CHAPTER FOUR

FINDINGS OF THE STUDY

Introduction

This chapter presents findings of the study, which seeks to find out whether the word processor has any discernible influence on the writing behaviour of the subject and the quality of texts produced. To determine whether the word processor affects the subject’s writing behaviour, her composing strategies and habits associated with the pen-and-paper and the word processor were coded, analysed and then compared for differences. Essays written with the pen-and-paper and those written with the word processor were analysed and compared for differences in text productivity (writing output), text complexity (syntactic complexity) and text precision (grammatical and mechanical accuracy). These essays were further evaluated, based on a 5-point holistic scale, by the researcher and two independent raters (see Chapter Three, p. 23).

The analyses of writing behaviours and written products are then integrated with findings from the follow-up interviews and post-writing questionnaires to answer the following research questions:

1. Does the use of the word processor affect the writing behaviour of the subject?

2. Are there differences in the essays written with the pen-and-paper to those written with the word processor in terms of text productivity, text complexity and text precision?

3. Does the use of the word processor affect the holistic ratings of the written products?
The results and their analyses will be presented in three sections. The first section attempts to answer Research Question One: *Does the use of the word processor affect the writing behaviour of the subject?* This section analyses the writing behaviours of the subject when writing with the pen-and-paper and the word processor. This is done so that comparisons can be made between the writing behaviours associated with the pen-and-paper and those associated with the word processor.

The second section of this chapter is devoted to findings from the text analyses on products written with the pen-and-paper and those written with the word processor. It attempts to answer Research Question Two: *Are there differences in the essays written with the conventional pen-and-paper to those written with the word processor in terms of text productivity, text complexity and text precision?* In this section, the analyses of essays written with the pen-and-paper and those written with the word processor would be compared for differences.

The third section of this chapter compares the holistic evaluations of essays written with the pen-and-paper and essays written with the word processor. The essays have been rated according to a 5-point holistic scale (Snyder, 1990) by the researcher and two independent raters. This section attempts to answer Research Question Three: *Does the use of the word processor for writing affect the holistic ratings of the written products?*

Finally, findings from the holistic evaluation would be integrated with findings from the analyses on text productivity, text complexity, and text precision to determine whether the word processor has any influence on the overall quality of the written products.
Research Question 1: Does the use of the word processor affect the writing behaviour of the subject?

The first research question above will be discussed with reference to the analyses of the subject’s writing behaviours in the pen-and-paper writing sessions and the word processing sessions. These analyses are derived from the coded writing behaviour charts (see Appendix F1, F2 & F3).

Data on the writing process was gathered through direct observations of the writing behaviours of the subject (see Chapter Three, p. 22). The composing activities were coded and then presented in the form of coded writing behaviour charts (Appendix F1, F2 & F3). From these charts the following information was gathered and used for analysis of the subject’s writing behaviour:

1. The amount of time spent on the following:
   1.1 Prewriting, that is, observable planning acts such as outlining and list making, before starting to write.
   1.2 Composing activities such as pausing (P) when the writer is engaged in reflecting or cognitive thinking, actual writing (W), editing (E) and reading segments of written texts (R).

2 The frequencies of occurrence of the following composing activities:
   2.1. Pausing when the writer is engaged in reflection, cognitive thinking or reviewing (P)
   2.2. Pausing to check spelling and grammar (Pd)
   2.3. Reading segments of written text (R)
   2.4. Referring to the outline/topic (Ro)
   2.5. Editing or physically making changes in the text (E), and
   2.6. Reading the entire text (Rw)
The analysis of the subject’s writing behaviour in the pen-and-paper writing sessions are compared with the corresponding writing behaviour in the word processing sessions so that differences in composing strategies and habits can be identified. These comparative analyses are presented in the tables below.

Table 1 compares the amount of time spent on the various composing activities when the subject wrote Text 1A(PP) with the pen-and-paper and Text 1B(WP) with the word processor. The figures are derived from the coded writing behaviour charts in the production of these essays (see Appendix F1).

<table>
<thead>
<tr>
<th>Composing operations</th>
<th>Text 1A(PP) Pen-and-Paper</th>
<th>Text 1B(WP) Word Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(time in minutes) (%)</td>
<td>(time in minutes) (%)</td>
</tr>
<tr>
<td>Prewriting</td>
<td>5.6 (15)</td>
<td>1.1 (2)</td>
</tr>
<tr>
<td>Actual Writing (W)</td>
<td>11.6 (31)</td>
<td>14.5 (33)</td>
</tr>
<tr>
<td>Editing (E)</td>
<td>2.5 (7)</td>
<td>8.6 (19)</td>
</tr>
<tr>
<td>Pausing (P)</td>
<td>4.3 (11)</td>
<td>6.3 (14)</td>
</tr>
<tr>
<td>Reading segments of text (R)</td>
<td>3.2 (9)</td>
<td>5.7 (13)</td>
</tr>
<tr>
<td>Other composing activities*</td>
<td>10.1 (27)</td>
<td>8.3 (19)</td>
</tr>
<tr>
<td>Total writing time</td>
<td>37.3 (100%)</td>
<td>44.5 (100%)</td>
</tr>
<tr>
<td>Total words written</td>
<td>255</td>
<td>335</td>
</tr>
</tbody>
</table>

* Other composing activities include pausing to check spelling and grammar (Pd), referring to the outline (Ro) and reading the entire texts (Rw) (see Coding System, Chapter 3, p. 18).

With reference to Table 1 above, the most obvious difference between the pen-and-paper writing session and the word processing session is the total amount of time taken for the entire writing process. The amount of time taken to write Text 1A(PP) using the pen-and-paper is approximately 37.3 minutes while the total amount of time
spent on writing Text 1B(WP) with the word processor is approximately 44.5 minutes. As a result, Text 1B(WP) is 80 words longer than Text 1A(PP).

Another notable difference between the two writing sessions is the amount of time spent on prewriting activities before script was produced. This refers to observable planning activities such as outlining and list making before beginning to write. Approximately 5.6 minutes or 15% of the total writing time was spent on prewriting activities in the pen-and-paper writing process but only 1 minute or 2% of the corresponding time was recorded in the word processing session. The difference of 13% spent on prewriting is reflective of the different approach to writing with different tools. It indicates that the subject spent a lot of time planning before writing the essay with the pen-and-paper but did not do the same for the word processing session.

The proportions of time spent on actual writing (W) and editing (E) in the two writing sessions also differ. Approximately 33% of the total time was spent on actual writing with the word processor compared to 31% with the pen-and-paper. Although the difference of 2% is small, the number of words produced with the word processor is substantially more, indicating that the speed of text production with the word processor is higher than that of the pen-and-paper. However, a more profound difference lies in the relative percentage of time spent on editing with the word processor, which is 12% more than the corresponding time in the pen-and-paper writing session. This means that more revising and editing have occurred during the word processing session.

The absence of prewriting activities appeared to be compensated by the higher proportion of time spent on pausing (P) when the subject was engaged in reflection, cognitive thinking or reviewing throughout the word processing session. The subject
spent 14% of the total writing time engaged in pausing to think and plan in the word processing session, compared to 11% in the pen-and-paper writing session. This means that the subject spent more time reflecting and thinking when writing with the word processor than when writing with the pen-and-paper.

Reading over segments of text (R) appeared to be an important activity in the word processing session. This backward movement recurred more often in the word processing session, accounting for 13% of the total time spent on the entire writing process. In contrast, she spent only 9% of the total writing time reading over segments of texts during the pen-and-paper writing session.

Table 2

Proportion of time spent on composing activities for Text 2A(WP) and Text 2B(PP)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(time in minutes) (%)</td>
<td>(time in minutes) (%)</td>
<td></td>
</tr>
<tr>
<td>Prewriting</td>
<td>2.0 (4)</td>
<td>6.8 (17)</td>
</tr>
<tr>
<td>Actual Writing (W)</td>
<td>14.3 (33)</td>
<td>10.9 (29)</td>
</tr>
<tr>
<td>Editing (E)</td>
<td>6.6 (15)</td>
<td>4.5 (12)</td>
</tr>
<tr>
<td>Pausing (P)</td>
<td>7.0 (16)</td>
<td>3.8 (10)</td>
</tr>
<tr>
<td>Reading segments of text (R)</td>
<td>5.6 (13)</td>
<td>3.5 (9)</td>
</tr>
<tr>
<td>Other composing activities*</td>
<td>8.3 (19)</td>
<td>8.7 (23)</td>
</tr>
<tr>
<td>Total writing time</td>
<td>43.8 (100%)</td>
<td>38.2 (100%)</td>
</tr>
<tr>
<td>Total words written</td>
<td>330</td>
<td>239</td>
</tr>
</tbody>
</table>

* Other composing activities include pausing to check spelling and grammar (Pd), referring to the outline (Ro) and reading the entire texts (Rw) (see Coding System, Chapter 3, p. 18)

Table 2 above, compares the amount of time spent on the various composing activities when the subject wrote Text 2A(WP) with the word processor and Text 2B(PP) with the pen-and-paper (see Appendix F2).
With reference to Table 2, the amount of time spent on the entire writing process in the word processing session is 5.6 minutes more than the corresponding time in the pen-and-paper writing session, a finding that is similar to Table 1 above. Another similarity is that, Text 2A written with the word processor is longer than Text 2B written with the pen-and-paper, by 91 words. The proportion of time spent for planning before beginning to write is only 4% in the word processing session compared to 17% in the pen-and-paper writing session. This is a substantial difference of 13%, indicating that planning before writing is an important strategy used in the pen-and-paper writing session.

The proportions of time spent on actual writing (W) between the pen-and-paper and the word processing session also differ. Approximately 14.3 minutes or 33% of the total writing time was spent on actual writing with the word processor compared to only 10.9 minutes or 29% in the pen-and-paper writing session. Editing (E) or making changes in the texts during the word processing session is 3% more than the corresponding time in the pen-and-paper writing session. Again, this finding is similar to what was found regarding this activity in Table 1 above.

Differences in the proportions of time spent on pausing (P) when the subject was engaged in reflecting or thinking can also be identified from Table 2 above. Time spent on pausing for reflection during the word processing session is 6% higher than that in the pen-and-paper writing session. More time was also spent on reading over segments of texts (R) in the word processing session. When writing Text 2A(WP) with the word processor, the subject spent approximately 5.6 minutes or 13% of the total writing time reading over segments of written texts, which recurred in a cyclical manner throughout the writing process (see Appendix F2). In contrast, the subject
only spent 3.5 minutes or 9% of the total writing time engaged in reading over segments of written text during the pen-and-paper writing session, a difference of 4%.

Table 3, which compares the amount of time spent on the various composing activities when the subject wrote Text 3A(WP) with the pen-and-paper and Text 3B(PP) with the word processor, is derived from the coded writing behaviour charts for these texts (see Appendix F3).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(time in minutes) (%)</td>
<td>(time in minutes) (%)</td>
</tr>
<tr>
<td>Prewriting</td>
<td>3.0 (6)</td>
<td>8.5 (19)</td>
</tr>
<tr>
<td>Actual Writing (W)</td>
<td>16.0 (32)</td>
<td>12.2 (27)</td>
</tr>
<tr>
<td>Editing (E)</td>
<td>6.1 (12)</td>
<td>5.0 (11)</td>
</tr>
<tr>
<td>Pausing (P)</td>
<td>6.7 (13)</td>
<td>4.1 (9)</td>
</tr>
<tr>
<td>Reading segments of text (R)</td>
<td>6.5 (13)</td>
<td>4.8 (11)</td>
</tr>
<tr>
<td>Other composing activities*</td>
<td>11.8 (24)</td>
<td>10.8 (23)</td>
</tr>
<tr>
<td>Total writing time</td>
<td>50.1 (100%)</td>
<td>45.4 (100%)</td>
</tr>
<tr>
<td>Total words written</td>
<td>368</td>
<td>269</td>
</tr>
</tbody>
</table>

* Other composing activities include pausing to check spelling and grammar (Pd), referring to the outline (Ro) and reading the entire texts (Rw) (see Coding System, Chapter 3, p. 18.)

From the table, it is again clear that the total time taken for the entire writing process of Text 3A(WP) with the word processor is more than the total time taken to write Text 3B(PP) with the pen-and-paper. The subject spent nearly 5 minutes more time in the word processing session to produce a longer essay.

Another composing activity, which stands out in Tables 1 and 2 above and which recurs in Table 3 is the prewriting activity. In the pen-and-paper writing session shown in Table 3, prewriting activities made up a major proportion of the
writing process. Prewriting activities constitute 19% of the total time taken in the pen-and-paper writing session but the relative percentage of time spent on prewriting in the word processing session is only 6%, a difference of 13%. This indicates that substantially more planning was done before writing with the pen-and-paper. The subject spent 5% more time engaged in actual writing (W) during the word processing session, a feature consistent with the findings in Tables 1 and 2 above. However, the difference of 1% spent on editing (E) between the two writing sessions in Table 3 is negligible compared to the corresponding difference of 12% in Table 1 above. The proportion of time spent on pausing (P) during the word processing session is 4% more than the corresponding time in the pen-and-paper writing session, another finding that is similar to those in Tables 1 and 2. The proportion of time spent on reading (R) over segments of written texts in the word processing session (13%) is also more than that in the pen-and-paper writing session (11%). Although the difference is only 2%, the higher proportion of time spent on this activity appears to be consistent with the two previous word processing sessions, Texts 1B(WP) and Text 2A(WP).

Generally, a certain pattern of adaptation to writing with the word processor can be seen in all the three sets of data presented in the tables above. From the analyses, several writing strategies and habits of composing with the word processor, which differed from the pen-and-paper writing sessions, were found to be consistent across all the three word processing sessions (see Tables 1, 2 and 3 above). All these differences were found to be directly associated with the word processor.

Firstly, pre-planning or prewriting activities appeared to be consistently short in all the word processing sessions. This makes writing with the word processor appear rather ad hoc compared to the plan-write-revise strategy used in all the pen-and-paper
writing sessions. However, the high percentage of time spent on pausing when the subject was engaged in reflecting, reviewing and thinking throughout the word processing sessions compensated for the lack of initial planning or outlining before beginning to write.

The second outstanding difference between the pen-and-paper writing session and the word processing session was the substantially higher percentage of time spent on editing or making changes in the texts when the subject wrote with the word processor. This feature was most prominent in the word processing session of Text 1B(WP) shown in Table 1. The vast difference in the proportions of time spent on editing between the pen-and-paper writing session and the word processing session indicate that the subject revised more when writing with the word processor. It may also indicate that the subject experimented more with words and ideas when writing with the word processor. While editing and reading over segments of written texts appeared to be frequently recurring activities in all the word processing sessions, what stood out most in the pen-and-paper writing sessions was the high frequency of referring to the prewriting outline or plan. From investigations into the proportions of time spent on various composing activities, a conclusion that can be drawn is that the composing style in the word processing sessions is different from the composing style in the pen-and-paper writing sessions.

Tables 4, 5 and 6 below compare the frequency counts of the various composing activities involved in the writing processes. These tables are derived from the carefully coded writing behaviour charts (see Appendices F1, F2 and F3). Table 4 compares the frequency counts of various composing activities when the subject wrote Text 1A(PP) with the pen-and-paper and Text 1B(WP) with the word processor (Appendix F1).
Table 4

Frequency counts of composing activities for Text 1A(PP) and Text 1B(WP)

<table>
<thead>
<tr>
<th>Composing operations</th>
<th>Text 1A Pen-and-Paper</th>
<th>Text 1B Word Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>(frequency counts)</td>
<td>(frequency counts)</td>
<td></td>
</tr>
<tr>
<td>Editing/making changes (E)</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Pausing /reflecting/thinking (P)</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Reading segments of texts (R)</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Pausing to check grammar/spelling (Pd)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Referring to outline (Ro)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Reading entire texts (Rw)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

In terms of frequency counts, it is clear from Table 4 that there is more frequent editing (E) during the word processing session compared to the pen-and-paper writing session. When using the word processor, the subject made 7 changes in the text compared to 3 in the pen-and-paper writing session. Also, there is a significant difference in the frequency of pauses (P) between the pen-and-paper writing session and the word processing session. The subject paused more often in the word processing session, that is, 4 counts more than the pen-and-paper writing session. Another outstanding feature of the word processing session is that the subject read over segments of texts (R) much more frequently than she did when writing with the pen-and-paper. During the pen-and-paper writing process, she made 3 references to the outline (Ro) drawn up earlier. However, there was no written outline in the word processing session. While 2 references were made to the dictionary for the purpose of checking spelling during the pen-and-paper writing session, only 1 attempt was made to the spelling and grammar check function in the word processing session.

Table 5 below shows a comparison of the frequency counts of the various composing activities during the writing processes of Text 2A(WP) and Text 2B(PP).
Table 5

Frequency counts of composing activities for Text 2A(WP) and Text 2B(PP)

<table>
<thead>
<tr>
<th>Composing operations</th>
<th>Text 2A Word Processor</th>
<th>Text 2B Pen-and-Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editing/making changes (E)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pausing /reflecting/thinking (P)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Reading segments of texts (R)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Pausing to check grammar/spelling (Pd)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Referring to outline (Ro)</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Reading entire texts (Rw)</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

From Table 5 above, it is again clear that the frequency counts of editing (E), pausing (P) and reading over segments of written texts (R) are higher in the word processing session than in the pen-and-paper writing session. However, in the pen-and-paper writing session, the high frequency of referring to the outline (Ro) stands out among the other activities. The subject made 5 references to the outline but again, this activity was absent from the word processing session.

Table 6 below shows the frequency counts of the various composing activities during the writing processes of Text 3A(WP) and 3B(PP).

Table 6

Frequency counts of composing activities for Text 3A(WP) and Text 3B(PP)

<table>
<thead>
<tr>
<th>Composing operations</th>
<th>Text 3A Word Processor</th>
<th>Text 3B Pen-and-Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editing/making changes (E)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Pausing /reflecting/thinking (P)</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Reading segments of texts (R)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pausing to check grammar/spelling (Pd)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Referring to outline (Ro)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Reading entire texts (Rw)</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
In Table 6 above, the frequency counts of editing (E), pausing for reflection (P) and reading over segments of written texts (R) are slightly higher in the word processing session than in the pen-and-paper writing session. This trend was also noted in Tables 4 and 5 above. However, the difference in the frequency counts of editing (E) and pausing for reflection (P) between the word processing session and the pen-and-paper writing session in Table 6 is not as profound compared to the corresponding differences in Table 4 and 5. Table 6 also shows a high frequency of references to the outline (Ro) in the pen-and-paper writing session. This finding is similar to that of the two previous pen-and-paper writing sessions, Text 1A(PP), 2B(PP) and 3B(PP).

The analyses above have identified some consistent differences in writing behaviour between the pen-and-paper writing sessions and the word processing sessions. A different pattern of composing had emerged when the word processor was used, indicating that the word processor had been a primary influence on the writing behaviour of the subject. The portrait of the writer given below, illustrates the different patterns of composing with different tools. These descriptions are based on the researcher’s field notes made during observations of one of the writing sessions, Week 4 (refer to Figure 1, pp. 22).

Portrait of the Writer

The Computer-Writing Episode

Mei Ann (the subject in the present case study) looked eager to start writing with the computer. This was the second week of the study and unlike the previous week, she knew what to expect this time around. Seated at the computer, she quickly reached out for the booklet with the words Writing Task 2A on the front cover.
Flipping over the cover, she glanced through the "Instructions for Writing" and proceeded to read the essay topic on the following page, which read: "Women make better teachers than men". Do you agree?

Her eye movements showed that she read the topic twice before pausing for about two minutes when she started to key-in the first few sentences, with a speed and fluency which appeared as though the thought came, all in one flash:

I strongly disagree with the statement that "women make better teachers than men". I have both men teachers and women teachers who are hardworking.

Men teachers and women teachers have their own ways of teaching in class. For example, a woman teacher usually teaches her students in a gentle way but men teachers are usually sterner. However, sometimes, it is the other way round.

I watched from the side, a comfortable distance away, as she typed away at the keyboard. She made no written notes before starting to type. Eyes shifting from the monitor to the keyboard and back, she typed quite fluently, rarely stopping to hunt for a key and using two, three or four fingers. She continued typing for the next one and a half minute or so before pausing to read what was on the screen. Then, pointing the cursor at the end of the first sentence, she inserted the sentence: "It is unfair to the men teachers". Following that, she moved the cursor over part of a sentence, highlighted the word 'teaches' and clicked at the 'cut' icon. She substituted the word with 'approach'. After that she rephrased the sentence: "For example, a women teacher usually approach her students in a gentle way". A red wavy underline appeared on the word "gentle" and it caught her attention. She instantly moved the
cursor to the word, right-clicked at it and from the pop-up window, glanced through the list of suggested words that appeared and after making her choice, clicked at the word, "gentle". Immediately, the word replaced the earlier word "gentel" and the wavy underlines disappeared. Then, she continued with the sentence, "... but men teachers tend to approach their students in a stern way". After a short pause, she decided to delete the whole sentence and inserted new text, which read: "For example, a woman teacher usually approach her students in a gentle way but men teachers are usually sterner". Immediately after that, she was engaged in writing again for the whole of the next minute or so. Starting a new paragraph, she wrote: "My science teacher is a very gentle lady." I cannot help noticing an important point. This time around, she did not spell the word "gentle" as "gentel" which she did previously. That she had learnt the correct spelling of the word "gentle" from the spelling and grammar check was certainly something worthy of note.

This was followed by a short pause and her eye movements showed that she read over what she had written, and in the process, fixed errors as soon as she spotted the red or green wavy underlines made by the error prompter. This same behaviour occurred again at various points throughout the rest of the writing process. She frequently backtracked and paused to reflect before moving on to write down some more ideas. The rest of the writing process was somewhat similar, with frequent pauses for reflecting, reading over parts of written texts, scrolling up and down to review sections of paragraphs, deleting and substituting words and an occasional shifting of sentences from one paragraph to another. Finally, she concluded the essay by typing in one sentence: "Therefore, I disagree with the statement that "women make better teachers than men". At the fortieth minute, she highlighted the entire text and then clicked on "Tools" to check spelling and grammar. After reading the entire
text, she "saved" her work and finally printed out the 330-word long essay, at the forty-third minute. Looking pleased with her work, she handed in the printed copy of the essay.

In her response to the post-writing questionnaire, Mei Ann explained that she preferred to compose directly on the computer because when typing, she could look at the keys or the screen and think at the same time. All the planning was done mentally on the spot, as and when necessary. She preferred to revise on the screen rather than on hard copies because she could fix mistakes immediately, "in case I forget".

Watching Mei Ann write with the word processor convinces me that the computer is indeed, a useful and flexible writing tool. Obviously she was an experienced computer user, one who knew how to exploit the facilities of the electronic writing tool to improve her writing. Clearly, she knew what the machine could do for her, so she left the mechanics of writing to the spelling and grammar checker to prompt her while she concerned herself with generating ideas and revising. The error-prompter had been a great help to her. I saw a great deal of revision throughout the writing process but more importantly, I noticed her willingness to delete whole sentences and even paragraphs which she subsequently replaced after some thinking and reviewing.

In her response to questions in the Post-Writing Questionnaire, she perceived herself as a good writer and found writing with the word processor more enjoyable than writing with the pen-and-paper. She also saw the word processor as a useful editing tool, a tool for experimenting with ideas, a tool for improving the grammatical accuracy of her essays and therefore, a polishing tool and an aid in writing.
The Pen-and-Paper Writing Episode

She had just finished her twenty minutes break before sitting down at the table. After reading the essay topic for Text 2B(PP), which read: “Private Tuition: Is it Necessary?” to be written with the pen-and-paper, she started scribbling on a piece of paper, what appeared to me like short notes, main points and ideas that she had thought out in response to the topic. Sometimes she would just stare at the paper, rolling the pen with her fingers. Obviously, she was thinking hard. Then, she scribbled a short sentence on the paper, adding to what she had written. I noticed that she was struggling with the word ‘definitely’. She wrote the word three times, looked at it for a while, and then went on to add to the list of points she had scribbled. Actually, she had wanted to spell the word ‘definitely’ but was unsure of the spelling. The Oxford Advanced Dictionary and Roget’s Thesaurus were right in front of her but she did not attempt to refer to them. The planning and outlining went on for more than seven minutes. Finally, she started writing on a clean sheet of paper:

Many students nowadays go for private tuitions. They think it is a must to go to tuitions, but actually it is not necessary at all. In my opinion, as long as we pay attention in class, private tuition is not necessary at all.

To continue with the next sentence, she referred to the written outline she had drawn up earlier on another piece of paper. As she wrote, she paused, but for shorter periods than when she was writing with the word processor. On several occasions, she appeared to have some difficulty with the choice of words and tenses. Unaware that she had misspelled the words ‘students’ and ‘necessary’, she proceeded with her task, in an orderly manner, back and forth between the written plan and the essay that was evolving. She used the liquid eraser to fix mistakes that she detected and
appeared to be particularly careful with spelling and proper punctuation. At one point, she placed a comma after the word ‘class’ but almost immediately after that, erased it with the liquid eraser and added the word ‘but’ in its place. Thus, the sentence read: “Some parents pay a lot for their children who go for private tuitions but they still score low marks in school”. She erased the mistakes carefully and wrote according to plan. She appeared to be cautious, well aware of the consequences of making too many mistakes in the essay. After that, she continued writing the next sentence, which read: “So, sometimes, private tuition classes do not us at all”. Obviously, she was unaware that she had inadvertently omitted a word in the sentence (before the word ‘us’).

In the interview after the writing session, she admitted to being very careful about making changes in the essay in order to avoid having to rewrite, which she described as “time consuming and tiring”. As a result, her pen-and-paper composing style was one that was less recursive and less adventurous than the writing process I observed when she wrote with the word processor. Her pen-and-paper writing process followed a pattern, which could be represented roughly as “plan-write-revise”. In this pen-and-paper writing session however, the willingness to scrape phrases or sentences that I saw during the word processing session was absent. Spelling mistakes like the word “definately”, careless mistakes like “studnets” and omissions went unnoticed. As a result, there were more errors found in this essay than in the previous essay, Text 2A(WP) written with the word processor (see Table 2, p. 33).

The portrait of the writer above provides some insights on the reality of writing with the word processor. Besides evidence from direct observations of her writing processes, the subject’s responses to questions in the semi-structured interview and the post-writing questionnaire at the end of the study, further reinforced the finding
that writing with the word processor had given rise to a host of behavioural schemata that was different from writing with the conventional pen-and-paper. In their study of the composing processes of writers, Bridwell et al (1987) had referred to Stephen Spender's descriptions of two kinds of writers; the "Beethovians" — those who compose to find out what they have to say and the "Mozartians" — those who plan extensively and then execute. The subject in the present case study can be identified with the "Mozartians" in all the pen-and-paper writing sessions but in all the word processing sessions, she had behaved like a "Beethovian". True to Papert's (1981) view, the computer's value lies in its capability to change the ways people learn.

In order to provide a more definitive answer to the research question posed earlier, findings from the observable writing behaviours are integrated with findings from the semi-structured interviews and subject's responses to the post-writing questionnaire. These findings are discussed under two broad headings: before writing and while writing.

**Before Writing**

A similar pattern in planning activities like writing out an outline and listing down main points could be identified when the pen-and-paper was used. This pattern, however, was absent from the writing behaviour of the subject when the word processor was used. Although no written plans were drawn up before writing the essay with the word processor, there was a certain amount of mental pre-figuring involved, indicated by a short pause before script was produced. This was confirmed by the subject's response to questions during the follow-up interview:

I just figure out how to write the first sentence, then I type it down first, then as I write, I think for some more ideas.

(Transcript 3, line 6, p. 91)
The subject also confirmed the presence of a mental outline during the semi-structured interview in which she said:

Er... with the word processor, not really ... after reading the topic, I got some ideas, .. so I ... I just type down whatever ideas that come to my mind first 'cause later I could arrange them.

(Transcript 2, line 5, p. 92)

Clearly, the subject's approach to the writing task with the word processor was one, which involved capturing all her thoughts down on screen first and rearranging them later. Obviously, she was adapting her writing strategies to what the technology offered her when she said “… I just typed whatever ideas that come to my mind first, 'cause later I could arrange them”. This could also be an explanation for the higher frequency and greater amounts of time spent on revising and editing during the word processing sessions, particularly during the production of Text 1B(WP). With the pen-and-paper, planning before beginning to write appeared to be an important element of the writing process. However, there was very little planning before writing with the word processor. Haas (1989) too, found that there was significantly less planning before writers begin to write with the word processor.

Apparently, the subject’s approach to writing with the word processor was influenced by her perceived ease in which text could be manipulated, and that the word processor was very flexible and easy to use, expressed as follows:

It is so easy to use the mouse, click and highlight then cut, copy or paste!

(Post-writing Questionnaire)
In contrast, she painstakingly drew up outlines with topic sentences or main ideas when using the pen-and-paper. Due to her perceived limitations of the pen-and-paper, she planned more formally and spent a lot of time planning before she actually started writing the essay, more as a precaution against making extensive mistakes. Referring to the pen-and-paper, she wrote:

It’s better to jot down what you want to write first, in case you make a lot of mistakes ... if you make many mistakes, you have to rewrite again and again ... takes up a lot of time and your fingers will also ache, after writing so much ....

(Post-writing Questionnaire)

Obviously, this was a strategy to avoid the much dreaded rewriting or recopying which, to her, was time-consuming and tiring. On the other hand, her approach to writing with the word processor appeared to depend a lot on what Perl (1989) described as “felt sense”, a sense experience evoked by the topic itself. It was observed that almost immediately after reading the essay topic, usually more than once, she started keying in words on the computer straight away. The topic seemed to have evoked some associations within her, “which calls forth images, words, ideas and vague fuzzy feelings that are anchored in the writer’s body” (Perl, 1989, p. 151). This sense experience appeared to have triggered off a smooth start to the writing process. Apparently, she started keying in text as soon as “she got enough of a sense, and that if she began with a few words heading in a certain direction, words will continue to come which will allow her to flesh out the sense she had” (Perl 1989, p, 151).
While Writing

With the word processor, planning which was traditionally believed to precede actual writing, took place throughout the writing process, illustrating that “planning is not a unitary stage, but a distinctive thinking process which writers use over and over again during composing” (Flower & Hayes, 1981a, p. 375). Planning occurred throughout the entire writing process when the word processor was used. This was indicated by the considerably higher number of pauses when the subject was involved in reflecting, reviewing, rereading and cognitive planning during the word processing sessions. Her response to questions during the interview confirmed this.

I just stop to think about it for a while, then I will get some more ideas... so I write it down.

(Transcript 3, line 27, p. 92)

Contemplation of ideas and construction of meaning also occurred while writing.

... I rephrased sentences in my mind.

(Transcript 1, line 50, p. 85)

The higher frequencies of reflecting, reviewing and cognitive thinking throughout the writing process resulted in greater amounts of planning during the word processing sessions. This finding is consistent with Daiute's (1986) claim that word processing may increase planning since writers can turn their attention away from handwriting, recopying and checking for spelling and grammatical errors.

It was also clear from the observations that the subject was able to prioritize the tasks involved in writing according to what the writing tool could do for her. While the priority was to ensure correct spelling, punctuation and grammar when writing
with the pen-and-paper, the priority was in generating more ideas when writing with
the word processor. When writing with the pen-and-paper, her main concern was
spelling, punctuation and grammar (see Transcript 1). This was because the main
ideas have been thought out and listed down in the outline during pre-writing, thus
leaving her free to concentrate on the mechanics of writing. However, it was the
reverse when the word processor was used. When writing with the word processor,
her main concern was content generation and organization and not so much spelling,
punctuation and grammar because according to her,

... the computer could check it for you with the wavy lines, so you
know if there is mistake ... the computer will do the checking.

(Transcript 3, line 47, p. 92)

In the absence of an overall plan, the apparently smooth start to writing with the
word processor soon became punctuated with frequent pauses for reflection,
reviewing and even planning and editing simultaneously. This phenomenon can be
identified from the carefully coded writing behaviours charts (see Appendices F1, F2
and F3). From these charts, it is clear that the writing process appear to be dominated
by backward movements before more texts was produced. The subject frequently
backtracked or read over segments of written texts in order to proceed. Her word
processing session was one, which reinforced the notion of writing as recursive, and
there was an obvious presence of the “forward-moving action which exists by virtue
of a backward-moving action” (Perl, 1989, p. 150). The subject revealed that the
purpose of rereading was to make sure that the ideas cohered and were organized in
relation to the thesis statement.
I wanted to make sure that my first point and the other points are connected to one another.

(Transcript 1, line 63, p. 85)

With the pen-and-paper, a cyclical pattern of writing and referring to the outline could be identified throughout the writing stage. The subject was seen referring to the outlined plans regularly. With the pen-and-paper, the overall plan and outlines provided the direction for the progress of the writing but with the word processor, ideas were left to develop as the writing progressed. Outlines drawn up before writing with the pen-and-paper was closely adhered to and no attempts were made to change the direction of the writing away from what was planned.

With the pen, you have to rewrite the whole essay again if you make a lot of mistakes, that’s why it’s better to stick to the plan.

(Post-writing Questionnaire)

In contrast, the subject was more positive about using the word processor for writing and she also took pride in the work done on the computer.

... with the computer, you don’t have to spend so much time recopying or rewriting even if you make a lot of mistakes. It is so easy to make any correction and no matter how many corrections you make, the essay that comes out look so neat and nice, like a page from a book.

(Post-writing Questionnaire)

From her statement, it is also clear that she found it easy to manipulate texts and produce hard copies with professional look, which she described, “...like a page from
a book". There were occasional pauses to fix mistakes at the word or phrase level with
the liquid eraser during the pen-and-paper writing processes but no whole sentences
have been edited or rearranged. The pauses during the word processing sessions,
according to her, were for generating content and improving the quality of the essays.

I was thinking .... trying to get more ideas so I could make my
essay better.

(Transcript 3, line 54, p. 93)

Supporting this statement was the visibly recurring activity of reading over segments
of written text, which occurred after every few sentences. Obviously, these rereading
and pauses were for improving the text, both in meaning and coherence.

Reorganizing or moving chunks of texts and paragraphs was another recurring
activity in the word processing sessions. The word processor had facilitated the
manipulation of texts, so much so that planning, writing, reviewing and editing
occurred at no fixed time, place or frequency within any one writing session.
Evidence from other case studies of word processing revealed very much the same
phenomenon, that is, the processes of planning, reviewing and editing interweave and
occur during all phases of composition, with any process leading to any other process
(Bridwell et. al, 1987). It is obvious that in her word processing sessions, the notion of
composition as a series of discrete steps; prewriting—writing—revising, is being
challenged. Instead, it supports the observation that in reality, for many writers,
writing does not occur in separate steps. The next section presents analyses of essays
written with the pen-and-paper and those written with the word processor. It addresses
the second research question.
Research Question 2: Are there differences in the essays written with the pen-and-paper to those written with the word processor in terms of text productivity, text complexity and text precision?

To determine text productivity, the number of words in each essay was counted using the computer word-count function. The number of T-units in each essay was counted and divided with the number of words to obtain the mean T-unit length. The mean T-unit length is used to determine its syntactic complexity (see Appendix G). To determine text precision, the number of errors in each text was counted (see Appendix H). In the case of text precision, there is an inverse relationship between the number of errors and the overall merit of the essay. Table 7 below presents an analysis of texts written with the pen-and-paper while the analysis of texts written with the word processor is presented in Table 8.

Table 7

<p>| Analysis of Essays Written with the Pen-and-Paper in Terms of Productivity, Complexity and Precision |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Text Elements</th>
<th>Text 1A(PP)</th>
<th>Text 2B(PP)</th>
<th>Text 3B(PP)</th>
<th>Total</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>255</td>
<td>239</td>
<td>269</td>
<td>763</td>
<td>254</td>
</tr>
<tr>
<td>Complexity</td>
<td>13</td>
<td>10</td>
<td>15</td>
<td>38</td>
<td>13</td>
</tr>
<tr>
<td>Precision*</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>25</td>
<td>8</td>
</tr>
</tbody>
</table>

* For text precision, there is an inverse relationship between the number of errors and the overall merit of the text.
Table 8

Analysis of Essays Written with the Word Processor in Terms of Productivity, Complexity and Precision

<table>
<thead>
<tr>
<th>Text Elements</th>
<th>Text 1B(WP)</th>
<th>Text 2A(WP)</th>
<th>Text 3A(WP)</th>
<th>Total</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>335</td>
<td>330</td>
<td>368</td>
<td>1033</td>
<td>344</td>
</tr>
<tr>
<td>Complexity</td>
<td>23</td>
<td>21</td>
<td>26</td>
<td>70</td>
<td>23</td>
</tr>
<tr>
<td>Precision*</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

* For text precision, there is an inverse relationship between the number of errors and the overall merit of the text.

Table 9

Comparison of Essays Written with the Pen-and-Paper and the Word Processor

<table>
<thead>
<tr>
<th>Text Elements</th>
<th>Pen-and-Paper (mean)</th>
<th>Word Processor (mean)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>254</td>
<td>344</td>
<td>90</td>
</tr>
<tr>
<td>Complexity</td>
<td>13</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td>Precision*</td>
<td>8</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

* For text precision, there is an inverse relationship between the number of errors and the overall merit of the text.

Table 9 above, which presents the average counts for productivity, complexity and precision for texts written with the pen-and-paper and the word processor is derived from Tables 7 and 8. Findings from the analyses in Tables 7, 8 and 9 would be discussed in relation to these different measures of text quality: text productivity (writing output), text complexity (syntactic complexity) and text precision (grammatical and mechanical accuracy) as follows:
Text Productivity

In terms of word count or productivity, the number of words found in each of the three essays written with the word processor is evidently more than those written with the pen-and-paper. Table 9 shows that the average word count for essays written with the word processor is 344 compared to 254 words for essays written with the pen-and-paper. The average length of essays written with the word processor is therefore 90 words more than the essays written with the pen-and-paper. This finding paralleled the findings of a number of studies, which found differences between the number of words in essays written with the pen-and-paper and essays written with the word processor. Daiute (1986) found statistically significantly more words in texts, which were revised with the computer. Snyder (1990) found that essays written with the word processor were longer than those written with the pen-and-paper. Etchison (1985) and Jones (1994) also reported longer essays produced with the word processor. Owston, Murphy & Wideman (1992) conducted their study on experienced computer users and found that essays written on computers were longer than those written off computers. In the writing research literature, higher productivity has been associated with higher quality ratings of the written products (Daiute, 1986; Hillocks, 1986; Snyder, 1990).

Text Complexity

On this measure of text quality, essays written with the word processor were found to be syntactically more complex, indicated by the higher number of mean T-unit lengths. Table 9 shows that the average number of mean T-unit lengths of essays written with the word processor is 23 compared to 13 for essays written with the pen-and-paper. The higher numbers of mean T-unit lengths show that essays written with
the word processor are syntactically more complex than essays written with the pen-and-paper. This could be attributed to the higher frequencies of rereading and rephrasing sentences during the word processing sessions. One possibility is that the ease with which portions of the texts could be rephrased and reworded encouraged more revision and experimentation to produce more syntactically complex sentences. Higher syntactic complexity has been associated with higher quality ratings in Crowhurst’s (1980) study. Crowhurst (1980) concluded that the computer appeared to have facilitated the writing of argumentative essays. Snyder (1990) too found that computer-written argumentative essays were syntactically more complex than those written with the pen-and-paper.

Text Precision

Essays written with the word processor exhibited substantially less errors in spelling, punctuation and grammar compared to those written with the pen-and-paper. As can be seen from Table 8, the average number of errors found in essays written with the word processor is 2 compared to 8 for essays written with the pen-and-paper. Since the number of errors is inversely proportional to the overall merit of the texts, the fewer errors in essays written with the word processor means that these essays are grammatically more accurate and therefore, better in quality. This can be attributed to the spelling and grammar-checking programme found in the word processing software, which provided prompts on errors in spelling, punctuation, grammar and style. The subject had been alerted by these promptings and had responded to them, resulting in the production of almost error-free essays. In contrast, essays produced with the pen-and-paper exhibited more errors in spelling, punctuation as well as grammar. Although the dictionary and thesaurus were provided during all the pen-
and-paper writing sessions, it was observed that not many attempts were made to refer to them. The reason, as revealed, was:

.. I had to flip through the dictionary .... and that took a lot of time

(Transcript 1, line 32, p. 84)

However, the reaction was different when the word processor was used for writing.

... it was much easier because I just right-clicked the mouse (to check spelling and grammar).

(Transcript 1, line 34, p. 84).

As a result of the promptings, the subject was able to detect the errors immediately and correct them. It was also observed that she had learnt the correct spelling of several words as a result of the promptings, for instance, “complex” was wrongly spelt as “compleks” (Text 1B). Almost immediately, red wavy underlines appeared and the subject was alerted to the spelling error. She reacted immediately by right-clicking on the word and from the pop-up window, clicked on one of the suggested words in the list. When the wavy underlines disappeared, she knew that she had made the right choice. The lower number of mechanical errors contributed to the overall merit of the essays, making them more precise.

In as far as text precision is concerned, the lower error-count can be attributed largely to the word processor because the subject appeared to rely heavily on the error-prompter to alert her to mistakes made. Mistakes not detected by the programme went unnoticed. This explains why there were errors in essays written with the word processor even with the availability of the error-prompting programme. It also points
to the fact that the grammar and spelling checker is not foolproof. This is because it
relies solely on its database against which words keyed into the computer were
matched. As such, words not found in its database were not detected. Another
possibility could be carelessness on the part of the subject, even the promptings failed
to attract her attention.

On the whole, essays written with the word processor were found to be better
than essays written with the pen-and-paper in terms of productivity, complexity and
precision, thus answering the second research question.

The next section of this chapter deals with the holistic evaluation of the essays.
It attempts to answer the third research question.

Research Question 3: Does the use of the word processor
affect the holistic ratings of the written products?

The texts were evaluated by the researcher and two independent raters based on
a 5-point holistic ratings scale developed by Snyder (1990). Each essay therefore
received three scores. To facilitate comparisons of holistic ratings between essays
written with the pen-and-paper and essays written with the word processor, these
scores were totalled and the mean score found. This procedure therefore precluded the
necessity of an inter-rater reliability test. Furthermore, there was a near-consensus of
marks awarded by the three different raters (see Tables 10 and 11 below). As such, the
mean score, by itself was a good measure.

The tables below show the holistic scores of essays based on a 5-point scale
holistic evaluation of texts by the researcher and two independent raters. Table 10
shows the holistic scores awarded to essays written with the pen-and-paper while
Table 11 presents holistic scores awarded to essays written with the word processor.
Table 10

Distribution of Holistic Scores of Texts Written with the Pen-and-Paper

<table>
<thead>
<tr>
<th>Writing Tasks</th>
<th>Researcher</th>
<th>Rater 1</th>
<th>Rater 2</th>
<th>Holistic Score</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text 1A(PP)</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>3.3</td>
</tr>
<tr>
<td>Text 2B(PP)</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>10</td>
<td>3.3</td>
</tr>
<tr>
<td>Text 3B(PP)</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>11</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Total Holistic Score: 31
Mean Holistic Score: 10.3

With reference to Table 10 above, Texts 1A(PP) and 2B(PP) received the same scores that is, 10 marks but Text 3B(PP) received 11 marks, a difference of only 1 mark. Evidently, the marks awarded by the different raters do not differ much.

Table 11

Distribution of Holistic Scores of Texts Written with the Word Processor

<table>
<thead>
<tr>
<th>Writing Tasks</th>
<th>Researcher</th>
<th>Rater 1</th>
<th>Rater 2</th>
<th>Holistic Score</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text 1B(WP)</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>11</td>
<td>3.6</td>
</tr>
<tr>
<td>Text 2A(WP)</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>3.6</td>
</tr>
<tr>
<td>Text 3A(WP)</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>13</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Total Holistic Score: 35
Mean Holistic Score: 11.5

From Table 11 above, it is clear that there is no difference in total scores between Text 1B(WP) and Text 2A(WP). However, Text 3A(WP) is 2 marks higher than Text 1B and Text 2A.

A comparison of the scores of essays written with the pen-and-paper in Table 10 and essays written with the word processor in Table 11 show that essays written with the word processor receive higher holistic scores than those written with the pen-and-
paper. This is indicated by the higher total mean score of 11.5 for essays written with the word processor compared to the corresponding score of 10.3 for essays written with the pen-and-paper, a difference of 1.2 marks. Although the difference is small, the fact remains that essays written with the word processor were awarded higher holistic ratings compared to essays written with the conventional pen-and-paper. That the word processor had affected the overall quality of texts is evident because of the higher holistic ratings awarded to all the essays written with the word processor. This finding answered the third research question.

Discussion of Findings

What stands out most from the present case study is the consistency of differences in writing behaviour and quality of products written with the word processor and the pen-and-paper. The strength of the findings lies in the consistency of differences in the proportions of time spent and frequency counts of major composing activities like prewriting, planning, writing, editing and revising between the pen-and-paper writing sessions and the word processing sessions.

Firstly, consistent differences in prewriting strategies and composing habits were found between the pen-and-paper writing sessions and the word processing sessions. The long prewriting stage before writing with the pen-and-paper remained consistent across all the three pen-and-paper writing sessions. This is in contrast to the consistently short pause before starting to write in all the word processing sessions. This apparent absence of written outlines during the word processing sessions, however did not appear to have adversely affected the quality of texts. Instead, essays written with the word processor received higher ratings than essays written with the pen-and-paper. A possible explanation for this could be found in Emig’s (1970)
finding that "able students engage in very little written prefiguring for pieces of 500 words or fewer " (p. 53) when referring to Lynn, one of her four subjects. The higher holistic ratings and hence, more superior quality of essays written with the word processor could be a result of the high frequency of backtracking or reading over segments of texts, which contributed to the more coherent linking of ideas. Also, the higher frequency and greater amount of planning that occurred during the word processing sessions could have contributed to the better quality of essays. This finding is substantiated by the finding that better writing is the result of more planning (Sufumi So, 1989).

Other consistent findings were the higher frequency of pauses for reflection, reading over segments of written text and editing in all the word processing sessions. On the other hand, frequency counts of references to the written outlines were consistently higher on all three occasions when the subject wrote with the pen-and-paper.

Secondly, the positive influence of the word processor on text quality was obvious in all the computer-written essays. All the three essays written with the word processor, Text 1B(WP), Text 2A(WP) and Text 3A(WP), were awarded higher holistic ratings by three raters, namely the researcher and two appointed raters. Although the difference in the marks awarded to the essays is small, it attests to the fact that the three experienced raters, working independently, were unanimous in their judgment of essays written with the word processor, which they found to be holistically better than essays written with the pen-and-paper. This perhaps constitutes the most succinct evidence that essays written with the word processor are better in quality than essays written with the pen-and-paper.
Finally, the higher holistic ratings awarded to essays written with the word processor provided evidence that the writing processes associated with the word processor were responsible for enhancing text quality. This also means that the word processor had facilitated the composing operations involved in the production of these essays. The higher frequency and amounts of revising and editing done during word processing are largely due to the ease with which texts can be entered and manipulated with its block, cut and paste functions. This finding provides additional support for Snyder's (1990) finding that the easy movement capability exclusive to the word processor contributed to the better quality of the argumentative essays.

Process and Product

Analyses of data on the writing process showed that the word processor had influenced the writing behaviour of the subject. Analyses of the written products also showed that essays written with the word processor fared better in all the measures of text quality investigated. The higher holistic ratings awarded to essays written with the word processor reinforced the findings on text productivity, complexity and precision and provided evidence that the writing behaviours associated with the word processor were responsible for enhancing the quality of these essays.

Firstly, due to the relative ease with which text could be manipulated with the word processor, the subject revised more and made more changes in the text. This could have contributed to the better linking of ideas to the thesis statement.

Secondly, the word processor had helped the subject stay longer with a piece of writing. The longer writing engagement in all the word processing sessions have contributed to the longer essays while the recursiveness of its writing processes contributed to the tighter linking of ideas.
Thirdly, findings from the text analysis showed that text productivity or text length and syntactic complexity were high while the number of errors was low in all the essays written with the word processor.

Finally, the absence of written outlines or prewriting plans led to the higher frequency and greater amounts of planning on occasions when the word processor was used for writing. More planning led to better writing quality.

The nature of the writing tool and what the subject did or did not do with the tool, are thus reflected in the written products. In sum, the higher holistic ratings received by essays written with the word processor is reflective of the higher writing output, fewer errors and syntactically more complex essays.

Conclusion

The main conclusion that can be drawn from findings on the writing processes and analysis of written products is that, the different approach, writing strategies and habits of composing associated with the word processor have resulted in the better quality of essays written with the word processor. Differences in writing behaviour and quality of texts can be attributed to the different writing tools used because all other variables have been held constant in the design of the study (see Chapter Three, p. 17).

However, one could argue that factors other than the word processor could also be responsible for the better quality of these computer-written texts. These factors include the subject's experience in word processing, language proficiency and writing skills plus the writing instruction given to her at the outset of the study.

The next and final chapter summarises the main findings of the study. It concludes by providing suggestions on the directions that future research should take.