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Effects of Word Processing on Arab Postgraduate Students' Essays in EFL

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Abstract

This study investigates the effects of word processor in composing essays in English as a foreign language (EFL) among Arab postgraduate students at Universiti Kebangsaan Malaysia (UKM) in terms of quality and quantity. The first part of the study was published in Darus and Ismail (2008). In the present study, 20 respondents composed essays on two topics: the first topic by using the conventional way (pen and paper) and the second using a word processor. The quality of writing such as spelling, Flesch Reading Ease, and Flesch-Kincaid Grade Level while the quantity of writing such as the length of the essay including other aspects like number of words, paragraphs, sentences, sentences per paragraph and words per sentence are also considered. The results of the study show that there was obvious difference between the quality and quantity of writing in the two modes. In most cases, the essays that were composed using word processor were longer and exhibited improvement in quality and quantity.

Keywords: EFL, word processor, Arab students, writing quality.

Introduction

The idea of using the word processor to facilitate the writing process is not a novel one. For the last thirty to forty years, more and more students are relying on the word processors to help them with their written assignments. The word processor looks neat in print and where a writer needs to make changes to his/her writing, all that is required is the ease of 'cut' and 'paste' where portions of one's writing is easily 'rewritten' without the hassle of 'canceling', and rewriting all over again. However, while all of these conveniences may be enjoyed by writers of English, it is possible that writers whose first language (L1) uses a different orthographic feature may experience difficulties.

The objective of this study is to examine in what way the computer affects Arab postgraduate students' writing by comparing the hand written essays with word-processed essays in terms of quality and quantity. Arab postgraduate students form the second biggest group of international students after the Indonesians at UKM. Therefore, insights into the effects of word processing on Arab postgraduate students are very much welcomed.

The research questions for the present study are as follows:
1. What are the aspects that Arab postgraduate students show an improved quality in essays that are word-processed compare to essays that are hand written?
    (a) Spelling errors
    (b) Flesch Reading Ease
    (c) Flesch-Kincaid Grade Level
2. What are the aspects that Arab postgraduate students show an improved quantity in essays that are word-processed compare to essays that are hand written?
    (a) Number of words
    (b) Number of paragraphs
    (c) Number of sentences
    (d) Sentences per paragraph
    (e) Words per sentence

Literature Review

Previous studies have shown that the word processor is better than pencil-and-paper in writing process. In a study led by Nichols (1996) with sixth-grade students, it appeared that the length of the composition, or number of words, is affected by the method (pencil-and-paper or computer). The study found that work completed with word processors was much longer then work done with pencil-and-paper. Nichols (1996) also concluded that if keyboard skills were developed along with word processing knowledge, students' ideas tend to flow more easily than when they use pencil and paper.

A three-year longitudinal study done by Owston and Wideman of York University on a group of third grade students provided similar findings. They were found to be typically using more words in their texts (Owston & Wideman, 1997).

However, not all studies show that the use of word processors in writing education is supportive. Some researchers believe that the cognitive de¬mands of using word processor editing tools may divert students' attention away from the quality of their writing (Cochran-Smith, Paris, & Kahn, 1991). For instance, experienced students with word processors may use these tools simply to make surface level changes rather than to think about deeper revisions in their writing (Dickenson, 1986; Owston, Murphy, & Wideman, 1992). For students with little word processing experience, the quality of their writing may decrease when composition takes place on a word processor (MacArthur, 1988). They may be distracted from their writing tasks because of their lack of keyboarding skills. Consequently, much of their preliminary writing time were spent on acquainting themselves with the layout of the keyboard (Dalton & Hannafin, 1987).

Another perspective of word processor worth looking into is the impact it has on the three critical elements of writing which are: context, process and products. Snyder (1990) investigated writing with pen-and-paper and writing done on word processor by comparing across three genres of writing; arguments, narratives and reports. It was found that the word processor facilitated the writing of argumentative essays because of the convenience and ease of the writing process where texts can be manipulated, thus they also created more revisions and improved the quality of their essays. This finding concurs with Warschauer's (1995) study on word-processed essays with hand written essays in English as a second language (ESL) context where he claims that the ease of editing, and the widespread use of computer dictionaries may have influenced writers' behavior and product. Due to this ease provided by computer writing, composing stages such as planning, revising, and editing no

longer have clear boundaries. Pennington (2003) claims that, this seamless and recursive computer-writing process is especially worthwhile for second language (L2) writers. Students may be able to avoid writer's block, memory load, and stress, all of which are demanding tasks for L2 writers (Pennington, 2003).

With regard to quality, in studies that compare word processing with writing with pen-and-paper in controlled situations, a range of variables has been used as indicators of quality. These include length, the number of revisions, the number of errors and neatness (Cochran, in Bangert-Drowns, 1993). By using these kinds of quantitative variables, word-processed writing generally scored better than writing with pen-and-paper. A similar conclusion was found when using holistic qualitative measures of overall competence and mechanics (Owston 1991).

The following section shows the result of the meta-analysis study carried out by Goldberg, Russell and Cook (2003). Figure 1 illustrates the studies based on outcomes. The analysis focused on the quantity of writing, quality of writing, and number of revisions. Fourteen studies included sufficient information to calculate effect sizes that compared the quantity of writing measured by word count, between computer and paper-and-pencil groups. The meta-analysis of these studies focused on the effect of word processing on the quality of students' writing. A positive overall effect that was about one-half standard deviation was found. This effect tended to be larger for middle and high school students than for elementary students.

Figure 1: Outcomes measured in the study of Goldberg, Russell and Cook (2003, p.7)
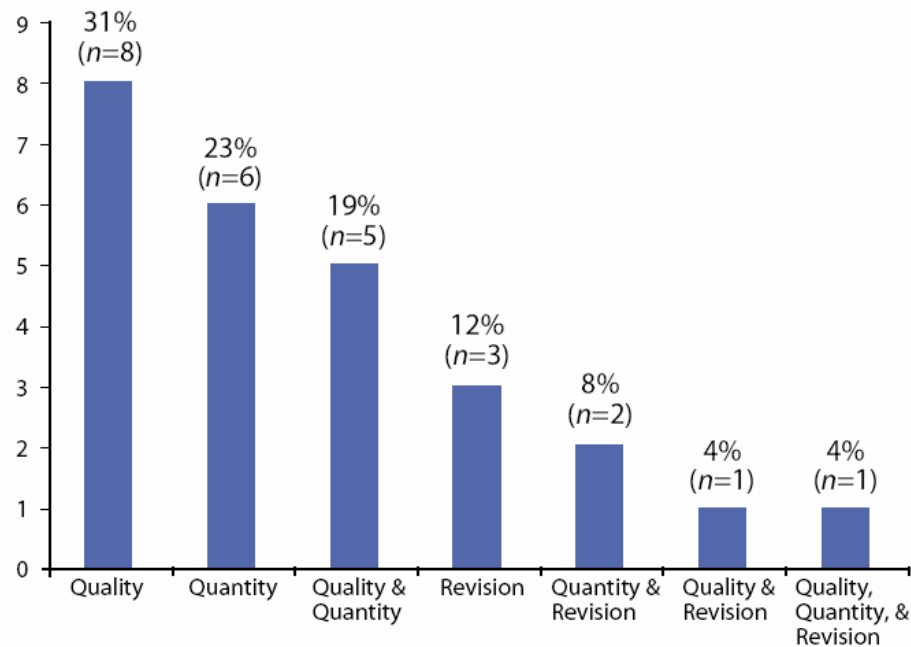
Fifteen studies included sufficient information to calculate effect sizes that compare the quality of writing between computer and pencil-and-paper groups. The meta-analysis of studies that focused on the effect of word processing on the quality of student writing found a positive overall effect that was about four-tenths of a standard deviation. As with the effect for quantity, this effect tended to be larger for middle and high school students than for elementary students.

The Effects of Word Processor on the Quality and Quantity of Writing

Word processing research has shifted from analysis of written products to looking at writing processes. There have been many studies, which combined investigations on writing processes and the writing

products through word processing (Duling (1985), Daiute, (1986), Haas (1988), and Owston and Wideman (1997). In the ESL context, Thang Eng Fung (1996) looked at revision strategies employed in word processing and examined its effect on the quality of written products. Etchison (1985) found in his study gains in holistic quality of essays written with a word processor were five times greater than those written with pen-and-paper. Another study conducted by Schramm (1989) found a small but significant improvement of quality of those using word processors when comparing quality of writing samples of 836 students (kindergarten through college) using word processors versus traditional writing methods.

Snyder's research concluded that many writers enjoy using word processing and he believes it enhances composing, revising, and the quality of written products. His findings reveal that word processing is an important tool amongst professional writers and teachers (1993). Li and Cumming (2001) carried out a case study of an adult male Mandarin learner of ESL. They investigated his writing processes, thinking processes, and quality of writing to ascertain whether using a computer for writing promotes higher-level revisions and improves the quality of compositions. Their findings confirm that the use of computers helped the learner to improve the written products.

Thus, it can be argued that the word processor introduces many advantages to a writer that affect their writing quality and quantity. From these advantages, students who write in an EFL environment can learn to write with confidence and this will affect their writing performance.

Methodology
Participants

As stated earlier in the Introduction section, the present study is a continuation from a previous study carried out by the authors (2008). Altogether 80 respondents participated in the previous study. 20 respondents who participated in the previous survey were asked to compose an essay on two similar topics with unlimited time.

Instrument

Spelling errors, Flesch Reading Ease, and Flesch-Kincaid Grade Level were used to gauge improved in quality of essays while number of words, number of paragraphs, number of sentences, sentences per paragraph and words per sentence were used to determine improved in quantity of both groups of essays.

The number of spelling errors was determined by using spelling checker while Flesch Reading Ease and Flesch-Kincaid Grade Level were calculated using grammar checker in Microsoft Word tools.

Flesch Reading Ease is a Reading Ease Scale that was developed by Rudolf Flesh. It uses ASL (average sentence length), and ASW (average syllables per word) to determine reading ease. The formula is $206.835 – (1.015 \times ASL) – (84.6 \times ASW)$. Total scores can range from 0 to 100. The scores were calculated by using Microsoft Word 2003.

Table 1 shows readability analyses of composed essays according to Hochhauser (2003). According to Hochhauser (2003), Rudolf Flesch ranked the difficulties of reading from "Very Difficult" to "Very Easy" in terms of Flesch Reading Ease. Texts that are easy to read have high scores and texts with scores below 30 are similar to legal contract.

Table 1:   Readability analyses (Hochhauser, 2003)

Average	Description
0 – 29	Very Difficult
30 – 49	Difficult
50 – 59	Fairly Difficult
60 – 69	Standard
70 – 79	Fairly Easy
80 – 89	Easy
90 – 100	Very Easy

The Flesch-Kincaid grade level formula is derived from two aspects; average sentence length (ASL) and average number of syllables per word (ASW). The Flesch-Kincaid grade level is calculated by using the formula: $(0.39 \times ASL) + (11.8 \times ASW) – 15.59)$. The values were also calculated by using Microsoft Word 2003.

Procedure

The first essay was hand written while the second was word-processed. The topic for the first essay was a general topic entitled "What are the interesting aspects that you have found in your own country? Explain why". Respondents wrote the first essay in a classroom at the School of Language Studies and Linguistics, UKM in the conventional way using pen-and-paper. After one week had passed, the same respondents composed the second essay entitled "What are the interesting aspects that you have found in Malaysia? Explain why". In order to compose the second essay, respondents used the computers at the computer laboratory at the School.

The hand written essays were typed in Microsoft Word and analysed for differences in quality and quantity. The word-processed essays were analysed in the same manner. In this way, differences in terms of quality and quantity between essays written in the conventional way and essays written by using a word processor can be determined. Microsoft Excel was used to analyse data statistical results were obtained using SPSS.

Results and Discussion

Research Question 1: What are the aspects that Arab postgraduate students show an improved quality in essays that are word-processed compare to essays that are hand written?
   (a) Spelling errors
   (b) Flesch Reading Ease
   (c) Flesch-Kincaid Grade Level

Spelling Errors

The ability to spell well and correctly is an indication of a writer's ability in that language. Thus, when the spellings are correct, it may mean a number of things to different people. It is hypothesized that there will be significant difference between hand written essays and word-processed essays in terms of spelling errors. To get the total number of spelling errors in the essays produced by the two modes, the researcher checked all the essays manually.

The total number of spelling errors in composed essays is shown in Table 2. The average percentage in Table 2 indicates the ratio of spelling errors found in the total number of words in all the essays. In the hand written essays, it is found that the average percentage of spelling errors that occur in 20 essays is 6.69 % and this seems to be higher than the 2.41% that occurred in word-processed essays.

Table 2: Number of spelling errors in composed essays

Student No.	Hand written essays (HW)			Word-processed essays (WP)		
	No. of words	No. of spelling errors	Percentage of spelling errors (%)	No. of words	No. of spelling errors	Percentage of spelling errors (%)
1	252	21	8.3	293	7	2.4
2	111	3	2.7	178	3	1.7
3	266	18	6.7	427	4	0.9
4	72	10	13.8	246	5	2.03
5	115	10	8.7	203	1	0.5
6	173	19	11	240	7	2.9
7	151	7	4.6	274	18	6.5
8	176	9	5.1	241	3	1.2
9	237	20	8.4	367	6	1.6
10	204	6	2.9	334	4	1.2
11	144	12	8.3	199	3	1.5
12	219	18	8.2	297	2	0.7
13	135	5	3.7	217	2	0.9
14	194	16	8.2	164	1	0.6
15	236	2	0.8	237	0	0
16	122	17	13.9	257	7	2.7
17	103	15	14.5	240	31	12.9
18	130	9	6.9	246	15	6.1
19	190	10	5.2	410	4	0.8
20	207	3	1.4	281	6	2.1
Total	3437	230	6.7	5351	129	2.4
Percentage of spelling errors in total no. of words	9.69%			2.41%		

Table 3 shows paired-sample statistics for spelling errors. The mean for spelling errors for hand written essays is 11.50 and the mean for spelling errors for word-processed essays is 6.45.

Table 3: Paired-sample statistics for spelling errors

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Spelling errors (HW)	11.50	20	6.126	1.370
	Spelling errors (WP)	6.45	20	7.280	1.628

Table 4: Paired-sample test for spelling errors

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	Spelling errors (HW) Spelling errors (WP)	5.050	8.888	1.987	.890	9.210	2.541	19	.020

Paired-sample t-test was conducted to evaluate the impact of word processor on Arab postgraduate students' essays in terms of spelling errors. The result shows that there is a statistically significant decrease in number of spelling errors in the word-processed essays (M= 6.45, SD = 7.28), t-value (19) =2.54, p=0.020) when compared to hand written essays (M=11.50, SD =6.12). The eta-squared statistic that calculates an effect size statistic can be obtained using the following formula.

$$\text{Eta-squared} = \frac{t^2}{t^2 + N - 1}$$

$$= \frac{(2.54)^2}{(2.54)^2 + 20 - 1}$$

$$= 0.25$$

where N= number of students

Given our eta square value of 0.25, we can conclude that there is a large effect of word processor on Arab postgraduate students' essays, with a substantial difference in spelling errors.

The results of Table 3 and Table 4 show that all respondents had committed less spelling errors when they used word processor. On the contrary, there were many spelling errors in hand written essays except for students no. 7, 17, 18, and 20. This may be due to their low English proficiency and they have little experience in using Microsoft Word tools such as the spelling checker.

Flesch Reading Ease

Tables 5 and Table 6 show the results of the quality of essays written in both modes: hand written and word-processed. The quality of the composition is represented by Flesch Reading Ease and Flesch-Kincaid Grade Level.

As mentioned earlier, Flesh Reading Ease is the readability score formula that rates text on a 100-point scale based on the average number of syllables per word and words per sentence. The higher the Flesch Reading Ease score, the easier it is to understand the document. For most standard documents, the Flesch Reading Ease score is approximately 60 to 70. Table 5 shows Flesch Reading Ease of students'essays. We note that there is obvious difference between hand written and word-processed essays. In addition, we note that in general, word-processed essays received lower scores, which indicate that word-processed essays are more difficult to read. One possible reason may be that the respondents used more complex sentences and higher-level vocabulary in their essays.

Table 5: Flesch Reading Ease of students' essays

Student No.	Hand written essays (HW)	Word-processed essays (WP)
	F R E	F R E
1	64.0	63.0
2	51.9	49.8
3	62.6	60.4
4	29.9	61.5
5	33.3	47.7
6	68.9	32.0
7	66.6	66.6
8	58.2	47.3
9	54.8	47.3
10	69.7	54.9
11	56.1	43.2
12	54.8	60.3
13	73.0	63.8
14	66.2	61.1
15	52.9	49.6
16	67.9	68.2
17	73.5	52.5
18	46.3	64.7
19	37.5	52.4
20	49.6	39.2

Table 5 shows that there were 5 students (no. 4, 5, 12, 16 and 19) who got higher values for word-processed essays, and student no. 7 got the same value for both. Other students got lower values

for word-processed essays. This indicates that word processor has obvious role in assisting Arab postgraduate students to compose their essays.

Flesch-Kincaid Grade Level

The Flesch-Kincaid Grade Level readability score analyzes and rates texts on a U.S grade-school level based on the average number of syllables per word and words per sentence. For example, a score of 8.0 means that an eighth-grader would understand the text.

Table 6 shows the Flesch-Kincaid Grade Level of hand written and word-processed essays.

Table 6:   Flesch-Kincaid Grade Level of students' essays

Student No.	Hand written essays (HW)	Word-processed essays (WP)
	FKGL	FKGL
1	8.8	8.9
2	15.2	11.2
3	7.6	8.3
4	14.9	9.7
5	18.1	12.8
6	9.9	20.8
7	8.6	8.5
8	9.5	12.3
9	12.1	12.7
10	7.1	9.3
11	11.1	14.2
12	10.5	10.0
13	8.6	10.3
14	7.8	8.4
15	10.3	9.6
16	6.5	7.2
17	7.2	14.4
18	8.8	8.1
19	12.0	14.4
20	10.5	14.7

From Table 6, we note that 12 out of 20 students got higher score for word-processed essays. This shows that Arab postgraduate students were able to write better quality essays when they used a word processor.

Research Question 2: What are the aspects that Arab postgraduate students show an improved quantity in essays that are word-processed compare to essays that are hand written?
  a) Number of words
  b) Number of paragraphs
  c) Number of sentences
  d) Sentences per paragraph
  e) Words per sentences

Number of words

The result in Table 7 illustrates the total number of words found in essays composed through both modes. Microsoft Word tool called Word Count was used to count the words in each essay automatically. The total number of words identified in the hand written essays is 3,437 and the total number of words identified in word-processed essays is 5,351. This seems to imply that hand written essays were generally shorter while word-processed essays tended to be longer and the difference between the two modes is 1,914 words.

Table 7: Total number of words in hand written and word-processed essays

Student No.	Hand written essays (HW) No. of words	Word-processed essays (WP) No. of words	Percentage of increase in no. of words
1	252	293	16.3
2	111	178	60.4
3	266	427	60.5
4	72	246	241.7
5	115	203	76.5
6	173	240	38.7
7	151	274	81.4
8	176	241	36.9
9	237	367	54.8
10	204	334	63.7
11	144	199	38.2
12	219	297	35.6
13	135	217	60.7
14	194	164	-15.5
15	236	237	0.4
16	122	257	110.6
17	103	240	133
18	130	246	89.2
19	190	410	115.8
20	207	281	35.7
Total	3437	5351	

Table 7 shows that 19 students have a positive percentage of increase in the number of words for word-processed essays.

Table 8: Paired-sample statistics for number of words in composed essays

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	No. of word (HW)	171.85	20	54.978	12.293
	No. of Word (WP)	267.55	20	71.126	15.904

Table 8 shows the mean scores for hand written and word-processed essays. The mean number of words for hand written essays is 171.85 while for word-processed essays is 267.55.

Table 9: Paired-sample test for number of words

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	No. of words (HW) No. of Words (WP)	-95.700	58.779	13.143	-123.209	-68.191	-7.281	19	.000

A t-test was conducted to evaluate the impact of word processor on Arab postgraduate students' essays in terms of number of words. There is a statistically significant increase in number of words for word-processed essays (M= 267.55, SD = 71.12), t-value (19) =-7.28, p=0.000) when compared to hand written essays (M=171.85, SD =54.97).

$$\text{Eta-squared} = \frac{t^2}{t^2 + N - 1}$$

$$= \frac{(-7.28)^2}{(-7.28)^2 + 20 - 1}$$

$$= 0.73$$

Given the eta square value of 0.73, we can conclude that there is a large effect of the word processor on the students' essays, with a substantial difference in number of words. The word-processed essays that were composed by these students were longer than hand written essays. Therefore, we can conclude that there was a significant increase in number of words from hand written essays to word processed essays.

The results from this section indicate that most of the respondents have used more words in writing their essays using the word processor than in the conventional way. This indicates that the word processor is a helpful tool for Arab postgraduate students to compose their essays.

Number of paragraphs

Table 10 illustrates the number of paragraphs identified in the hand written and word-processed essays. The total number of paragraphs of essays for both modes is similar. However, for individual cases, there is a difference between the two modes in the number of paragraphs. Out of 20 students, 7 students composed the same number of paragraphs in the two modes; 8 students composed more paragraphs using the word processer, and 5 students composed less number of paragraphs for the word-processed essays.

Table 10: Number of paragraphs in students' essays

Student No.	Hand written essays (HW) No. of paragraphs	Word-processed essays (WP) No. of paragraphs
1	6	6
2	3	3
3	4	4
4	3	4
5	3	5
6	4	5
7	5	6
8	7	7
9	4	4
10	3	5
11	5	4
12	5	4
13	3	4
14	10	3
15	4	3
16	5	5
17	2	5
18	4	4
19	4	5
20	7	5
	91	91

Number of sentences

Table 11 shows the total number of sentences in the essays written in both modes. The results show that in general, the total number of sentences in the word-processed essays is more than the number of sentences in hand written essays. 17 students wrote more sentences in their essays using the word

processor, while 2 students (student no. 6 and 8) composed fewer sentences in word-processed essays. One student composed the same number of sentences in both modes. This may indicate that students were able to create more sentences to develop their ideas when they compose using the word processor.

Table 11:   Total of number of sentences in students' essays

Student No.	Hand written essays (HW) No. of sentences	Word-processed essays (WP) No. of sentences
1	12	16
2	3	9
3	21	30
4	2	11
5	3	8
6	8	4
7	8	15
8	10	8
9	9	15
10	14	21
11	6	7
12	11	13
13	6	9
14	11	11
15	13	17
16	11	18
17	6	7
18	7	14
19	4	12
20	8	9
Total	173	254

Table 12:   Paired-sample statistics for number of sentences

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	No. of sentences (HW)	8.65	20	4.499	1.006
	No. of sentences (WP)	12.70	20	5.939	1.328

Table 12 shows that there is, indeed, a significant positive correlation between the scores for each of the two sets, namely, hand written and word-processed. The mean number of sentences for hand written essays is 8.65 and the mean number of sentences for word-processed essays is 12.70.

Table 13:   Paired-sample test for number of sentences

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	No. of sentences (HW) No. of sentences (WP)	-4.050	3.692	.825	-5.778	-2.322	-4.906	19	.000

A paired-sample test revealed a significant difference in the increase of the number of sentences from hand written essays (M=8.65, SD =4.49) to word-processed essays (M= 12.70, SD = 5.93), t-value (19) = -4.90, p=0.000.

$$\text{Eta-squared} \quad = \frac{t^2}{t^2 + N - 1}$$

$$= \frac{(-4.90)^2}{(-4.90)^2 + 20 - 1}$$

$$= 0.55$$

Eta-square value of 0.55 indicates a large effect of the word processor on word-processed essays of Arab postgraduate students.

Sentences per paragraph

Table 14 indicates the number of sentences in each paragraph. These values were generated from the readability features of the Microsoft Word. The results show that the number of sentences per paragraph for word-processed essays is generally more than the number of sentences per paragraphs for hand written essays. 16 out of 20 students wrote more sentences per paragraph using the word processor. This may show that more students prefer to use the word processor to develop their paragraphs.

Table 14: Number of sentences per paragraph

Student No.	Hand written essays (HW)	Word-processed essays (WP)
	Sentences per paragraph	Sentences per paragraph
1	2.4	3.2
2	1.0	3.0
3	5.2	7.5
4	1.0	2.7
5	1.0	2.0
6	2.0	1.3
7	1.6	2.5
8	1.4	1.6
9	2.2	3.7
10	4.6	4.2
11	1.2	1.7
12	2.2	3.2
13	2.0	2.2
14	1.8	3.6
15	3.2	5.6
16	2.2	3.6
17	3.0	1.4
18	1.7	4.6
19	1.0	2.4
20	2.0	1.8
Total	42.7	61.8

Table 15 shows the mean score for each of the two sets of scores. The mean number of sentences per paragraph for hand written essays is 2.13 and the mean number of sentences per paragraph for word-processed essays is 3.09.

Table 15: Paired-sample statistics for number of sentences per paragraph

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	No. of sentences per paragraph (HW)	2.135	20	1.1389	.2547
	No. of sentences per paragraph (WP)	3.090	20	1.5393	.3442

Table 16: Paired-sample test for number of sentences per paragraph

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	No. of sentences per paragraph (HW) No. of sentences per paragraph (WP)	-.9550	1.1367	.2542	-1.4870	-.4230	-3.757	19	.001

Table 16 shows that there is a statistically significant increase in the number of sentences for the word-processed essays (M = 3.09, SD = 1.53) compared to hand written essays (M= 2.13, SD =1.13) with t-value (19) = -3.75, p=0.001.

$$\text{Eta-squared} = \frac{t^2}{t^2 + N - 1}$$

$$= \frac{(-3.75)^2}{(-3.75)^2 + 20 - 1}$$

$$= 0.42$$

The value of eta-squared is 0.42. This means that there is a large effect size of word processor on Arab postgraduate students' essays. The number of sentences per paragraph in the word-processed essays is more than in the hand written essays. This indicates that the length of paragraphs that were written using the word processor is longer than the paragraphs written in conventional way.

Words per sentences

Table 17 illustrates the result of the fifth aspect. The results show that the number of words per sentence in word-processed essays is more than the number of words per sentence in hand written essays. 10 out of 20 students composed more words per sentence using the word processor (except for student no. 1, 2, 4, 5, 7, 9, 14, 15, 18 and 19).

Table 17: Number of words per sentence

Student No.	Handwritten essays (HW)	Word-processed essays (WP)
	Words per sentence	Words per sentence
1	18.0	17.9
2	37.0	19.7
3	12.6	14.2
4	23.5	22.3
5	38.3	25.0
6	21.6	48.5
7	18.8	18.2
8	17.9	23.0
9	26.3	24.4
10	14.5	15.9
11	24.0	28.4
12	19.9	22.2
13	22.5	24.1
14	15.7	14.9
15	18.1	13.9
16	11.0	14.2
17	17.1	34.2
18	18.5	15.7
19	47.5	34.1
20	4.6	31.2
Total	427.4	462

Conclusion

The first research question of the study is to investigate what are the aspects that Arab postgraduate students show an improved quality in essays that are word-processed compare to essays that are hand written in terms of spelling errors, Flesch Reading Ease and Flesch-Kincaid Grade Level. The results show that the word processor has helped the students to discover spelling errors in their essays and to rectify them. This appeared clearly in the higher percentage of total number of spelling errors in the hand written essays compare to word-processed essays. The results of the t-test show that there is a statistically significant decrease in number of spelling errors in word-processed essays.

For Flesch Reading Ease, the results show that there are obvious differences between the two modes of writing. In general, word-processed essays got lower scores than hand written essays. This indicates that word-processed essays were more difficult to read than hand written essays. Students used higher level of vocabulary in word-processed essays than in hand written essays. The word processor helped the Arab postgraduate students to compose more quality essays. The dictionary in the word processor played a big role in helping Arab postgraduate students to compose their essays and to choose relevant words (vocabulary).

In general, the results showed an increased level in Flesch-Kincaid Grade Level in word-processed essays. More than half of the students got high Flesch-Kincaid Grade Level scores in word-processed essays. It is possible that the word processor is the influencing factor for the increased level. The present study has proved that word processor assisted Arab postgraduate students to improve the quality of their writing in EFL.

The second research question of the study is to investigate what are the aspects that Arab postgraduate students show an improved quantity in essays that are word-processed in terms of number of words, paragraphs, sentences, sentences per paragraph and words per sentence. The results show that in general, the word-processed essays have an increased number of words and sentences than hand written essays, but the total number of paragraphs is equal between the two modes of written essays. Arab postgraduate students composed longer essays with Microsoft Word. This result corresponds with studies by Bangert-Drowns (1993) where using a word processor improved the quantity in terms of length of the students' document. The results of the present study also concur with the results of Etchison's (1985) study where respondents who used word processors write longer composition. The findings from the present study also seem to correspond with the findings reported in studies by Schramm (1989), and Li and Cumming (2001).

This investigation has shown that the word processor is a facilitating tool, which enables Arab postgraduate students to improve their writing in EFL in terms of both quality and quantity.

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