing task to perform each week. They were allowed two 90 minute writing sessions per week to complete each task: using either word processing or the conventional pen and paper method. These writing sessions generally occurred every Wednesday and Friday morning, and were all conducted in the school hall, adjacent to the subjects' classroom. All subjects were in the same location for each of the 20 writing sessions.

Both groups were given specific instruction in revision and editing strategies in Weeks 1 and 6. The current word processing group (at that time) was also shown how to use the revision functions of the word processing software.

The writing tasks were all of the same genre and of a similar level of cognitive demand. All writing tasks were narrative in nature, taken from the second level of Moffet's schema (see Appendix 6). This type of writing task has been used successfully in the past with ESL writers (Heuring, 1985; Raimes, 1985, 1987). 'Standardising' the writing tasks was necessary as research has shown that the nature of the writing task affects revision (Heuring, 1985). The five following writing tasks (each repeated once) were given to the subjects over the ten weeks of the study.

Table 4.3

Writing Tasks

Task No:	Genre:	Requirements:	Weeks:
1	Narrative	Write about an exciting or interesting experience that you had before coming to Australia	1 & 6
2	Narrative	Write about your first day at school - what was it like? What do you remember most about it?	2 & 7
3	Narrative	Write about "coming to Australia" What was it like? What happened?	3 & 8
4	Narrative	Write about your own country and the things you remember most about it	4 & 9
5	Narrative	Write about what it has been like getting used to living in Australia - and how hard (or easy) has it been	5 & 10

For the 10-week duration of the research, all written and word processed work was collected and analysed. In the case of word processed work, the subjects' modifications to text were indicated by sections of the discourse having been formatted using the word processor's 'strikeout' command for deletions (that is, ~~this~~) and an inverted triangle symbol on either side of any addition (that is, ∇this∇). Similar revision markings were used by the subjects in their pen and paper work. The combination of these two revision marks was sufficient for the researcher to identify and record the six main revision operations (see Figure 4.2). While the possibility exists that the methods of subject recording of revision changes outlined here have added an element of unnaturalness or artificiality to the word processing condition, there was no other reliable alternative available to the researcher (see limitations).

It should be noted here that although each writing task involved two writing sessions (and hence two written or word processed 'drafts'), for the purposes of this study, no distinction has been made between changes made 'within-draft' as opposed to 'between drafts'. A change made in the first draft of any writing task was counted only once. Even if it had been retained in the second draft, it was still counted as one change. The only instruction given to the subjects regarding the second writing session for each task was that they were expected to use this session to 'improve' their written piece in any way they felt they could.

While the subjects were writing or word processing, their verbal protocols for each writing session were audio-taped. An observational schedule was used to record any relevant anecdotal records or comments (see Table 4.2).

CHAPTER FIVE

Results

This results chapter is divided into three main sections. The first section addresses Parts A and B of the main research question, the second section addresses Part C, and the third section addresses the subsidiary research question. Most of the data analysis procedures were quantitative: involving the use of descriptive and inferential statistics, and the graphical display of these data.

5.1 The Effect of Word Processing Software on the Primary ESL Writer's Revision and Editing Strategies

5.1.1 Descriptive statistics for subjects' revision in the word processing and pen and paper conditions

Descriptive statistics were calculated for each of Faigley and Witte's four major categories of revision changes: for both word processing and pen and paper conditions. These are presented in Tables 5.1 to 5.4.

Tables 5.1 to 5.4 provide a numerical comparison of the median and range for changes to text (of the four main revision categories) made by the 6 subjects in their word processing and pen and paper conditions. Formal and meaning-preserving changes both come under the category of 'surface changes' (non-meaningful revisions), while microstructure and macrostructure changes come under the category of 'text-base changes' (meaningful revisions).

For the taxonomy-based revision analysis from which these data were calculated, inter-rater reliability was established by comparing the researcher's classification of revisions with those of two independent coders. The Faigley and Witte taxonomy was shown to and demonstrated for the two independent coders, who then used it to code the changes to text in a randomly selected 10% sample of the collected written and word processed texts. Two inter-rater reliability percentages were arrived at by calculating the percentage agreement for researcher/coder 1 (91.83%) and researcher/coder 2 (80.00%).

Table 5.1 shows a median for formal changes in the pen and paper condition that is nearly four times larger than that for the word processing condition. The difference between the two conditions is emphasised by the gap between the range for word processing and range for pen and paper (there is no overlap). In the pen and paper condition, the subjects made a total of 493 formal changes to text, compared to 113 in the word processing condition. For both conditions, formal changes were predominantly changes to spelling or punctuation.

Table 5.1

Descriptive Statistics for Formal Changes Across Word Processing and Pen and Paper Conditions

Word Processing:		Pen and Paper:	
Median	18.5	Median	68
Range	10 - 33	Range	57 - 156

Table 5.2 shows a similar pattern to that in Table 5.1. The median for meaning-preserving changes is more than eight times larger in the pen and paper condition than in the word processing condition. Once again, the ranges do not overlap. The total of meaning-preserving changes in the pen and paper condition was 157, compared to a total of 26 in the word processing condition.

In both conditions, the predominant meaning-preserving changes were additions and deletions. Additions normally took the form of single words added within sentences: for example, 'I caught ∇my∇ bus to school'. Deletions normally consisted of one or two words: for example, 'He was feeling happy'.

Table 5.2

Descriptive Statistics for Meaning-Preserving Changes Across Word Processing and Pen and Paper Conditions

Word Processing:		Pen and Paper:	
Median	3	Median	25
Range	1 - 14	Range	18 - 42

In Table 5.3, the difference between the medians for microstructure changes in the word processing and pen and paper conditions is comparatively small. The absence of a large difference between the two conditions is further emphasised by the size of the overlap that occurs between the range for word processing and the range for pen and paper. In the pen and paper condition, subjects performed a total of 184 microstructure changes, compared to 124 in the word processing condition.

At the microstructure level, the most frequent changes to text (in both conditions) were additions and deletions - although there were occasional substitutions and permutations. Substitutions normally consisted of words or phrases being replaced. For example, 'I felt bad' being replaced with, 'It was terrible'. Permutations normally combined a change in sentence word-order with the meaningful substitution of at least one word for another: for example, 'It was a long, *hard* journey' becoming, 'The journey was long but *fun*'.

Table 5.3

Descriptive Statistics for Microstructure Changes Across Word Processing and Pen and Paper Conditions

Word Processing:		Pen and Paper:	
Median	23	Median	27.5
Range	8 - 29	Range	21 - 50

Table 5.4 shows what is perhaps the most important difference between the two writing conditions. Although there is overlap between the ranges for word processing and pen and paper, and the difference between the two medians is comparatively small (compared to formal and meaning-preserving revisions), the extent of the differences between macrostructure-level revision in the two conditions is much larger than is immediately apparent.

The total number of macrostructure changes made was small (in the word processing condition, subjects performed a total of 27 macrostructure changes to text in comparison to a total of 15 in the pen and paper condition). However, a single instance of macrostructure addition in the word processing condition involved a range of 27 to 340 words being added to the text: whereas an instance of macrostructure addition in the pen and paper condition involved a range of 14 to 106 words being added. Macrostructure changes to text in both conditions were almost exclusively end-of-text *additions* (see Appendix 10 for revision samples and coding key).

Table 5.4

Descriptive Statistics for Macrostructure Changes Across Word Processing and Pen and Paper Conditions

Word Processing:		Pen and Paper:	
Median	4	Median	2.5
Range	3 - 7	Range	1 - 5

5.1.2 Results of statistical analysis

Because of the small sample size ($N = 6$), a non-parametric test: The Wilcoxon Signed Ranks Test, was considered more appropriate for this population than its parametric equivalent: the related samples *t-test*. The Wilcoxon test is a less powerful (and thus more conservative) test of significance. It was used to determine whether or not the differences in numbers of revisions made (for Faigley and Witte's four main categories) in the two conditions, were statistically significant.

Table 5.5 shows the results of the Wilcoxon Signed Ranks Test for four sets of data - the numerical differences between the total word processing (WP) and total pen and paper (P&P) changes made by all six subjects for the four major categories of revision changes: formal, meaning-preserving, microstructure and macrostructure changes. The related medians for both conditions are also included here for direct comparison.

Table 5.5

Results of Wilcoxon Signed Ranks Test

	Number of Subjects:	Median: (WP)	Median: (P&P)	Wilcoxon Statistic:
Formal changes:	6	18.5	68	21.0 *
Meaning-preserving changes:	6	3	25	21.0 *
Microstructure changes:	6	23	27.5	18.0
Macrostructure changes:	6	4	2.5	21.0 *

* $p < .05$

Note: 'WP' = Word processing, 'P&P' = Pen and Paper.

The differences in revising behaviours between the word processing and pen and paper conditions were statistically significant for three of the four categories - these being: formal, meaning-preserving and macrostructure changes. For formal and meaning-preserving changes, significantly more revisions were made in the pen and paper condition. For macrostructure changes, significantly more revisions were made in the word processing condition. The difference between microstructure changes in the word processing and pen and paper conditions, was not statistically significant.

5.1.3 Macrostructure changes

Of particular significance to this thesis is the difference observed by the researcher in number and extent of macrostructure revisions made in the word processing and pen and paper conditions. While it is apparent that more macrostructure changes were made in the word processing condition in comparison with the pen and paper condition, Table 5.6 is necessary to give an indication of the differences in number of words and sentences involved in these macrostructure changes to text, between the two conditions.

While there was not a large difference in the number of words and sentences per *draft* between the two writing conditions (a median of 144.0 words and 3.0 sentences per draft in the word processing condition compared to a median of 130.5 words and 4.0 sentences per draft in the pen and paper condition), a much larger number of words and sentences were involved in the *macrostructure changes* in the word processing condition when compared to the pen and paper condition (see Table 5.6).

Table 5.6

**Macrostructure Revisions: Total Numbers of Words and Sentences
Involved in the Word Processing and Pen and Paper Conditions**

Subjects:	Word Processing - Total Words:	Pen and Paper - Total Words:	Word Processing - Total Sentences:	Pen and Paper - Total Sentences:
A	261	23	6	2
B	208	79	14	11
C	150	24	10	3
D	586	130	25	8
E	1265	171	7	4
F	471	242	18	11

The difference in number of words involved in macrostructure changes is perhaps a more reliable indicator of how this revision type differed in the word processing condition; rather than the difference in number of sentences. This is because the subjects have not yet fully mastered the use of punctuation marks (such as full stops). Throughout the 10-week study, the subjects were not consistent in the marking of sentence boundaries. For example, it was not uncommon for Subject B (and others) to use full stops to separate single words and phrases or to use them as an alternative to commas: for example, "...I in the hongkong buy school bag. pencilcase. shoes. jumper. t shirt. jeans. and buy anything I very happy" (Extract from Subject B's work for Writing Session 6).

Even if one disregards the difference in total number of sentences involved in macrostructure changes (produced by each subject in the two writing conditions), a large difference can still be seen in the total number of

words involved. Not only did the subjects produce more macrostructure changes in the word processing condition when compared to the pen and paper condition: In all cases these changes involved much larger numbers of words.

Referring to Table 5.6, Subject E illustrates the most significant numerical difference. She performed macrostructure changes to text involving a total of 1265 words in the word processing condition in comparison to 171 words in the pen and paper condition.

In the word processing condition, macrostructure changes to text were exclusively additions. In the pen and paper condition, they were predominantly additions, although there were some deletions and one or two instances of macrostructure distribution. For both conditions, the majority of macrostructure additions have been end-of-text additions. While it could be argued that some of these macrostructure revisions recorded constituted nothing more than the continuation of an ongoing writing process, any attempt on the part of the researcher to differentiate between such 'continuations' and macrostructure additions would have been highly speculative in nature, and would have made the consistent application of (and adherence to) Faigley and Witte's taxonomy (see Figure 4.2), an impossible task.

In one or two instances, additions have been made at the beginning of the text or in the middle. Table 5.7 compares the type of macrostructure revisions made in the word processing and pen and paper conditions, as well as identifying each instance of revision in terms of its position in the text. A macrostructure change can occur at the beginning ('initial'), in the middle ('medial'), or at the end ('final') of the text.

Table 5.7

**Macrostructure Revisions in the Word Processing and Pen and Paper
Conditions (Categories and Position in Text)**

Macrostructure Revision Categories:	Word Processing:	Position: (initial, in- text/medial or final)	Pen and Paper:	Position: (initial, in- text/medial or final)
Additions:	27	2 initial 25 final	10	1 initial 1 medial 8 final
Deletions:	0		0	
Substitutions:	0		2	1 initial 1 medial
Permutations:	0		0	
Distributions:	0		3	3 medial
Consolidations:	0		0	

5.1.4 Changes to text: patterns and comparisons

The total revision changes over time (for the 20 writing sessions) for each subject, in the four major categories of revision, were plotted on column graphs. These data can be seen in Figures 5.1 to 5.8. They are also presented in summarised form in Figures 5.9 to 5.12.

The reason for this apparent duplication of graphically presented data is that Figures 5.1 to 5.8 illustrate a number of patterns and possible relationships that are not immediately apparent in Figures 5.9 to 5.12 or from the tables.

Figures 5.1 to 5.8 are labelled as revision changes for either 'Group 1' or 'Group 2'. Group 1 comprises Subjects A, B and C, who were word processing for the first 5 weeks of the study and writing with pen and paper for the last 5 weeks. Group 2 comprises Subjects D, E and F, who were writing with pen and paper for the first 5 weeks of the study and word processing for the last 5 weeks.

Looking at Figures 5.1 and 5.2, it can be seen that a large number of formal changes were made by both Groups 1 and 2 in the pen and paper condition. A much smaller number were made by both groups in the word processing condition.

The vertical line in the centre of each of the following column graphs indicates the 'changeover' in Week 6 (Writing Session 11). This changeover was from word processing (WP) to pen and paper (P&P) with Group 1 and from pen and paper to word processing with Group 2.

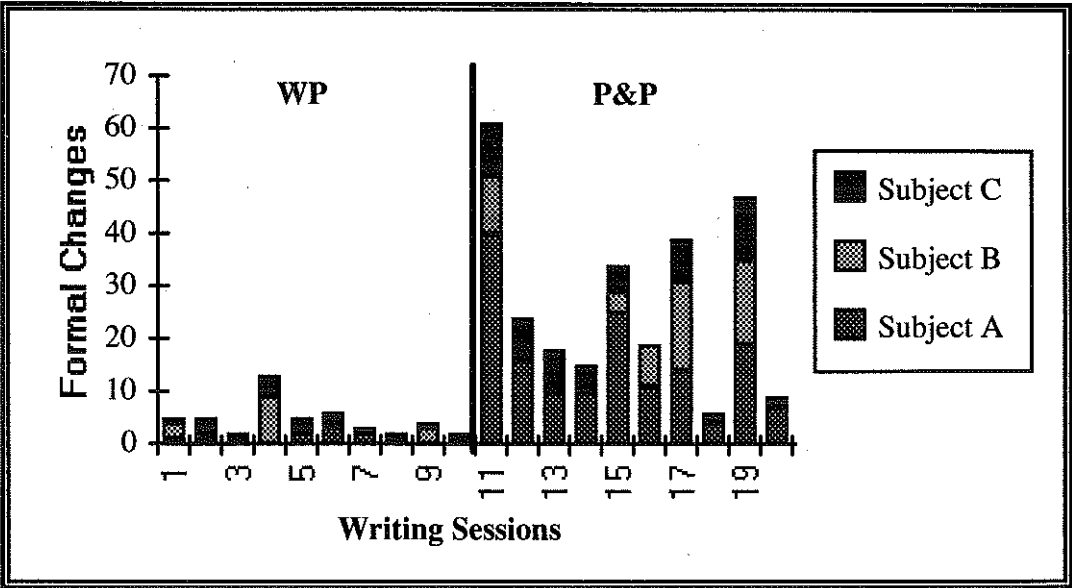


Figure 5.1: Surface Changes - Formal Changes - Group 1

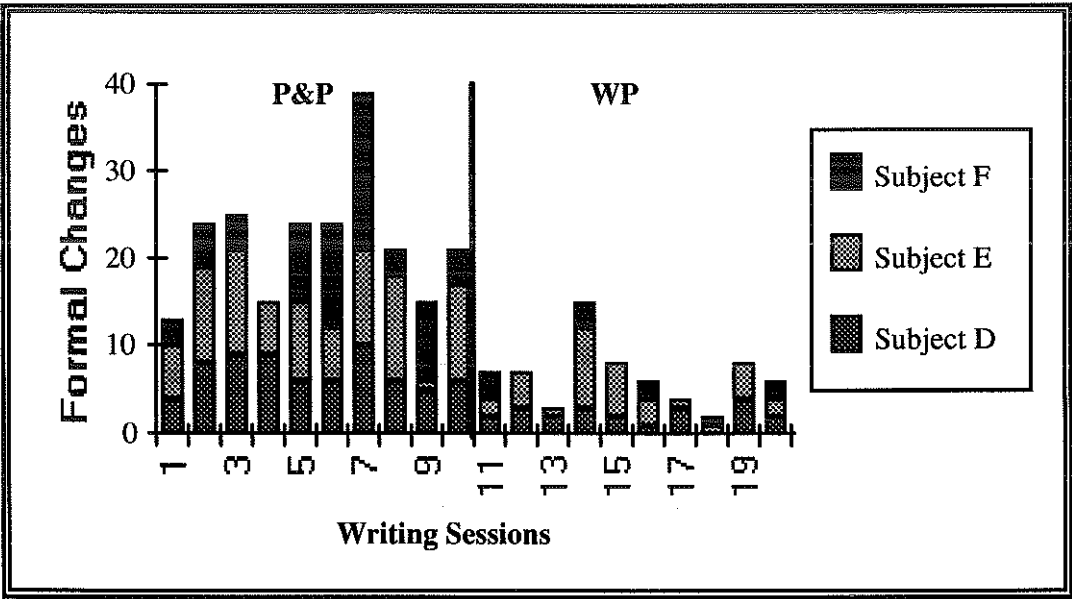


Figure 5.2: Surface Changes - Formal Changes - Group 2

A similar pattern is evident in Figures 5.3 and 5.4. In the pen and paper condition, both groups produced a much larger number of meaning-preserving changes than in the word processing condition.

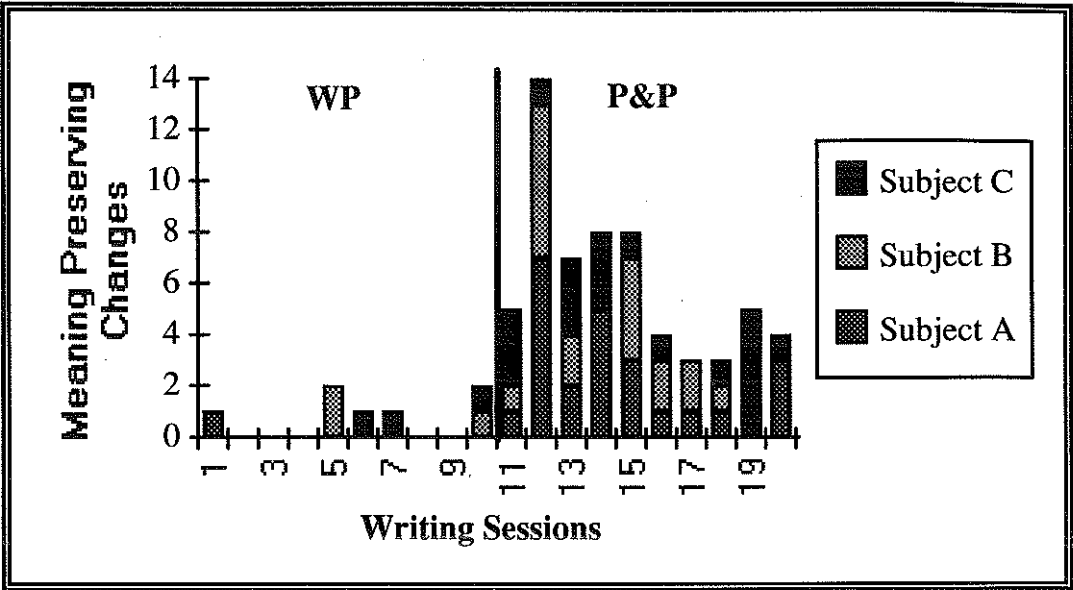


Figure 5.3: Surface Changes - Meaning-Preserving Changes - Group1

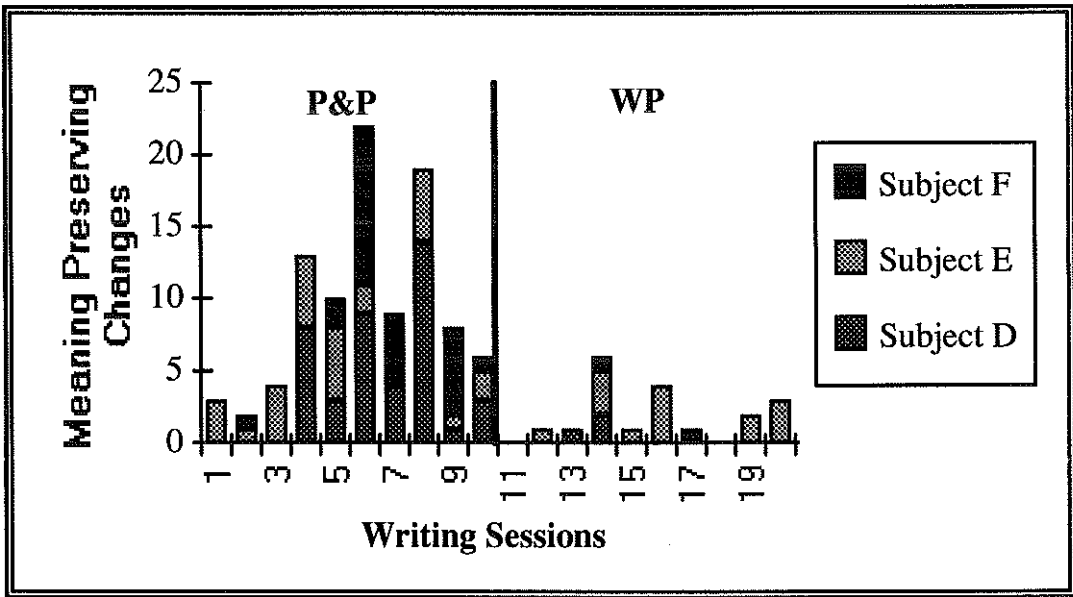


Figure 5.4: Surface Changes - Meaning-Preserving Changes - Group 2

Figures 5.5 and 5.6 show an interesting contrast to the other levels of revision. There was no significant difference in microstructure changes for Group 1 or Group 2. There was, however, a slight difference in the median for microstructure changes performed between the word processing (median = 23) and pen and paper (median = 27.5) conditions.

Although the transition from word processing to pen and paper involved a significant *increase* in formal and meaning-preserving changes accompanied by a significant *decrease* in macrostructure changes, there was no significant change in the quantity of microstructure-level revisions.

It is also worth noting that while macrostructure changes in the word processing condition were exclusively *additions* and usually added on to the end of the text (see Table 5.7), microstructure changes (in both conditions) were usually a mixture of additions and deletions that occurred both in-text and 'added on' at the end. Typical examples can be seen in Subject D's word processed work from Session 14 and pen and paper work from Session 4 (see Appendix 10). It seems that the subjects were more willing to experiment with *in-text* additions and deletions (in both conditions) at the microstructure level. This contrasts with the tendency (in both conditions) at the macrostructure level to simply 'add on' at the end of the text.

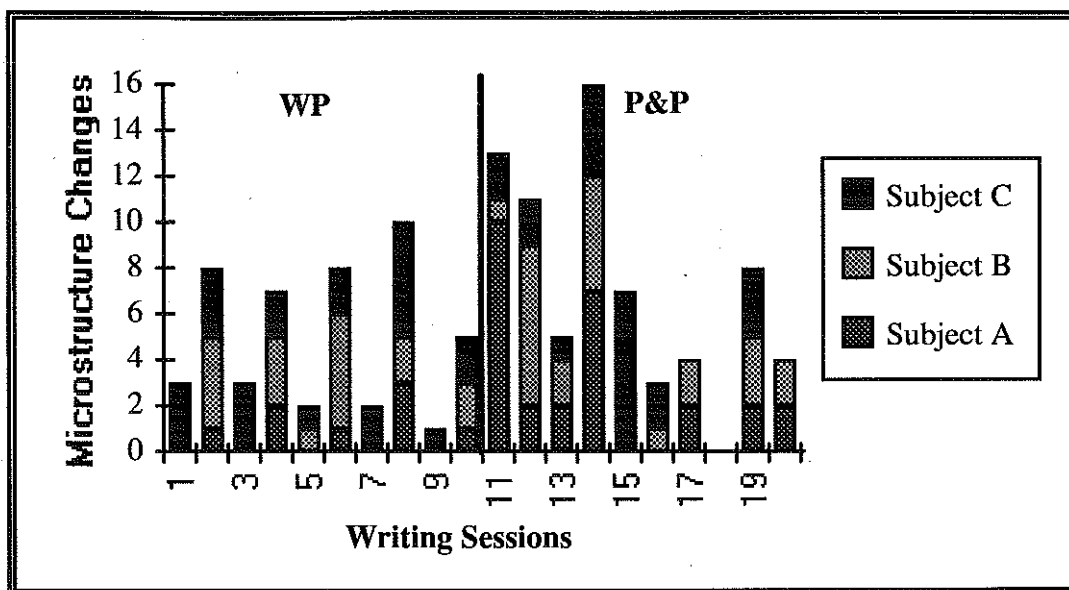


Figure 5.5: Text-Base Changes - Microstructure Changes - Group 1

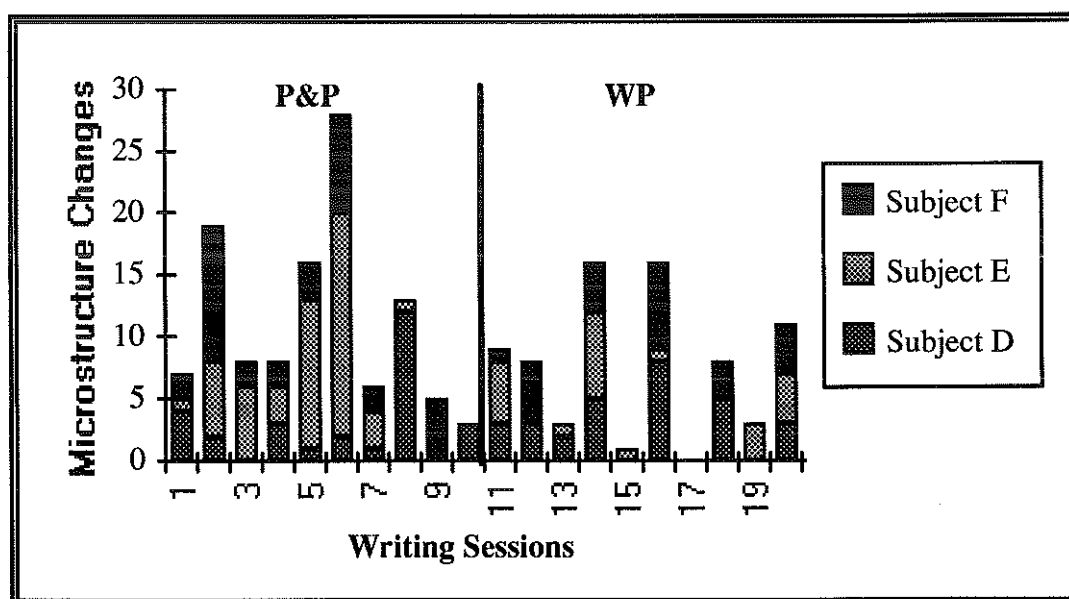


Figure 5.6: Text-Base Changes - Microstructure Changes - Group 2

In Figures 5.7 and 5.8, there has been a significant increase in macrostructure revisions in the word processing condition and a significant decrease in the pen and paper condition. Reference to Table 5.7 will show that this increase in number of macrostructure revisions is accompanied by a dramatic increase in their size.

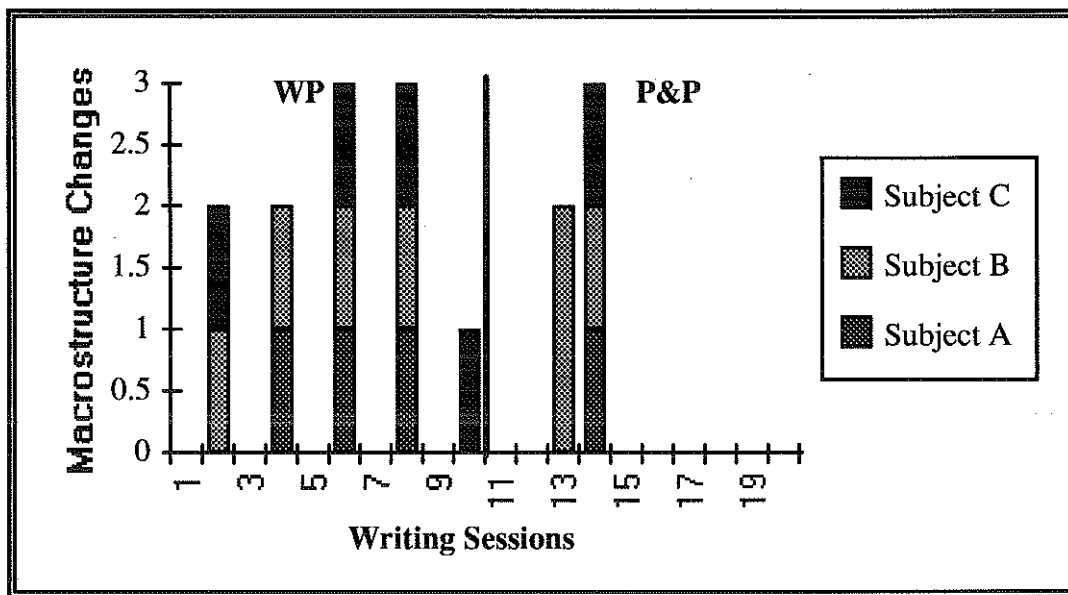


Figure 5.7: Text-Base Changes - Macrostructure Changes - Group 1

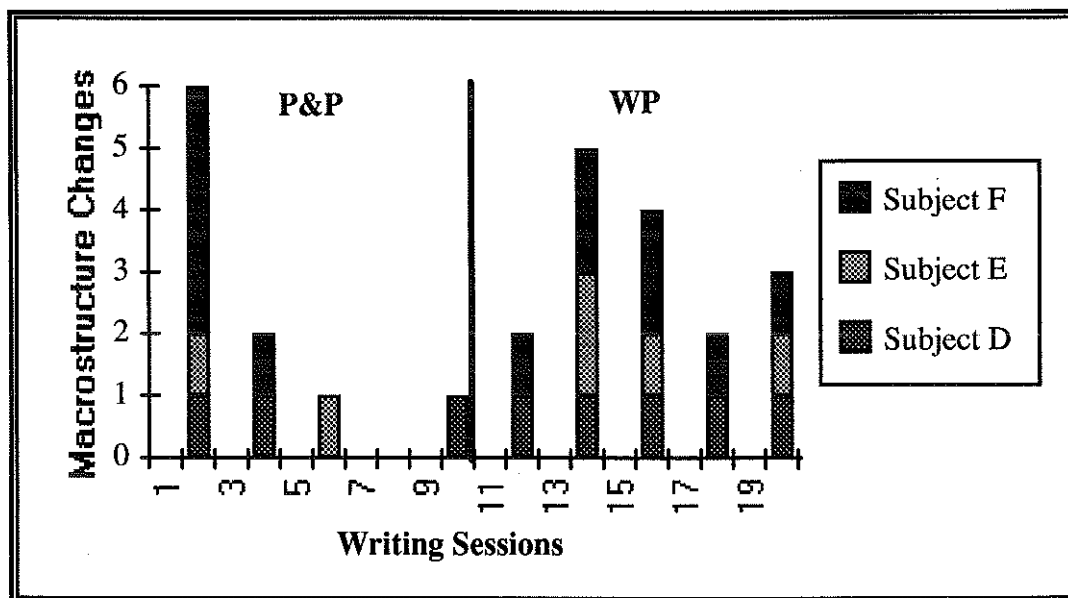


Figure 5.8: Text-Base Changes - Macrostructure Changes - Group 2

Figures 5.9 to 5.12 provide a graphical ‘summary’ of the data already presented. Looking at Figures 5.1 to 5.12, a number of patterns seem to have emerged. These are discussed in Section 5.1.5.

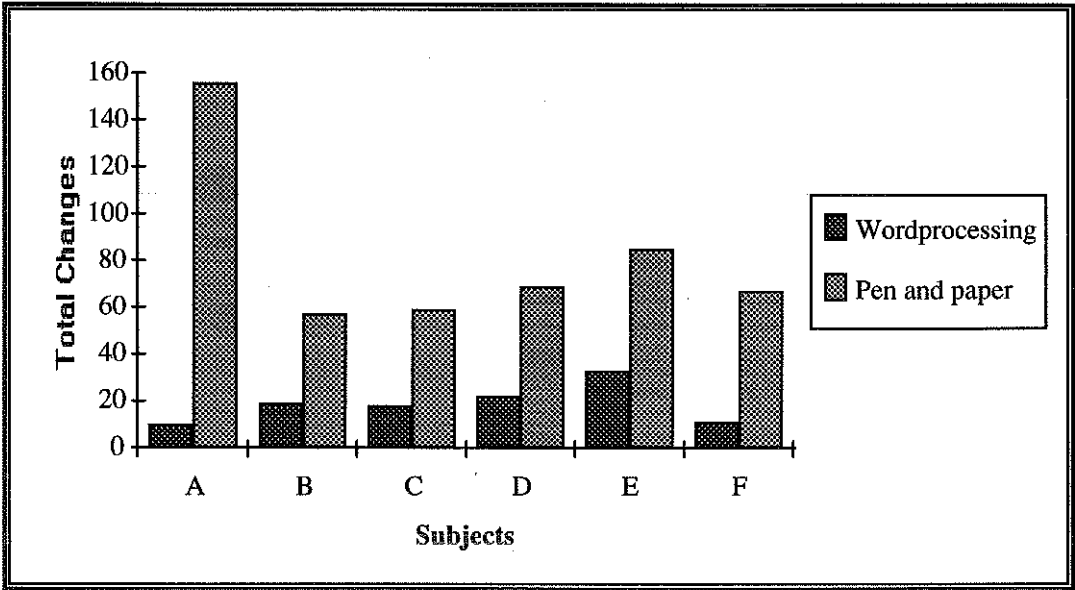


Figure 5.9: Surface Changes - Formal

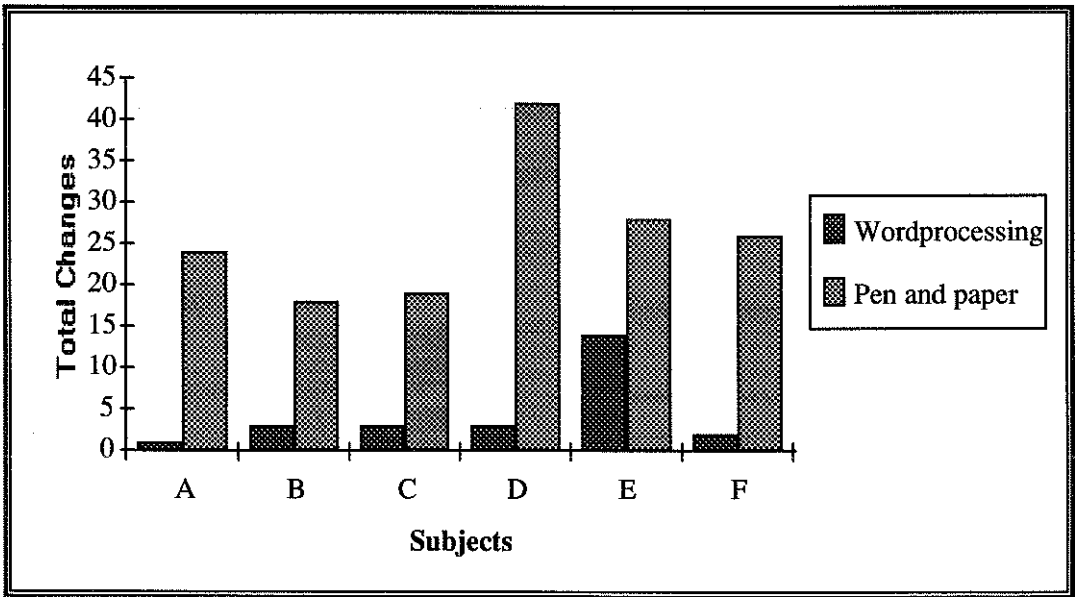


Figure 5.10: Surface Changes - Meaning-Preserving

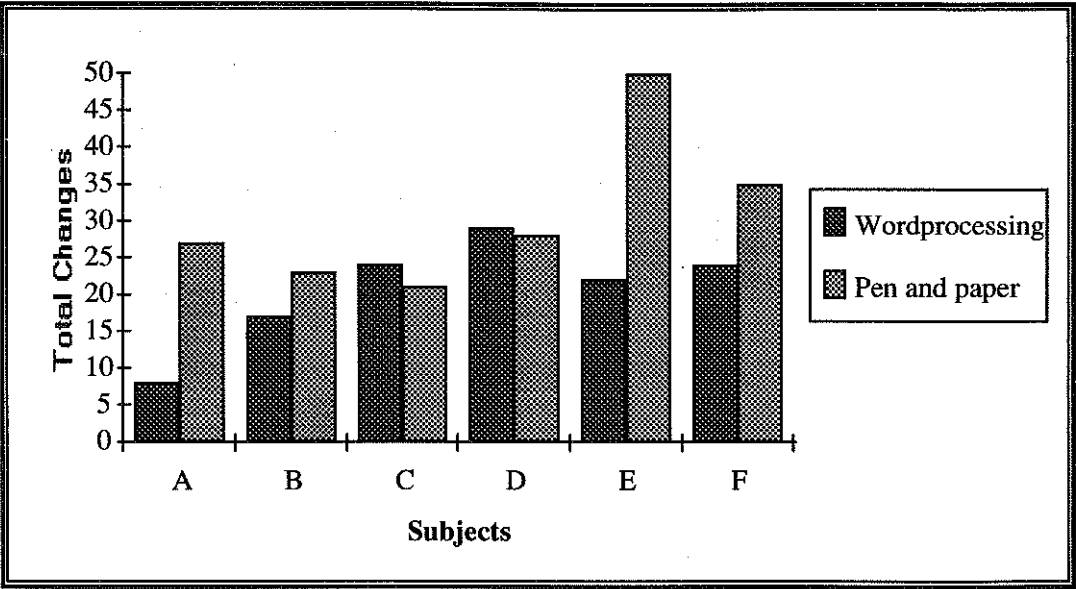


Figure 5.11: Text-Base Changes - Microstructure

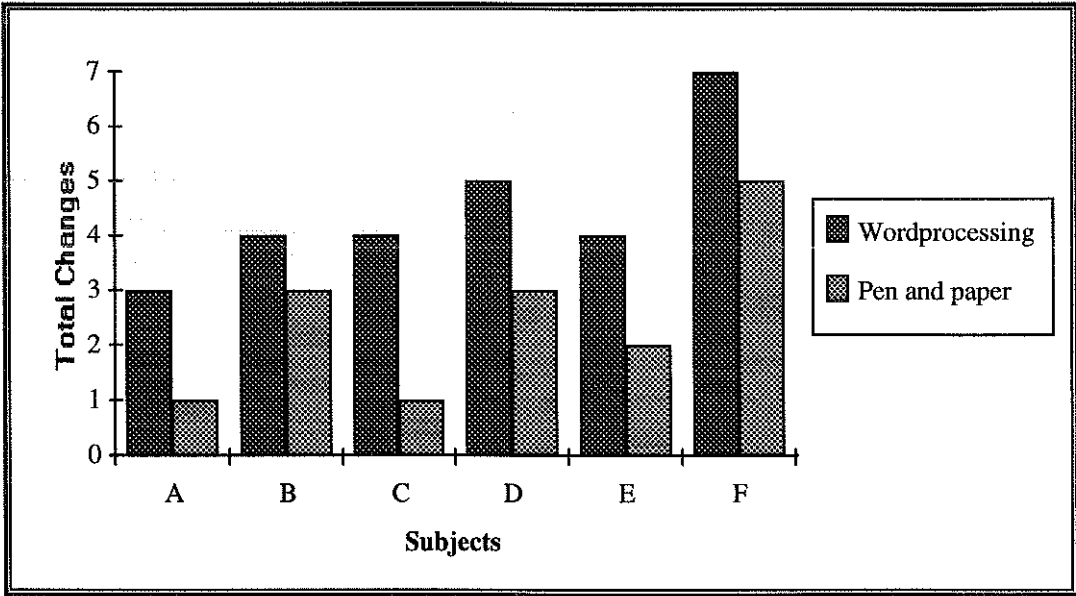


Figure 5.12: Text-Base Changes - Macrostructure

5.1.5 Emerging patterns

All subjects in the word processing condition focussed far less on the two major categories of 'surface changes' (or non-meaningful revisions) than they did in the pen and paper condition. Figures 5.9 and 5.10 illustrate this tendency. There was, however, no significant difference in the number microstructure (sentence-level and below) meaningful changes in the word processing condition when compared to the pen and paper condition (see Figure 5.11).

It is interesting to note how the number of formal and meaning-preserving changes produced alters so substantially (and quickly) as subjects make the transition from pen and paper to word processing. This can be seen by examining the change in the number of revisions made in one or two writing sessions on either side of the 'changeover point' (marked by the central vertical line) in Figures 5.2 and 5.4.

A major focus of revising in the word processing condition was on macrostructure (above the sentence level) meaningful changes to text. More of these (and much more extensive ones) were produced by all subjects in the word processing condition in comparison to the pen and paper condition. These changes were almost exclusively additions at the end of text. There is evidence of these changes in the audio-taped protocols referred to in Section 5.1.6

Over the 20 writing sessions the subjects wrote a median of 144.0 words per draft in the word processing condition and 130.5 words per draft in the pen and paper condition. The subjects also wrote longer sentences in drafts

composed on the computer (a median of 48.0 words per sentence and 3.0 sentences per draft) when compared to drafts written with pen and paper (a median of 32.62 words per sentence and 4.0 sentences per draft).

5.1.6 The 'protocols'

The researcher listened to 120 cassettes to transcribe all 'protocols' and utterances of relevance to the subjects' composing processes. Although the think-aloud protocols transcribed were a rich source of information on the subjects' revising and composing processes, and were useful in the analysis of revision changes to text, they did not provide examples of the sort of 'thinking aloud' that had been anticipated.

The types of 'protocols' recorded throughout the study were not (in most cases) examples of 'thinking aloud'. The examples given here were taken from the audio-taped writing sessions of Subjects D and E (The written results of these protocols can be seen in Appendix 10). For each type of protocol, a word processing (WP) and pen and paper (P&P) example has been given. Descriptions of protocols recorded and an indication of their relative frequency will be found in Appendix 7. For the most part, the utterances recorded included the following:

- (a) cases of subjects reading and rereading (sometimes sub-vocalising) text to themselves: for example,

Subject D (WP) - Session 13, "When I came to school...came school...when I came school in Mayland...my mum take I...my mum

take I and my brother...came to school I feel I scared...". Most of this utterance was incorporated into the text,

Subject D (P&P) - Session 3, "When finish singing...finish singing I came back...came back my class work". This utterance was incorporated into the text,

(b) the making of spelling requests to other subjects or the researcher: for example,

Subject E (WP) - Session 19 - spelling request in Vietnamese to Subject D, "How I spell CATERPILLAR?". This word was then used in the text,

Subject E (P&P) - Session 9, "How I spell DIFFERENT?". This word was then used in the text,

(c) requests for alternative words/ways of saying things: for example,

Subject D (WP) - Session 13, "Mr Oliver, what you call the thing in playground...you slide down?" The researcher told the subject that the phrase he wanted was 'slippery slide'. This phrase was incorporated into the text,

Subject D (P&P) - Session 3, "Mr Oliver, what you call the thing on computer you write with?". After responding with 'keyboard' and 'word processor', the researcher found the subject was referring to

the word processing software. This was not incorporated into the text,

(d) occasional discussion of the topic with the researcher or other subjects: for example,

Subject E (WP) - Session 20 - the subject started writing about coming to Australia from Vietnam with her mother. When she asked the researcher, "Mr Oliver, what else you like I write about?", a discussion developed about how the subject felt about starting school in Australia, how she felt about the teachers, and about her 'extended' as well as her 'immediate' family. Much of this information was incorporated into her text,

Subject E (P&P) - Session 10, "Mr Oliver, I talk about school in Vietnam?...". The subject discussed with the researcher the differences between schools in Australia and Vietnam: including timetabling, classes, discipline, learning styles, and friends at school. Only part of this information (on timetabling differences) was committed to paper (see Appendix 10).

Of the 'protocols' described in Appendix 7, one of the few examples of actual 'thinking aloud' occurred with Subject B in Session 10. He 'thought aloud' in Mandarin, "nobody plays with me", and then translated this phrase into English, "nobody play". This phrase was incorporated into the text.

Despite the rarity of actual 'think-aloud protocols', the audio-taped utterances of the subjects were useful and revealed an interesting pattern. In the word processing condition, subjects tended to spend a lot of time reading/rereading (sometimes subvocalising) their compositions to themselves, and strategic pausing combined with 'retrying' of certain phrases and words occurred on many occasions. Many of the considered changes to text indicated in the audio-taped 'protocols' were later made in the subjects' texts. This can be established by comparing the protocol examples already given with the subjects' work in Appendix 10. In several instances, subjects in the word processing condition had asked the researcher for further ideas/information to extend the topic. In many cases, this resulted in a macrostructure addition to the text. This was far less frequent in the pen and paper condition. There were also some spelling requests in the word processing condition: but few in comparison to the pen and paper condition (in the word processing condition, there was a median of 8 spelling requests per session compared to 17 in the pen and paper condition).

As well as reading and rereading their texts, subjects in the word processing condition frequently asked other subjects to read and comment on their work and often discussed their work with other subjects (in both the L1 and L2).

In contrast, the utterances of subjects in the pen and paper condition were mostly spelling requests. Some of these spelling requests were in the subjects' L1. For example, Subject D frequently made spelling requests in Vietnamese to Subject E. There were some instances of meaningful discussion and reading/rereading of text to self in the pen and paper condition: but these were much less frequent than in the word processing

condition. Reference to the protocol record in Appendix 7 will show that the majority of utterances in the pen and paper condition were spelling requests while the utterances in the word processing condition were predominantly examples of reading and rereading of text and topic discussion.

5.1.7 Written/word processed samples

Due to the large number of written and word processed drafts produced, only a few have been included for comparison (see Appendix 10). These are a representative sample of the work produced in the subjects' word processing and pen and paper conditions.

Subject D's Written/Word Processed Samples

Word Processed Drafts:

Subject D's word processed samples (Writing Sessions 13 and 14) for Topic 2 illustrate a pattern that is common in all the word processed work examined. In the first draft, the subject has made a combination of microstructure changes, meaning-preserving changes and formal changes. In the second (and final) draft, the subject has concentrated on meaningful additions to the end of the text. These meaningful additions (specifically the six microstructure additions at the end of the second draft) when combined, constitute one macrostructure addition at the end of the text. In the word processing condition, each macrostructure change involved a range of 20 to 340 words. They were almost exclusively additions at the end of the text.

Subject D's word processed drafts also demonstrate a recursiveness (in terms of both surface and text-base changes) in the revising process. After the first draft, the subject went back to make changes at the beginning of the text while also focussing on meaningful additions at the end of the text. This indicates that a lot of rereading and analysis of text was occurring in this writer's composing process.

'Recursive' Changes:

The 'recursive' changes are interesting in that they are not always 'corrections' in the normal sense of the word. In some cases they represent spelling changes in which the writer looked 'backwards', changing a word that was spelt correctly into one incorrectly spelt. In other cases, microstructure or meaning-preserving additions or deletions were made as the writer's rereading of the text caused him/her to perceive a need to add, delete or otherwise change something.

Pen and Paper Drafts:

Subject D's pen and paper drafts (Writing Sessions 3 and 4) provide an interesting contrast to his word processed work. Although all subjects initially produced more work with pen and paper, within a few sessions on the computer they were generally producing more word processed work than handwritten work. Subject D's pen and paper work differed from his word processed work - but not solely in terms of quantity. In his pen and paper work, there were much larger numbers of formal and meaning-preserving changes when compared to his word processed work. In his word processed work there was more of a balance between surface and text-base changes when compared to the pen and paper work. In the latter

a majority of the changes made were either formal or meaning-preserving changes (both non-meaningful categories of revision).

This subject's handwritten work illustrates at least one similar pattern to that found in his word processed samples. The 'recursive' changes (changes made by going back to previous portions of the text) made, tended to be non-meaningful (formal or meaning-preserving) whereas the one macrostructure addition made by the subject will be found added to the end of his writing sample from Session 4. As in the word processing condition, this macrostructure change consisted of several smaller microstructure additions.

Subject E's Written/Word Processed Samples

Word Processed Drafts:

Subject E's word processed samples (Sessions 19 and 20) are similar to those of Subject D in many respects. This subject produced far more work in the word processing condition than in the pen and paper condition. The two word processed drafts show a similar pattern to that which occurs in the word processed samples of Subject D. There were a number of formal, meaning-preserving and microstructure changes in the first draft and the numbers of each type of change were comparable. In the second draft, a very large macrostructure addition was added at the end of the text. This macrostructure change (consisting of 340 words) was made up of several smaller microstructure additions. Within this macrostructure addition, a number of other operations such as spelling changes, additions and deletions were also performed.

Pen and Paper Drafts:

Subject E's pen and paper work for Sessions 9 and 10 was very different to her word processed work. Firstly, there were no meaningful changes to the text (neither microstructure nor macrostructure). Secondly, the subject chose not to copy the writing done in her first draft into the second draft. In the second session, she chose instead to continue on from the exact point at which she had finished in the first writing session on this topic. This was unusual. In almost all cases, the subjects would use their second writing session on a given topic for rewriting what had been done previously (in the first session) *before* continuing to write any new material. This facilitated the making of any changes that the writer saw as necessary or appropriate. Although the subject was happy to do this on the computer, she was either unwilling or unable to work in this way with pen and paper (in this particular instance).

Although Subject E produced meaningful changes to her texts in the word processing condition (at both the microstructure and macrostructure levels), she produced none in her pen and paper drafts for this writing task.

5.1.8 Summary

The observations made so far are based on the patterns that have emerged from the data. The patterns illustrate the way the subjects' revision work on the word processor differs from that done with pen and paper. Two patterns have emerged that are distinctive for the way the subjects revise on the word processor when compared to pen and paper.

In the word processing condition, subjects performed significantly fewer surface changes (either formal or meaning-preserving), a comparable number of microstructure changes (for both conditions), but more (and much more extensive) macrostructure changes. There was also a similar range of formal, meaning-preserving and microstructure changes, for both conditions.

In the pen and paper condition, subjects performed significantly larger numbers of formal and meaning-preserving changes, a comparable number of microstructure changes, and fewer (and much less extensive) macrostructure changes. In the pen and paper condition, formal changes were the most predominant revision type, far exceeding the number of all other types of changes.

Common Features:

Some features that appear to be common to both the word processing and pen and paper conditions relate to *how* revisions were made. In both conditions, a large number of surface changes appear to have been made recursively (that is, in the process of looking back over and rereading the text) while macrostructure changes were almost exclusively additions at the end of the text. In both conditions, microstructure changes appeared initially, medially and finally, in the text. They were sometimes performed recursively, and were, in many cases, part of larger macrostructure modifications to the text.

5.2 The Effect of Word Processing Software on the Primary ESL Writer's Attitudes Towards Writing and Himself/Herself as a Writer

5.2.1 Attitude survey

A qualitative comparison was made between the pre-, mid- (changeover) and post-study survey findings. This revealed a number of changes in the subjects' attitudes towards writing and themselves as writers.

The survey (Appendix 1) revealed a number of positive attitudinal changes over the 10-week duration of the study. Most subjects described an improvement in how they felt about their writing towards the end of the study. One subject changed from being undecided on how he felt about writing (after the pen and paper condition) to saying (after the word processing condition), "I feel very important in writing". Several subjects described themselves as 'bad writers' at the beginning of the study and as 'good writers' at the end.

Some of the most interesting responses were to Question 7. When questioned at the beginning of their word processing condition, several subjects said that they did not usually try different ways of saying things. By the conclusion of their word processing condition, these subjects indicated that they did try alternative wording and phrasing in their writing.

In response to the question on specific problems with writing in English, three of the subjects, on completion of their word processing treatment, indicated that they had problems with grammar and spelling. On completion of their pen and paper condition, five of the subjects indicated

that they had problems with spelling and grammar. Although the word processing software used has 'built-in' 'spell-checking' and 'grammar-checking', these features were (intentionally) not available to the subjects.

A possible explanation for this difference may be the fact that all the subjects found their word processed work more legible than their handwritten work. If letter/word recognition was easier on the computer, this may partially explain why fewer subjects reported difficulty with spelling and grammar in the word processing condition.

In Question 12, the subjects were asked if they wanted to add any further comments on the survey form. Four of the six subjects (2 from Group 1 and 2 from Group 2) indicated (at the conclusion of their word processing condition) that they now had more positive feelings towards writing and saw writing as important. The same subjects focussed on their spelling and grammar problems when asked the same question after their pen and paper condition.

5.2.2 Anecdotal notes

The anecdotal notes did not turn out to be a major source of data. They did, however, provide some insight into what transpired in a typical writing session. A selection of these can be seen in Appendix 8. They are a representative sample of the notations made by the researcher throughout the study. Far more information was provided by the audio-taped protocols, however (see Appendix 7).

The anecdotal notes provided some insight into the types of problems faced by the subjects in learning to use the word processor (such as

learning to control the mouse and problems with accidental 'reboots' of the computers). They also record how the quantity of word processed work was initially much less than that produced in the pen and paper condition. By about Week 3 however (for both groups), this situation was dramatically reversed and the word processed work in most cases exceeded in quantity, the work produced in the pen and paper condition.

One important feature of the subjects' word processing work that is referred to in the anecdotal notes, was the need for the researcher to frequently remind (and occasionally reteach) the subjects to use the appropriate revision markings. This required the children to use either the mouse or a key combination, and usually took them three or four writing sessions to master.

5.3 How do Primary ESL Writers React to Using the Word Processing Software/Computer and What Differences do They Perceive?

The final interviews (see Appendix 9), provided a large amount of information on the subjects' views and impressions on using the computer as a writing tool. They also indicate that some caution is necessary in interpreting what in some cases were subject responses possibly framed with the intention of 'pleasing the teacher'. Despite this, the work produced shows that the use of word processing has had several beneficial effects on the subjects in this study.

The subjects were unanimous in indicating that word processing was both enjoyable and worthwhile for them. One or two subjects indicated that they still considered writing with pen and paper to be easier and faster, but they all agreed that they felt they would get better at word processing with

practice and that given the opportunity, they would like to do more (if not all) of their work, on the computer in future.

Advantages of word processing cited by the subjects included the following. They saw their work with word processing as (compared to writing with pen and paper):

- easy (and quick) to learn (Subjects A, C, D, E, F),
- easier to do (Subjects A, D, E, F),
- neater (all subjects),
- easier to change or make deletions (all subjects),
- enabling them to produce more work and of a better quality (Subjects A, D, E, F),
- making it easier to find/see errors and easier to read their work (all subjects),
- having made them more creative writers (Subjects A, D, E, F).

These advantages are comparable to those cited by Pennington (1990) (see Appendix 2). It is interesting to note that one subject (Subject E) found the keyboard easier to use than the pen! Not only did several of the subjects consider their writing to be better with word processing: they also indicated that they felt more confident about their writing and themselves as writers.

There were also a number of disadvantages to word processing that were cited by the subjects. These included:

- accidental loss of work (usually caused by accidental 'rebooting' of the computer),
- one subject (Subject B) said that he found it very hard to learn to use the computer (the software and commands),

- two subjects (Subjects B and C) thought that their pen and paper work was much better,
- the length of time required to find all the keys and learn the keyboard (one subject - Subject B),
- not seeing a full page on the screen at any one time (Subject D).

Some of these disadvantages have also been cited by Pennington (1990) (see Appendix 3). The interview responses do seem to indicate that the subjects all saw the act of revising as different (and usually easier) on the word processor when compared to pen and paper writing.

CHAPTER SIX

Discussion

This discussion chapter is divided into five main sections. The first four sections address the three sub-sections of the main research question and the subsidiary research question. The final section addresses the limitations of the study.

6.1 The Effect of Word Processing Software on the Primary ESL Writer's Revision Strategies

Since the present study has examined the effect(s) of word processing on the revising behaviours of subjects who have limited English proficiency (LEP), Johnson's (1986) claim that conventional pen and paper writing may actually discourage extensive revising with LEP children, needs to be addressed.

A number of interesting findings have emerged from this study. These have shown that the revising of primary ESL writers is a different process when using word processing instead of the more conventional pen and paper method. Although there was insufficient evidence to support Johnson's (1986) claim that conventional pen and paper composing actually discourages extensive revision, it is clear that word processing encouraged the subjects in this study to produce more (and more extensive) macrostructure revisions.

In most cases, the major focus of the subjects in their word processing condition was on macrostructure-level, meaningful changes (mostly additions) to the text. In this condition the subjects produced a significantly larger number of such changes (which tended to be much larger and more complex) when compared to changes made in the pen and paper condition.

In the pen and paper condition, subjects were predominantly interested in lower level non-meaningful revisions (formal or meaning-preserving changes). In the same condition, subjects produced more formal changes than any other type: mostly spelling, punctuation and capitalisation changes. There was no significant difference in the number of microstructure changes produced in the two conditions.

Considering the age and limited experience with English of the subjects in this study, it is possible that they found it difficult to focus on two levels of meaning at once (in their revising). Thus, they tended to focus more on the macrostructure level in the word processing condition and the formal and meaning-preserving levels in the pen and paper condition.

Unfortunately, the literature reviewed by the researcher has not considered this possibility. The data, however, do appear to support such an interpretation - which leads one to the conclusion that the word processing software has facilitated more extensive and complex revisions than were possible for these writers with pen and paper. It has achieved this by somehow causing a shift in the writers' focus from meaningful to non-meaningful revision. In essence, the subjects focussed more heavily on extensive meaningful revision in their word processing work and more heavily on surface editing in their pen and paper work.

For both conditions (word processing and pen and paper), the claim of Faigley and Witte (1984) and Heuring (1985) that revision is a *recursive process*, was supported. The results of the present study can add some new information here. For the subjects in this study, revisions made recursively (by going back and rereading/changing text) were predominantly non-meaningful changes (formal or meaning-preserving changes). Although some microstructure changes were made recursively, they were comparatively rare. The most extensive and complex meaningful revisions (macrostructure changes) were almost exclusively 'added on' at the end of the text. This is true for both word processing and pen and paper conditions.

Researchers such as Sudol (1985) and Daiute (1986) found that word processing involves a type of revision very different to that done with pen and paper. Sudol (1985) refers to this with his 'principle of addition'. Sudol found that his L1 adult college students revised very differently on the computer. Unlike their pen and paper counterparts, his word processing subjects tended to 'add first, delete last'. They would normally not start deleting or changing anything until they had gone through the process of making long and extensive additions (to the end of the text). Once they had added everything they wanted, a recursive process of rereading and searching for possible deletions and modifications began.

A possible explanation for the subjects in the present study producing much more extensive and comprehensive revisions (and more text) in the word processing condition, may be that Sudol's 'principle of addition' applied here also.

The findings of the present study, conflict with those of Hawisher (1987) who found that word processing produced fewer (and less comprehensive) revisions. A possible explanation for this may lie in the fact that Hawisher gives no indication of how she was able to record revisions made on the word processor.

One of the more difficult problems of analysing revisions performed on the word processor is that the researcher must rely on the subject to somehow 'mark' his or her revisions (for example, a line through a deleted word). With pen and paper this presents no difficulty, but unless the researcher instructs his or her subjects in similar strategies for the computer (for example, using the 'strikethrough' command on a word rather than actually deleting it), many revisions performed on the word processor will be lost. Unlike pen and paper composing, there will be no trace of a change having been made. If the researcher were to rely purely on observation or on computer printouts at the end of each writing session, a large number of revisions would be lost. Even if subjects are instructed in specific revision-marking strategies for the computer (as in the present study), there will be occasions where they forget to use them.

There is agreement between the findings of the present study, and those of Johnson (1986). Johnson's was the only study located that dealt specifically with primary ESL writers. Johnson found that her subjects who used word processing tended to write longer stories, edited more frequently, and revised more extensively than their pen and paper counterparts.

The subjects in the present study wrote longer texts and revised more extensively in the word processing condition. They did not perform such extensive revisions in the pen and paper condition. In the present study, however, subjects edited far more in the pen and paper condition. This is one area of disagreement between the findings of the present study and those of Johnson's. The subjects in the present study produced far more surface changes (instances of 'editing') in the pen and paper condition. This difference will be discussed further in Section 6.2.

To sum up, the use of word processing software influenced the revision strategies of the primary ESL writers in the present study, in the following ways:

1. facilitating much more extensive and complex revisions than were produced with pen and paper,
2. encouraging the writers to focus much more on 'text-base' (meaningful) changes at the macrostructure level (when compared to pen and paper writing),
3. significantly reducing the writers' otherwise predominant focus on formal and meaning-preserving revision types (both non-meaningful forms of revision) and,
4. causing the writers' revising to take the form of what Sudol (1985) refers to as the 'principle of addition': writers 'adding first, deleting last'. Throughout this process, the major emphasis was on *meaningful addition* to the text (rather than deletion or other alterations).

6.1.1 The theoretical models

The data collected support the composing process models of Flower and Hayes (see Figure 2.1) and Heuring (see Figure 2.2). The audio-taped 'protocols', anecdotal records and writing samples of the subjects indicate that the revising of these subjects has been part of what Heuring (1985) calls the 'reviewing component' of the composing process.

This process consists of the two sub-processes of *crystallising* and *evaluating*. The cognitive process of crystallising (which involves re-examining the text to stimulate further ideas) seems to be linked to the end-of-text macrostructure additions made by all subjects in both the word processing and pen and paper conditions: although more of these changes (and more extensive ones) were made in the word processing condition.

The sub-process of evaluating (which involves a writer examining what has been written in order to determine what changes or improvements are necessary), seems to be linked to the 'recursive' changes made by the subjects in both conditions.

For the subjects in this study, it is significant that based on the data collected, these two cognitive sub-processes of reviewing could be classified in terms of Faigley and Witte's taxonomy of revision changes. Crystallising (as a sub-process of reviewing), seems to result in *text-base* (or meaningful) changes to text. Evaluating seems to result in recursive *surface* (or non-meaningful) changes. This leads to the important conclusion that for the subjects in this study, revising on the computer was both *quantitatively* and *qualitatively* different. The quantitative differences have already been

addressed. The *qualitative difference* relates to the cognitive sub-process of reviewing that is operating when the writer is revising.

Although there is evidence of both crystallising and evaluating in both conditions with the subjects, it would appear that the sub-process of crystallising is facilitated more in the word processing condition. It can be concluded therefore, that the use of the word processing software as a revising 'tool', facilitates large-scale meaningful revision for these subjects (more so than the use of pen and paper), and that it does so by facilitating the cognitive process of 'crystallisation' in some way.

Flower et al's Cognitive Processes in Revision Model

The 'paradigm of revision' used in this study was that of Flower et al. (1986) and can be seen in Figure 3.2. It is important to realise that this model was originally intended to represent the cognitive processes involved in the revising of adult writers in their L1. Despite this, the model does seem to be an accurate reflection of what happened in the revising process of the subjects in this study. The one significant difference between this model and the revising of subjects in the present study, is the absence (in the model) of a 'translating' stage.

The Translating Process

Referring to Figure 3.1, 'translating' can be seen to be a sub-process of 'transcribing' (which is the process of encoding thought into writing). It is understandable that second language speakers should have an additional process here: that of 'translating' from L1 to L2 before 'translating' the

thought into the written word. The audio-taped protocols and anecdotal notes in the present study have provided some examples of Heuring's (1985) translating process in action.

These examples were usually either an utterance (recorded on tape) in the subject's L1 that was subsequently translated into the L2 verbally and/or in written form: or they involved a subject having an L1 discussion of the writing topic with another subject. Having done this, the subject would then 'translate' the content of that discussion into utterances in the L2 and/or part of his/her written work in the L2.

If, as Heuring (1985) suggests, translating is such an important and unique part of the L2 writer's composing process, it is possible that word processing (more than pen and paper writing) also facilitates this process in some way. This inference could be drawn from the few meaningful (topic-related) discussions in the subjects' L1s recorded (the researcher often used other subjects to translate their peers' L1 utterances) in the word processing condition, and from the fact that L1 exchanges in the pen and paper condition were predominantly spelling requests (see Appendix 7).

In summary then, the use of word processing software has affected the revising strategies of the subjects in this study, both qualitatively and quantitatively. It can be inferred from this, that there has been a corresponding effect on the cognitive processes associated with these strategies. The findings of the present study support Johnson's (1986) claim that the computer is a more powerful writing and revising tool (than the more conventional writing methods) for the ESL classroom.

6.2 The Effect of Word Processing Software on the Primary ESL Writer's Editing Strategies

The term 'editing' refers to all changes made to text that do *not* affect meaning. 'Formal' and 'meaning-preserving' changes are the two major 'editing' categories of revision.

Contrary to Johnson's (1986) findings, the subjects in the present study edited far more in the pen and paper condition. One possible explanation for this is that while Johnson's subjects all came from Spanish-speaking backgrounds (and thus used the Roman Alphabet), most of the subjects in the present study (four out of six) had L1s that use a non-Roman Alphabet writing system. Thus, it is possible that the subjects in the present study needed to do much more editing in the pen and paper condition because they lacked the appropriate letter-recognition and formation skills.

Since the majority of formal changes in the pen and paper condition were spelling changes, the data lend partial support to this interpretation. It is possible that this would not be such a large problem for subjects using the word processor as every letter is formed 'correctly' (and is more easily recognisable) by pressing the appropriate key on the computer keyboard. Further support is given to this interpretation by Subject A's interview. He gave the following reply when asked why he preferred word processing to conventional writing, "I don't like writing with pen....because too *messy*" (see Appendix 9 [*italics added*]).

The nature of the editing that occurred did not vary qualitatively between the two conditions. It did, however, vary in terms of quantity and proportion of different editing types. For both conditions, a number of formal and meaning-preserving changes were coded. In the pen and paper condition however, formal changes (mostly spelling changes) outnumbered all other changes made.

Due to the 'cross-over' design of the study, this 'pen and paper effect' (a much larger number of formal changes to text in the pen and paper condition - usually spelling changes), has been repeated. Figures 5.1 to 5.8 illustrate how noticeably (for both groups) the subjects' focus on surface changes diminishes as they make the transition from pen and paper to word processing (as this occurs, there is also an increase in the number and size of macrostructure revisions).

There seems to be a relationship between frequency of 'editing' (making surface changes) and frequency and size of 'text-base' (or meaningful) revisions. The more the writer is focussed on 'editing', the less he or she is able to focus on the making of more extensive meaningful revisions. At the same time, however, the frequency of editing has no significant impact on the occurrence of microstructure (sentence-level and below) meaningful changes.

Although this *pattern* is supported by the data (see Figures 5.1 to 5.8), the hypothesised *relationship* is not. As to whether the increase (or decrease) in frequency of one type of revision is more due to the writing 'mode' (word processing vs. pen and paper), the *interaction* of the different levels of revising (with their differing cognitive demands), or a *combination* of both factors, is a question that cannot be answered by the present study.

In both the word processing and pen and paper conditions, the editing performed was a mixture of 'normal' editing (that is, 'done on the spot') and 'recursive editing' (performed by rereading/looking back to previous parts of the text). For both conditions therefore, editing was (in some cases) recursive. This was seldom the case with meaningful revisions.

In the pen and paper condition, approximately 30% of editing was recursive, compared with approximately 40% in the word processing condition. Only approximate figures are possible here as the classification was largely based on the comparison of subjects' texts with their audio-taped 'protocols' and utterances for the related writing sessions. In many cases, an 'educated guess' was required to assess whether a formal or meaning-preserving change was made 'on the spot' or recursively.

To sum up the differences observed between editing in the word processing and pen and paper conditions, the following points are made:

1. word processing tends to significantly reduce the writer's focus on editing (surface-level revisions) and this decrease is accompanied by an increase in the number and size of extensive meaningful ('macrostructure') revisions,
2. conventional pen and paper writing seems to encourage the writer to focus significantly more on making surface changes to text,
3. Points 2 and 3 may also be influenced by whether or not the writer's L1 uses the Roman Alphabet in its written form),

4. in both conditions, editing consists of a mixture of 'on the spot' (WP = 60% , P&P = 70%) and 'recursive' (WP = 40%, P&P = 30%) surface changes. More recursive editing seems to occur in the word processing condition (Note: the percentages are approximate).

6.3 The Effect of Word Processing Software on the Primary ESL Writer's Attitudes Towards the Writing Process and Him/Herself as a Writer

Both the attitude surveys (see Appendix 1) and final interviews with the subjects (see Appendix 9) indicate that in a comparatively short period of time (10 weeks), most of the subjects in this study described an improvement in how they felt about themselves as writers. One subject who had just completed his 5 weeks of word processing commented that he felt, "very important in writing". Several subjects who had indicated that they saw themselves as 'bad writers' before commencing their 5 weeks of word processing, said (at the changeover) that they now saw themselves as 'good writers'.

Responses to the attitude survey indicate that word processing has made the subjects more confident in their abilities as writers, more prepared to experiment with language, and that most of the subjects were more satisfied with their word processed product: seeing this as better in terms of both quality and quantity.

Further questioning of the two subjects who felt their pen and paper work was superior to what they had produced on the computer, revealed that they felt a need for more time and practice on the computer. They both

expressed the belief that with more experience of word processing, they would be better writers and produce better work using the computer.

It is possible that many of the disadvantages of word processing identified by the subjects in this study (Section 5.3) would not have been identified as disadvantages at the conclusion of a study of longer duration.

In terms of the subjects' attitudes towards writing and themselves as writers, one final factor needs to be considered. Due to the short duration of the study, the 'novelty value' of the computer needs to be considered. Throughout the study, the subjects displayed an amazing amount of motivation, curiosity and excitement, when they worked on the computers: much more so than that displayed in the pen and paper condition. This 'placebo effect' would not last forever.

To what extent the novelty value of the computer needs to be discounted in considering the overall impact of word processing on the writers' attitudes towards themselves as writers and the writing process, is a question that this study is unable to address. Only a longer study (of perhaps 6 or 12 months' duration) would be able to answer this question.

6.4 How do Primary ESL Writer's React to the use of Word Processing Software/Computers and What Differences do They Perceive?

The subjects in this study all reacted positively to the use of word processing/computers in their writing. They found word processing motivational, interesting to learn, and satisfying. They all expressed an interest in learning more about the use of the computer:

although some believed they would require more time to master its use. One subject (Subject A), said that given the choice, he would prefer to do all his future written work on the computer!

The major differences perceived by the subjects themselves in using the computer were:

1. making changes (revising) was easier,
2. the work looked much neater and was easier to read,
3. mistakes were easier to detect and locate,
4. word processing enabled them to be more creative. Several subjects said that they felt it was easier to experiment with alternative wording, phrasing and sentence construction, than it was with pen and paper,
5. some of the subjects felt that word processing enabled them to produce better work in less time. There was at least one subject however, who felt that learning to use the word processor was difficult for him,
6. two subjects still felt that they did better work with pen and paper: although they felt this would change if they had more practice with the software,
7. one subject (Subject D) was uncomfortable with not being able to see a whole page of text on the screen at any one time. Collier (1983) found that some of his subjects made this same complaint.

Overall, the differences perceived by the subjects between word processing and pen and paper writing, show that four of the subjects preferred word processing and two preferred pen and paper. Of the differences that subjects saw as disadvantages of word processing, it is possible that all but one would not have been seen as significant problems in a study of longer duration. In Point 7, the complaint of subject D about not being able to see a whole page of text (in legible print - as opposed to a 'print preview' screen) at any one time, is a significant one. Although word processing software has come a long way since the 1980s, this is one disadvantage that has yet to be addressed by software developers.

6.5 Limitations of the Study

Due to the small sample size and selection of subjects from the same school and classroom setting, the researcher acknowledges the need to exercise caution in generalising to the wider student population.

It could be argued that whichever group was word processing at a given time, would have received more instruction in revision strategies and techniques than the pen and paper group, as they were (necessarily) taught word processing functions that were also revising functions. The researcher attempted to minimise this effect as much as was possible (by limiting the amount of word processing instruction given), but the very nature of word processing itself made it impossible to eradicate entirely. If the subjects had not been instructed in how to use the revision functions of the software, the study findings would have been of little practical value.

The analysis of think-aloud protocols needs to be mentioned here. The concern has been raised that the use of verbal protocols will either affect the, "...naturalness of a writing situation..." (Heuring, 1985, p. 8) or actually cause more revision to occur (Raimes, 1987). Although opinion is divided in some respects, the majority of research reviewed seems to consider that the benefits of utilising protocols far outweigh the disadvantages of any potential confounding influences (Raimes, 1985, 1987; Heuring, 1985; Swarts, et al., 1984; Selfe, 1985).

In the present study, the researcher did make use of protocol analysis. He was careful, however, to follow the advice of researchers such as Heuring (1985) and Raimes (1985, 1987) and avoided imposing any additional cognitive demands on the subjects. The subjects were asked to 'think aloud' while composing - but were not asked to explain or analyse their writing behaviours further.

The possibility still exists that the subjects' 'thinking aloud' may have (to some extent) influenced the quantity and type of revising behaviours exhibited (Raimes, 1985, 1987). Due to the design of the study however, any such influence should have similarly affected revision in both conditions, rather than selectively influencing revision in only one condition.

The writing task is also an important consideration. Hillocks (cited by Raimes, 1987) puts it this way, "...even extensive variations in the framing of topics - particularly in the specification of rhetorical situations result in significant differences in writing..." (p. 445). The writing tasks were 'standardised' in the present research. This will influence the generalisability of the findings.

The findings of the present study will allow for some generalisation to other ESL writers performing similar narrative writing tasks on the computer. It is possible however, that the effects of word processing on revising may vary considerably for different writing tasks. Because of this, caution should be exercised in attempting to generalise the findings of the present study to ESL writers performing 'any type of writing' on the computer. It is likely that some writing tasks will facilitate revision - while others will not.

Due to the design of the study, the possibility of a 'carry-over effect' should also be considered. Since the transition between word processing and pen and paper conditions was accompanied by a significant change (for all subjects) in number (and nature) of revisions for three of Faigley and Witte's four major revision types, it would seem that any 'carry-over effect' on the subjects' revising behaviours was negligible. Figures 5.1 to 5.8 appear to support this conclusion.

A final issue to be considered is the subjects' recording of revision changes. As mentioned previously (see data collection procedures), this method of recording revision changes may have added an element of unnaturalness or artificiality to the word processing condition. No viable alternative was available to the researcher, however, and it would have been inappropriate in a study of this nature to rely exclusively on researcher observation or anecdotal records.

In summary, a number of variables (in addition to the writing 'mode') had the potential to influence the revising behaviours of the subjects in this study. Where possible, these have been controlled for: where not, their potential influence has been recognised.

CHAPTER SEVEN

Conclusions

This study has addressed a number of issues. First and foremost, it has established that for the subjects selected, the revision process (and thus the composing process) was significantly different on the computer. A number of findings from this study are of relevance to the educator of primary school children who may be contemplating the use of computers in his/her writing lessons.

This study is of particular relevance to teachers of primary ESL students. It indicates that these children will derive a number of specific benefits from being taught to write/compose on the computer. Word processing will enable them to:

- write more,
- perform more extensive and complex revisions,
- focus more on *meaning* and less on surface features of the text,
- be more motivated and feel more positive about the writing process and themselves as writers,
- locate and edit errors more easily ,
- read and revise their own work more easily.

These are some of the advantages of word processing that were experienced by the subjects in this study. This is not to say that the quality of students' writing will instantly improve if they are all simply given access to computers and word processing software.

This research has intentionally avoided the issue of writing quality. It would require a much larger longitudinal study to even begin to establish the effects of word processing on 'writing quality': assuming a reliable and valid method can be developed for measuring what is, in itself, such an abstract concept.

This study has merely 'scratched the surface' of what is an extremely complex and largely unseen process: the writing process. It has focussed on one aspect of writing (revision) and on the effects of manipulating one feature of the writing environment (the writing 'mode'). For the results to be reliable, it was even necessary to limit the writing tasks to a single narrative genre. Variation of the writing task will often greatly influence the writing and revising that takes place.

It is not possible to say that the revising or composing performed on the computer (by the subjects in this study) was inherently *better*. This study has simply established that for these subjects, their revising (and thus composing) processes were different in the word processing condition, when compared with conventional pen and paper writing. However, there is no doubt that the computer enabled these subjects to revise more extensively and to write more. It would also seem that the computer offers certain advantages that the more conventional writing methods do not.

The question of whether word processing enables the primary ESL writer (or primary school children in general) to produce superior writing cannot be answered here. What is clear however is that, for the subjects in this study, the computer has been a more powerful and versatile composing and revising 'tool', than its more traditional alternatives.

The findings of this study have answered the research questions: but have also posed additional questions. There is a need for further research into the effects of word processing and computers on the composing processes of ESL writers. Inferences have been made in this study about the cognitive processes behind the observable writing behaviours - and these have been based on the analyses of a large amount of data. They are still *inferences*, however. For example, it is possible to say that an instance of editing in a text represents the cognitive process of 'crystallising', but it is *impossible* to 'prove' this conclusively. What can be done is to strengthen (or weaken) the case for such a relationship through the analysis of as much relevant data (and from a variety of sources) as possible.

Perhaps the most important issue here, is that any research that attempts to analyse the effects of word processing on an individual's writing, is really trying to analyse how the computer affects the way he or she is *thinking* (inferred from what he or she *does*). The writing process is much like an iceberg: the larger portion of it is always hidden from view, and it is on the basis of what we can *see*, that we attempt to draw conclusions. In light of this, there is a need for more research, utilising diverse methodologies and involving large samples, large amounts of data (from a variety of sources) and longer periods of time.

The findings of this study, however, are certainly in agreement with the following statement from Curtis, "...*writing is revising*, and the computer's function is to provide a tool for easy revision and a pleasurable motivation for its practice..." (1988, p. 342 [italics added]). There is no doubt that the computer and word processing software have served this function well for the subjects in this study.

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Appendix 1:

Attitude Survey

Name: _____

Date: _____

Attitude Survey:

Your answers to these questions are very important. They will help your teachers to learn more about you as writers - and how to help you better.

Make sure you put your name and date at the top of this sheet. Try to answer all of the questions. If you do not understand something, ask the teacher.

1. What things are difficult for you when you are writing?

2. What things are easy for you when you are writing?

3. How do you feel about writing?

4. Do you think that you are a good writer? Why?

5. How much help do you need when writing? Why?

6. When you are writing, what is more important to you - using good English or saying what you want to say?

**7. When you are writing, do you like to try different ways of saying things?
Why?**

**8. What is more important to you - how good your writing is or how much
you write? Why?**

9. Do you think you write more than your friends or less?

10. Describe how you feel when you have finished a piece of writing.

11. Do you have any special problems when you have to write in English?

12. Now you can write anything else you want to say about your writing.

Appendix 2:

Benefits Reported for Word Processing

Previous research indicates word processing benefits the student writer in three main areas:

- (1) Development of Ideas through Written Language**
 - more time spent on writing
 - longer compositions
 - increased experimentation with language
- (2) Revision behaviour**
 - facilitation of the revision process
 - increased number and types of revisions
 - more discourse-level revision
 - fewer surface errors
- (3) Affective/Social**
 - reduced writing apprehension and improved attitudes to writing
 - improved attitudes about English
 - greater objectivity about own writing
 - increased sense of competence and self-esteem
 - more collaboration among student writers

(Pennington, 1990, p. 84)

Appendix 3:

Negative Causal Factors Attested in Some Word Processing Research as Contributing to Lack of Positive Effects

- Premature completion of work
- Interactive effects that discourage the development of ideas
- Local rather than global revision
- Attention directed primarily to surface features
- Focus on structure at expense of content
- Premature publishing or overpublishing of work
- Preoccupation with physical appearance of paper
- Inhibited experimentation and planning
- Focus on quantity at the expense of quality
- Superficial synthesis rather than depth of analysis
- Ineffective writing process
- Isolation of student writers

(Pennington, 1990, p. 85)

Pennington (1985) notes that the negative factors listed above result from unfavorable psychological reactions to the properties of the medium (word processing) and/or unproductive use of its capabilities. Under certain conditions, the properties of the computer described in Appendix 2 as benefits for writers can have negative effects on students' writing.

Appendix 4:

Situational and Methodological Variables in Word Processing Research

- | | | |
|-----|------------------------|---|
| (a) | Subjects | (Individual differences) |
| (b) | Teachers | (Attitudes) |
| (c) | Setting | (Computer lab or classroom?) |
| (d) | Time-Span | (Short/long period?) |
| (e) | Training | (Amount, type, quality) |
| (f) | Instructional Format | (Word processing with process writing approach? Genre Interventionist Approach? Use of text analysing software?) |
| (g) | Software | ('User-friendly'?) |
| (h) | Effectiveness Measures | (The type of measure applied to assess the effectiveness of word processing needs to be appropriate to the treatment) |

(Pennington, 1990, p. 89)

Pennington (1985) lists these variables as potential causes of the conflicting findings in word processing research with L1 and L2 writers. Each of these factors, if not properly identified (and where appropriate, controlled) has the potential to bias the findings of any such research.

Appendix 5:

Faigley and Witte's Six Revising Operations

- Additions:** "...raise to the surface what can be inferred (*you pay two dollars => you pay a two dollar entrance fee*)".
- Deletions:** "...do the opposite so that a reader is forced to infer what had been explicit (*several rustic looking restaurants => several rustic restaurants*)".
- Substitutions:** "...trade words or longer units that represent the same concept (*out-of-the-way spots => out-of-the-way places*)".
- Permutations:** "...involve rearrangements or rearrangements with substitutions (*springtime means to most people => springtime, to most people, means*)".
- Distributions:** "...occur when material in one text segment is passed into more than one segment. A change where a writer revises what has been compressed into a single unit so that it falls into more than one unit is a distributional change (*I figured after walking so far the least it could do would be to provide a relaxing dinner since I was hungry. => I figured the least it owed me was a good meal. All that walking made me hungry*)".

Consolidations: "...do the opposite. Elements in two or more units are consolidated into one unit (*And there you find Hamilton's Pool. It has cool green water surrounded by 50-foot cliffs and lush vegetation.* => *And there you find Hamilton's Pool: cool green water surrounded by 50-foot cliffs and lush vegetation*). As the last example suggests, consolidations are the primary revision operation in sentence-combining exercises"

(Faigley & Witte, 1981, p. 403).

N.B. It is important to realise that these definitions of Faigley and Witte's six revision operations are only suitable for defining these operations when they are *meaning-preserving changes*. None of the previous research reviewed by this writer has made the distinction between these six operations as surface changes *or* text-base changes, explicit. Essentially, these definitions will remain the same for text-base changes, but with one important difference. There will (and must) be a change in the *meaning* of the text, at either the microstructure or macrostructure levels, for an addition, deletion, substitution, permutation, distribution, or consolidation, to be a *text-base change*.

Appendix 6:

Adaptation of Moffett's Schema

Levels of Cognitive Demand:			
Temporal Aspect:	Discourse Acts:	Informing Faculties:	Examples:
Level 1: What is happening	describing, recording	discourse organised by the senses	field notes, love notes, diary entries
Level 2: What happened (or will happen)	reporting, narrating (or planning)	discourse organised by memory (chronological thinking)	memoirs, news reports, summaries of field notes, plans
Level 3: What happens	generalising (using examples), explaining, analysing, classifying, advising from experience	discourse organised by analogical reasoning - the capacity to recognise a basis for excluding instances from and including instances within classes and categories; i.e., generalisations	history, scientific inquiry and explanation, literary analysis, prudential wisdom,
Level 4: What might happen, What should happen	arguing (using reasons), advising from theory, speculating, theorising, disputing	discourse organised by the formal logic of argument or by the "tautologic" that generates new theoretical frameworks yielding new perspectives and arguments	professional advice and speculation, literary theory, philosophical and scientific theories and proofs, legal argumentation

(Blau, 1983, p. 301)

Appendix 7:

Descriptions of Verbal Protocols from the 20 Word Processing and Pen and Paper Writing Sessions

(N.B. 'WP' = word processing, 'P&P' = pen and paper.)

Writing session:	Subject:	Writing mode:	Samples of Protocols Recorded:
4	B	WP	- Reading and rereading of text to self - alternatives 'tried', - discussion with subject C - content and truth of text discussed,
	C	WP	- reads portions of text and entire text to self - some alternative phrases 'tried',
	D	P&P	- 6 individual spelling requests made to the researcher - no meaningful discussion,
	E	P&P	- a large number of spelling requests to the researcher - one question related to the meaning of the text,
5	B	WP	- discussion of topic with subject C - several instances of reading text to self - and making meaningful changes to text,
	C	WP	- several sentences read/reread to self - some of these then modified, - subject asks subject B to read her work - short discussion follows,
	D	P&P	- a large number of spelling requests - to the researcher and other subjects - some of these in Vietnamese,
	E	P&P	- 7 or 8 spelling requests (to researcher), - asks when she can finish,
	F	P&P	- 5 spelling requests - discusses the meaning of one of these words,
6	C	WP	- subject asks for more ideas - to extend the topic further, - subject asks researcher for help on marking revisions in the text,
	E	P&P	- some reading of text to self,
7	B	WP	- subject reads/rereads text to self - frequent pauses followed by 'retrying' of individual phrases - some of these then changed in the text, - 1 or 2 spelling requests,

	C	WP	<ul style="list-style-type: none"> - subject reads entire text and portions to self - frequent pauses and 'retries' of individual sentences/phrases, - several requests to the researcher for synonyms and alternate ways to express her ideas,
8	A	WP	<ul style="list-style-type: none"> - subject discusses topic with researcher - asks for more ideas on how to express the differences between his country and Australia, - request for help - how to do a 'page preview' on the computer - wants to keep track of his progress (quantity of work produced)
	C	WP	<ul style="list-style-type: none"> - subject reads whole text and portions to self - 'retries' and changes several phrases, - discussion with subject B - on content and wording of text,
	F	PP	<ul style="list-style-type: none"> - subject briefly discusses her writing with subject E, - several spelling requests (in Vietnamese),
9	A	WP	<ul style="list-style-type: none"> - subject gets subject C to read his work - they read together and discuss, - on several occasions the subject gets other children to come to the computer to look at his work,
	B	WP	<ul style="list-style-type: none"> - subject asks the researcher several questions related to rephrasing/changing wording, - subject reads several passages to himself and changes the order/emphasis of several words and ideas in the text,
	D	PP	<ul style="list-style-type: none"> - subject makes several spelling requests to the researcher - makes one spelling request in Vietnamese to subject E,
10	B	WP	<ul style="list-style-type: none"> - One of the only instances of an actual 'think aloud protocol' - in Mandarin! (saying a Chinese phrase to himself and then translating it into English).

Appendix 8:

Anecdotal Notes: Samples

Key: 'Sp.r' = spelling request

'Q.r' = question to researcher

Date	Time	Subject	Comment
22.07.92	09:45		All 3 WP's - problems with mouse control - gave keyboard alternatives
	09:55	B	Some spelling protocols
27.07.92			WP - consistently MORE motivated - not 'pen and paper' kids though!
		C	spelling - 'girl' - instead of 'girl' (on WP) - computer made error more obvious - she corrected
			All 3 WP's needed constant reminding on editing rule - i.e. 'striketrough' - 'dont erase!'
			As in the 3 previous sessions - much less quantity from WPing group
31.07.92	13:12		Spelling requests - several from all 3 WP's
	13:15	E	- makes micro addition - "day"
05.08.92	09:35		Spelling requests - 'B' & 'C'
	09:38		Formatting problems - 'B' & 'C'
	09:39	B	- needed reminding on 'strikeout' for deletions
	09:44	B	- lost part of document - showed him how to retrieve - successful
	13:18	A	Accidental 'reboot' - work recovered
		E	Requests to use picture dictionary
	13:37	A	Formatting help requested (to justify, etc.)
12.08.92	09:30 - 9:45		Several formatting requests
	09:46	B	Ideas/context discussion
	09:47	E	Using picture dictionary
14.08.92		B	Reboots computer again - solved problem - he was accidentally hitting the 'reset' button
			Further conferencing needed for all subjects (on revising) - what to do - i.e. "change whatever you like...", etc.
19.08.92			Problems with topic - all needed more discussion
	09:30	C	Switched off PC - accidentally - r. helped get doc. back!
	09:35	B	Requests help - special formatting of heading/title
21.8.92			Changeover - busy! - need to rely on tapes for this one!
27.08.92	09:25	C	Conferencing MEANING - extra discussion
			Needed to revise WP - striketrough/arrow for insert, etc.
	09:34		Many spelling requests - both groups
27.08.92	11:02	C	Researcher conferences on changing MEANING - i.e. sentence wording, etc.
			!!! Quantity (WP) massive increase! compare to week 11

02.09.92	09:26	E	Formatting question
	09:29	C	Sp. r. 'country'
	09:30	E	Formatting problem - 'lost' half a page - shown 'home key'
	09:31	D	Sp. r. 'slippery slide' - and Q. "what is?", etc.
	09:40	B	Needed more ideas - r. talks through topic with him - "what were Chinese teachers like?", etc.
03.09.92	09:11	F	Needed help with "strickethrough" - needed reminding
		B	Sp. r. "little bit"
			Sp. r. "playground"
	09:49	E	Paragraphing Question (to subject F)
	10:00		Q. Consistently better behaviour of WP over 'pen and paper' group!
09.09.92	09:46	All subjects	Large number of spelling requests
	09:55	E	Q. r. How to save/close documents - r. assists
	10:10	E	Problem with lost text - due to several 'accidental' reboots - subject experimenting with computer
	10:20	B	Sp. & meaning r. (wording of phrases)
10.09.92	09:09	D	Sp. r. - 'Aunty'
16.09.92	09:30	C	Sp. r. - 'crazy'
		B	Sp. r. - 'some', 'people'
		E	Sp. r. - 'crazy'
	09:47	E	Problem - loses her document! (accidentally 'exits' without 'saving')

Appendix 9:

The Final Interviews: Extract From Interview With Subject A

Note: 'R' = researcher, 'S' = subject.

R. Tell me about using the computer and pen and paper?

S. Good.

R. Which one was good? You liked them both exactly the same?

S. Yes.

R. What things were easy for you when you used the computer?

S. Typing.

R. Was there anything that was more difficult in using the computer - compared to using pen and paper?

S. No.

R. Was there anything that surprised you in using the computer - that was different?

S. No.

R. If you were going to do lots of writing now (in school), which one would you like to use? Computer or pen and paper?

S. Computer.

R. Would you do any writing by hand at all?

S. No.

R. Why is that?

S. I don't like writing with pen.

R. What is it you don't like about writing with pen?

S. Because too messy.

R. How about computer - what do you like about the computer?

S. When you typing, the computer write the letter for you....and you don't have to work with your hand.

R. So how do you feel about using the computer? Does it make you feel more/less confident? Your writing is easier/harder?

S. Feel more confident - writing easier.

R. Would you like to do something like learn how to type later on? To help you use the computer?

S. Yes.

R. And would you like to use the computer in the future?

S. Yes.

R. Can you think of anything bad about using the computer? Anything that you don't like about it?

S. Make you lost some words.

R. When you lost your work? Like when you accidentally rebooted the computer?

S. Yes.

R. What things make using the computer better for you? Than using a pen and paper? What things make it better for you?

S. The keyboard - and the mouse.

R. Did you find it hard finding all the letters or not?

S. No.

R. Did it take you long to be able to find all the letters so you could type a story?

S. No. Maybe half an hour.

R. Is there anything else you can tell me about using the computer?

S. No.

R. How do you feel about writing now?

S. Good.

R. If you were going to use computers again - what would you like to do with them/use them for?

S. Play games.

R. Anything else?

S. Learn some typing.

R. Anything else?

S. Writing.

R. What sort of writing?

S. Big writing - like all big letters on the screen.

R. Is there anything else you would like to tell me about?

S. No.

R. Thank you

Appendix 10:

Samples of Written/Word Processed Work

Note: All revision changes have been coded according to the following coding key (refer also to Figure 4.2). In the following samples these abbreviations are inserted in brackets immediately after the revision - thus (Fs). The boundaries of microstructure changes have been marked with brackets thus - { }. Where several microstructure changes are also part of a macrostructure change, square brackets have been used to enclose all of the component parts that make up the macrostructure change - thus [].

It should also be reiterated that all subjects were given two writing sessions to complete each assigned writing task. Referring to the first two writing samples it will be seen that Subject D's sample 13 and 14 were both on writing task 2. Referring to Table 4.3 will enable the reader to see the five writing tasks (or topics) used throughout the research.

Revision Changes

Surface Changes

Formal Changes:	- Spelling	(Fs),
	- Tense, number and modality	(Ft),
	- Abbreviation	(Fa),
	- Punctuation	(Fp),
	- Format	(Ff),
	- Word combining	(Fw),
	- Capitalisation	(Fc).

Meaning-Preserving Changes:

- Additions	(Pa),
- Deletions	(Pd),
- Substitutions	(Ps),
- Permutations	(Pp),
- Distributions	(Pdi),
- Consolidations	(Pc).

Text-Base Changes

Microstructure

Changes:	- Additions	(ma),
	- Deletions	(md),
	- Substitutions	(ms),
	- Permutations	(mp),
	- Distributions	(mdi),
	- Consolidations	(mc).

Macrostructure

Changes:	- Additions	(Ma),
	- Deletions	(Md),
	- Substitutions	(Ms),
	- Permutations	(Mp),
	- Distributions	(Mdi)
	- Consolidations	(Mc).

Subject D: Word Processing Sample: Writing Session 13: Topic 2

When in VIETNAM first day I came to school I feel very happy and I have many friend. I said my friend played slippery slide with me. When bell going I and my friend played slippery slide. After played I go back to class my teacher teieh (Fs) ∇teach∇ I writting and teieh (Fs) ∇teach∇ I reading. After school I go home. I stay in school waat for my mum came and me go home. When I waat I played slippery slide with friend. When my mum came, my mum take me home .

When I came school {∇in MAYLAND∇} (ma) my mum take I and my brother came to school I feel I scared because when came in the class people talk english I don't understand but have teacher teich english {~~in the teich english~~} (md) {∇and∇} (Pa) some people don't know english like me. When bell go I not played any thing, after played I go back to class my teacher give me some work when lunch time I and my brother eating when finish eating I and my brother go. I take basketball in my class and played with my brother

Subject D: Word Processing Sample: Writing Session 14: Topic 2

(Ff) When in VIETNAM first day I came to school I feel very happy and I have many friend. I said my friend played slippery slide with me. When bell going I and my friend played slippery slide. After played I go back to class my teacher teich I writting and teich (Fs) I reading. After school I go home. I stay in school waat for my mum came and me go home. When I waat I played slippery slide with {my} (Pa) friend. When my mum came, my mum take me {go} (Pa) home.

When I came school in MAYLAND my mum take I and my brother came to school I feel I scared because when came in the class people talk english I don't understand but have teacher teich english {in the teich english} (ma) {~~VandV~~} (Pd) some people don't know english like me. When bell go I not played any thing, after played I go back to class my teacher give me some work when lunch time I and my brother eating when finish eating I and my brother go. I take basketball in my class and played with my brother [{and my friend.}] (ma) {After played I go back to class and do some ~~wokr~~ (Fs) work my teacher give to me, when finish I can I go to drink.} (ma) {After noon I go outside played monkeybar with my friend.} (ma) {After played I drink and came back to class my teacher give me some maths I do maths very fast and not wrong, when I ~~frin~~ (Fs) finish my teacher give me sticker and said I played computer, when they finish my teacher give me one more work and I do.} (ma) {After school my teacher give some work for home work.} (ma) {When I and my brother go out and I sow my mum and my take I and my brother go home.} (ma)] (Ma)

Subject D: Pen and Paper Sample: Writing Session 3: Topic 2

When I went to school I like because when I come school morning played competuer and when bell played I ran pfaster (Fs) borrow soccer ball and played soccer with my brother and my friengd (Fs) after played I whent (Fs) to Mrs xxxxxxxx I can singing. When finish singing I came back my class work. lunch time I eating after lunch my brother said I borrow soccer ball again I said class Mrs xxxxxxxx and my class eomention (Fs) competition (Fs) soccer my class winner after play eomebae (Fw) come back my class Mrs xxxxxxxx said I reading and Mrs xxxxxxxx give me some work. Afternoon I played monkey bar with my friengd (Fs) and drink after played come back my class I working finishh (Fs) Mrs xxxxxxxx said I can played eome (Fs) competuer. When tomorrow I went to school again but today I can't played competuer because my frieng ran to faster so I can't played when bell played I played soccer look like yesterday.

Subject D: Pen and Paper Sample: Writing Session 4: Topic 2

When I went to school I like because when I come sh (Fs) school morning {I} (Pa) played computer (Fs) and when bell played I ran faster borrow soccer ball and played soccer with my brother and my friend after played I went to Mrs xxxxxxxx I can singing. When finish singing I canme (Fs) back my class work. Lunch (Fc) time I eating after lunch my brother said I borrow soccer ball again I said class Mrs xxxxxxxx and my class competition soccer my class winner after play{ed} (Pt) {I} (Pa) come back my class, (Fp) Mrs xxxxxxxx {said I reading and Mrs xxxxxxxx} (md) give me some work. Afternoon I played monkey bar with my frieng (Fs) and din (Fs) drink after played {I} (Pa) come back my class {I} (Pd) working, (Fp) finish Mrs xxxxxxxx said I can played computer (Fs). When tomorrow I went to school again but today I can't played computer (Fs) because my friend (Fs) ran to faster so I {can't played when bell played I} (md) played soccer look {to} (Pd) like yesterday. [{After played I come back my class Mrs xxxxxxxx (Fs) xxxxxxxx give me some work w (Fs) very hark my said hard too.} (ma) {Lunch time I sitting with my frier (Fs) friend, my friend name N (Fs) Nu (Fs) Ngueyn He very {he} (Pd) {he} (Pd) funny He sit with me I lough but keeps funny.} (ma) After lunch I ran faster borrow soccer ball and played} (ma)] (Ma)

Subject E: Word Processing Sample: Writing Session 19: Topic 5

Write about you been in Australia

When I been in Australia I go with my mother ,I m {not-have} (ms) not go with my ~~gnd~~ (Fs) grandmother, grandfather ,because they died,and then I and my mother go to Australia, Im not have any uncle. I have two uncle one uncle is died one uncle is been in Australia and I come to Australa the weather is , sometime is very hot ,sometime very cold and the food is different and the clothesand the School is different in my country and when I been in Australia ~~fist~~ (Fs) ~~fist~~ (Fs) first I Airport and I saw my auty ,uncle and little sister and my uncle ~~friden~~ (Fs) friend and my mum saw my uncle and she cry because long time my mum cant see my uncle then my uncle, my auty sister and my uncle friend all go home {and} (Pd).Tomorrow I and my auty sist er my mother to all went to shop and go to Enlish shop and buy clothes for me and my mum and my sister so hungry and me hungry to and my auty buy for me and my sister small chip and sausage and then my mum hungry to and my auty {net} (Pd) not hungry to and all -aet (Fs) eat chip and sausage then finish go to shop buy clothes my auty buy for me shirt, and jacket,jumper and shoes come to School . In Australia is many insects is had {many} (md) a butterfly, circket, caterpillar, bee ,mosquito and {we-have} (md) in Australia Im scared Octopus the ainmal lived in under water I scared of shark , crocodile,the mammals Im scared of echidna bear tiger lion fox and

Subject E: Word Processing Sample: Writing Session 20: Topic 5

Write about you been in Australia

When I been in Australia I go with my mother ,I m ~~not have~~ not go with my ~~grand~~ grandmother, grandfather ,because they died,and then I and my mother go to Australia, Im not have any uncle. I have two uncle one uncle is died one uncle is been in Australia and I come to Australa the weather is , sometime is very hot ,sometime very cold and the food is different and the clothesand the School is different in my country and when I been in Australia ~~fist~~ ~~fist~~ first I Airport and I saw my auty ,uncle and little sister and my uncle ~~friebn~~ friend and my mum saw my uncle and she cry because long time my mum cant see my uncle then my uncle, my auty sister and my uncle friend all go home ~~and~~ .Tomorrow I and my auty sist er my mother to all went to shop and go to Enlish shop and buy clothes for me and my mum and my sister so hungry and me hungry to and my auty buy for me and my sister small chip and sausage and then my mum hungry to and my auty ~~not~~ not hungry to and all ~~aet~~ eat chip and sausage then finish go to shop buy clothes my auty buy for me shirt, and jacket,jumper and shoes come to School . In Australia is many insects is had ~~many~~ a butterfly, circket, caterpillar, bee ,mosquito and ~~we have~~ in Australia Im scared Octopus the ainmal lived in under water I scared of shark , crocodile,the mammals Im scared of echidna bear tiger lion fox and [{my auty said time to go home now and then me and my mum my aunty sister all go home and then my aunty talk out every thing get ready go to my friend house now and my aunty ride the car go to friend house and stand there watched T.V and Video {~~they took~~} (md) Hong KONG—Konf (Fs) Kong and they took Vietnamese and my mum aunty me sister all went home {~~and~~} (Pd) at Five o clock and then my auty cooking spaghetti and I eat is yum,yum.} (ma) {and then my sister and I play a game and watvhed T.V and Video and my uncle go to work and my auty in the kitchen is ~~bunsty~~ (Fs) busy and my mum help my aunty ,I said I help auty my mum said no thank you play with sister my sister name is Van,Anh {~~she have~~} (md) .} (ma) {When I come to Australia she have three year old and I come to School I year five and my School name Wa {VrwichV} (Pa) and my School not far away to my auty house and first day I come to {Schh} (Fs) School Im very scared because I thing to hard for me and my teacher change I to another class and my teather name is Mrs Smith and first day I come to her class and first she not hard and after she very hard and then me go home we need the bus to

go home and {my} (Ps) the bus number sometime I go number one
 sometime number two and every weekend *I go with my aunty and my
 mum my sister and I went to FACTORY and stand my mum and aunty
 they help us I and my sister if I not play with her , her cry and I play with
 her and my mum said I help she and my aunty and my mum sister went
 home at 10.30 sometime go home late some time not late} (ma)] (Ma).

Subject E: Pen and Paper Sample: Writing Session 9: Topic 5

In Vietnam the house is different and Weather is different (Fs) {and} (Pd)
 My mother said the weather is very cold. In Vietnam I took the language is
 Vietnam and then I have a {aunty} (Pp) brother, sister, aunty, gran uncle all
 live together.

When I come australia I saw my aunty, uncle sister wait for my mum and I
 been in australia I have one year and I come to Warwick school first and then
 I come to Highgate school and I year six.
 I took English is not too much and I been in australia I saw the food is
 different in vietnam.

Subject E: Pen and Paper Sample: Writing Session 10: Topic 5

(Ff) I wan't to live with my aunty uncle sister because I like it. My sister
 name is Van Anh and she very goode (Fs) gud (Fs). My I (Ps) aunty uncle
 sister and my mum I all live together and very happy.
 In vietnam the house is different and school, food, sport (Fs) at
 vietnam (Fs) I come school (Fs) at afternoon at 12.00 o'clock I'm not
 bring lunch beco (Fs) because (Fs) I eat all ready at home and 4.30 o'clock
 go home and on monday we have assembly and go to school at (Ps) on
 monday Tuesday Wednesday not Thursday Friday and go on saturday. My
 school name is An cu 1 and an cu 2 I go 2 school it. The house be (Fs) I
 (Fs) beatif (Fs) beautiful and the food it very good too
