



## Computer-assisted Writing: An Investigation of Metacognitive Awareness of Writing Strategies of Iranian EFL Learners

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### ABSTRACT

The purpose of this study was to compare the reported use of writing strategies of Iranian EFL learners in two different venues of technology-assisted and conventional writing classes. Overall, thirty two EFL students participated in this study, eighteen in a technology-assisted and fourteen in a conventional English class who responded to a 64-item Likert scale writing strategy inventory adapted from Wei and Chen (2004) and Griffiths and Jordan (2005). The results of the independent sample t-tests revealed that there was a statistically significant difference between the reported use of *language-related* writing strategies. The results of the paired-sample t-tests, in addition, demonstrated that just in the technology-assisted environment, there was a statistically significant difference for the constructs of *language-related* and *organization* strategies and *writing experience*. The results of this study could carry significant implications for technology-assisted writing instruction in EFL contexts.

**Keywords:** Technology-assisted writing, Metacognitive awareness, Writing strategies, EFL learners



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## INTRODUCTION

The increasing use of Information and Communication Technologies (ICT) in higher education has had a significant impact on the way we write and the genres we create (Hyland, 1996). Social theorists and literacy scholars strongly believe that the use of ICT including the Internet has changed the way in which literacy is defined in today's world (Bolter, 2001; Coiro, 2003; Isbell & Reinhardt, 2002; Marcoux&Loertscher, 2009; Singh, Mangalaraj&Taneja, 2010). Literacy, now has gone beyond "the ability to read and write" (Horning, 2004, p. 10) and has in addition embraced the skills of "being able to make sense of and navigate through several forms of information, including images, sounds, animation, and ongoing discussion groups" (El-Hindi, 1998, p. 1). The contribution of the electronic world into literacy development according to Karlsson (2002) has been discussed in terms of at least four contextual parameters: The web has brought a new technology to text-generation which enables different text structures; blurred the borders between public and private (or rather, it makes all texts globally available, whether intended or not; changes the traditional roles of readers and writers and challenges the dominant view of what writing is, and it has put new systems of meaning-making into the hands of homepage owners.

Perhaps the most immediately obvious implication of computer-based writing in a language classroom is the use of word processors. Word processing emphasizes the process rather than the product of writing, encouraging students to brainstorm ideas and move through a series of drafts to a completed version of a paper (Lam & Pennington, 1995). Hyland (1996) has summarized the potential advantages of word processors as greater development of content, improvements in quality, awareness of writing as a process, greater fluency and accuracy, increased experimentation with language, more revisions, removal of handwriting barriers, and greater motivation. The disadvantages of using word processors, nonetheless, according to Hyland (1996) include increased focus on surface features, local revisions rather than global, premature completion of work, increased plagiarism, quantity at the expense of quality, preoccupation with physical appearance, increased anxiety and decreased writer collaboration.

In addition to word processors, the increasing use of electronic mail (e-mail) in educational contexts has inspired numerous scholars to explore the implications of this specific feature of the Internet in writing courses. Generally speaking, e-mail can encourage students to use computers in realistic, authentic situations in order to develop communicative and thinking skills (Singhal, 1997). E-mail is a useful tool for writing instruction as it permits teachers to establish classroom interaction and long-distance exchanges, motivating students to concentrate on fluency and meaning while writing for a real audience and purpose (Hyland, 1996).

Several studies have illustrated the importance of careful introduction of e-mail communications into writing classes. In his case study of semester 4 students of Portuguese at a US university, for instance, Kelm (1998) described how students were required to write at least 50 lines of email messages in Portuguese every week, to anyone, about anything, but copied to the teacher. The teacher was then able to provide tactful feedback on language issues. Kelm claimed that the student work became less passive, more participatory and imaginative, and recommended further research focusing on which L2 skills students acquire while using email and which level of proficiency is needed to gain benefit. Li (2000) compared 132 e-mail texts produced by newly arrived ESL students in response to four different pre-writing task demands and rhetorical purposes – narrative, informative, persuasive, expressive – two involved interaction with peers, two did not. The texts with audience interaction had longer sentences, a consistently higher level of syntactic and lexical complexity but also a higher frequency of error.

One issue related to the notion of technology-enhanced EFL literacy development which requires to be further examined is the nature of strategy use in this particular venue. Research has demonstrated that EFL learners utilize different strategies for reading print and hypertexts (e.g., Marandi&Mokhtarnia, 2008); whether the same is true for the writing skill in two domains of technology-enhanced and conventional EFL classes is the focus of the current study. Exploring the question of whether EFL learners employ different writing strategies in two contexts of technology-assisted and regular writing classes could promise valuable potentials to shed more light on the process of EFL literacy development in today's digital world. Therefore, the research question addressed in this study included

- In what ways does the reported writing strategy use of Iranian EFL learners differ in two different environments of technology-assisted and conventional writing classes?

## METHOD

### Participants

Two intact general English classes of sophomore students majoring in Translation Studies at Azad University of Karaj took part in this study. Precisely speaking, eighteen students consisting of four males and fourteen females were grouped as Class A who were assigned technology-assisted writing assignments; and fourteen students including one male and thirteen female students were grouped as Class B who were assigned regular paper-and-pencil writing projects. Categorizing these two classes as on-line and print was done randomly.

### Instrumentation

To collect data for this study, three instruments were utilized:

1. A writing strategy inventory adapted from Wei and Chen (2004) and Griffiths and Jordan (2005).
2. A computer familiarity inventory adopted from Hedayaty (2005).
3. A Grammar test of the Michigan Test of English Language Proficiency.

Data regarding the participants' reported use of writing strategies was collected through a 64-item questionnaire adapted from Wei and Chen (2004) and Griffiths and Jordan (2005). This instrument consisted nine constructs of *researching* (W1), *planning* (W2),



supporting (W3), revision (W4), language (W5), organization (W6), content (W7), attitude (W8), and writing experience (W9). These items were concerned with the following issues.

*Researching* strategies (items 2, 7, 9, 40) aimed at tapping into the conscious decisions learners employed for seeking information which were required for completing their writing tasks. *Planning* strategies (items 1, 6, 16, 17, 18, 22, 24, 28, 46, 50) attempted to delve into techniques learners utilized for planning their writing assignments. *Support* strategies (items 3, 5, 14, 19, 23, 29, 30, 34, 38, 44, 48) referred to the process of consulting with external resources such as dictionaries, computers, teachers, and peers in order to complete their writing projects. *Revision* strategies (items 4, 15, 36, 47), on the other hand, represented possible editing techniques participants used for completing their writing projects.

*Language-related* strategies (items 10, 11, 13, 25), in addition, indicated techniques used for manipulating language elements such as grammar rules, and word choice to finish the writing tasks. *Organization strategies* (items 8, 12, 27, 31, 32, 33, 39, 42, 43, 45, 49), additionally included techniques required for establishing coherence in the written text. *Content-related* strategies (items 20, 21, 37), moreover, aimed at examining whether students attended to the content of their writing or not.

Furthermore, *attitude* questions (items 51 to 64) referred to the orientation of the participants towards writing in English in general. Finally, the questions of the construct of *writing experience* (items 26, 35, 41) pointed to whether students wrote in English for purposes other than classroom assignments or not.

This questionnaire was piloted to a small number of students similar to the main participants of this study in order to be examined for its quality and relevance. Furthermore, the content validity of the questionnaire was assessed by discussing the items with two applied linguists who were expert in teaching writing. The Cronbach alpha coefficient for this instrument in the pre-test and post-test were 0.79 and 0.77 respectively indicating acceptable reliability estimates for this instrument.

In addition, the degree of computer familiarity of the participants was determined based on their responses to a questionnaire which was originally developed and used by Eignor, Taylor, Kirsch, and Jamieson (1998, as cited in Hedayaty, 2005) to assess the degree of computer familiarity among TOEFL examinees. The questionnaire which contained 20 items concentrated on four areas of access (item 1), self-assessment of attitude and ability (items 3 through 7 and 9), and use of and experience with computers (items 2, 8, 12, 13 and 15 through 20), and use of and experience with related technologies (items 10, 11, and 14). The Cronbach alpha of this instrument at current study was 0.86.

Furthermore, In order to examine whether the participants of this study were initially homogeneous in terms of English proficiency, the grammar section of a Michigan Test of English Language Proficiency which consisted of 40 items on various grammatical points was given to the participants before the introduction of the treatment.

## Data Collection

Students of two intact general English classes took part in this study to allow the researchers to compare their reported use of writing strategies in two different venues of technology-assisted and conventional writing classes. For this purpose, class A was assigned ICT-assisted writing projects, employing Microsoft Word Processor to complete their writing projects and electronic mail to send the projects to their teacher and receive feedback from their her, whereas the other class, i.e., class B, was required to submit regular writing tasks and receive conventional print feedback. Overall, 10 sessions were held during the term where students were expected to submit 7 writing assignments on numerous conventional writing topics. On about 5 of these assignments, students were given feedback on grammatical mistakes/errors they had in their written texts. In addition, at the beginning and end of the term, a writing strategy inventory was given to the participants to examine whether significant changes occurred to their reported use of writing strategy or not following the introduction of the treatment. In addition, prior to administering the Writing Strategy Inventory, a Computer Familiarity Inventory and a grammar section of a Michigan Test of English Language Proficiency were also administered to determine their level of computer familiarity and grammar proficiency of the participants.

## RESULTS

The research question in the present study was directed towards examining the probable differences in the reported use of writing strategies of EFL learners in two venues of conventional and technology-assisted writing classes.

In order to establish the homogeneity of the participants, a series of independent samples t-tests were conducted to examine whether the participants in two classes of technology-assisted and conventional writing were initially significantly different from each other in terms of computer familiarity and grammar proficiency. As presented in Table 1, no statistically significant difference was found between these two groups; therefore, it could be concluded that these groups were homogenous.

To address the question of the current study, first, the descriptive statistics of the participants' scores on both pre-tests and post-tests of the Writing Strategy Inventory in both technology-assisted and conventional writing classes are presented to provide preliminary information on the reported writing strategies. As Table 2 illustrates, in the pretests, for both conventional and technology-assisted classes, the lowest mean belonged to the category of *researching strategies* with values of 20.02 (SD=5.70) and 19.73 (SD=7.48) respectively. The highest reported mean for both classes, on the other hand, pertained to the construct of *attitude* with values of 66.75 (SD=5.90) for the conventional class and 65.57 (SD=10.24) for the technology-assisted class.

**Table 1. Comparison of the participant's degree of computer familiarity and English proficiency in two venues of technology-assisted and conventional writing classes**

class	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	Mean Difference
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<b>Test of Computer familiarity</b>	Tech-assisted	18	65.71	13.467	3.174	.438	29	.664	2.05241
	Conventional	13	63.66	11.945	3.313	.447	27.679	.658	2.05241
<b>Grammar Test</b>	Tech-assisted	14	40.71	10.671	2.851	-.058	25	.954	-.24725
	Conventional	13	40.96	11.571	3.209	-.058	24.394	.955	-.24725

It was observed that prior to the treatment, participants in the conventional class reported a slightly higher use of writing strategies for all nine constructs of *researching, planning, support, revision, language-related, organization, and content-related* strategies as well as *attitude* and *writing experience*.

**Table 2. Descriptive statistics of the writing strategy inventory for both technology-assisted and conventional classes**

			Researching strategies	Planning strategies	Support Strategies	Revision strategies	Language-related strategies	Organization strategies	Content-related strategies	attitude	Writing experience	Total
<b>Pre-Tests</b>	<b>Tech-assisted (n=18)</b>	<b>Mean</b>	<b>19.73</b>	28.36	29.17	29.73	27.12	31.38	<b>32.72</b>	<b>65.57</b>	22.46	64.14
		<b>Std. Deviation</b>	7.486	4.841	6.759	5.652	7.149	5.963	5.834	10.245	11.078	7.164
	<b>Conventional (n=13)</b>	<b>Mean</b>	<b>20.02</b>	28.92	30.16	31.44	27.63	32.14	<b>34.41</b>	<b>66.75</b>	24.38	65.38
		<b>Std. Deviation</b>	5.703	3.593	4.867	3.870	6.188	6.462	4.468	5.901	6.692	5.321
<b>Post-tests</b>	<b>Tech-assisted (n=18)</b>	<b>Mean</b>	<b>21.06</b>	29.41	30.65	30.93	33.19	<b>36.66</b>	32.27	<b>65.47</b>	<b>27.57</b>	67.92
		<b>Std. Deviation</b>	6.506	5.165	6.005	5.050	5.233	4.920	5.827	8.960	8.040	6.126
	<b>Conventional (n=14)</b>	<b>Mean</b>	<b>19.09</b>	29.25	29.68	28.73	29.19	<b>37.26</b>	32.76	<b>68.87</b>	<b>23.95</b>	66.60
		<b>Std. Deviation</b>	5.487	4.153	3.786	5.876	4.481	5.831	5.907	6.214	7.853	4.975

Following the treatment, the reported mean of the writing strategies in the technology-assisted class (See Table 2) ranged from a low of 21.06 (SD=6.50) as pertained to the construct of *researching* strategies to a high of 65.47 (SD= 8.96) belonging to the construct of *attitude*. Likewise, in the conventional class, the lowest reported mean belonged to the construct of *researching* strategies with the value of 19.09 (SD=5.48), whereas the highest reported mean pertained to the construct of *attitude* with the value of 68.87 (SD=6.21). At this stage, contrary to the pre-tests, students in the technology-assisted class reported a slightly higher use of *researching, planning, support, revision, and language-related* strategies.

Tables 3 and 4 classify the reported writing strategies into three high, medium, and low usage category for both pretests and posttests based on an established criteria defined by Mokhtari and Reichard (2002). In the technology-assisted class, in the post test, five writing strategies (7.81%) belonged to the high usage category (means equal 3.5 or higher), 35 strategies (54.68%) fell into the medium usage category (means equal 2.5 to 3.4) and 24 of 64 reported strategies (37.5%) fell into the low usage category (mean of 2.4 or lower). In the conventional class, likewise, 6 writing strategies (9.37 %) went into the high usage category, 35 strategies (54.6 %) pertained to the medium usage category and 23 strategies (35.9 %) were related to low usage category.

**Table 3. Degrees of metacognitive awareness of writing strategies in the technology-assisted class**



Computr-assisted class		Researching St.	Planning St.	Support St.	Revision St.	Language-related St.	Organization St.	Content-related St.	Attitude	Writing experience	Total
Pre-test (n=18)	2.4 0r lower= Low	3 (4.6%)	5 (7.8%)	7 (10.9%)	1 (1.5%)	–	5 (7.8%)	1 (1.5%)	5 (7.8%)	3 (4.6%)	30 (46.87%)
	2.5-3.4= Medium	1 (1.5%)	4 (6.2%)	4 (6.2%)	3 (4.6%)	3 (4.6%)	6 (9.3%)	2 (3.1%)	8 (12.5%)	–	31 (48.43%)
	3.5 or higher =High	–	1 (1.5%)	–	–	1 (1.5%)	–	–	1 (1.5%)	–	3 (4.68%)
Post-test (n=18)	2.4 0r lower= Low	3 (4.6%)	4 (6.2%)	7 (10.9%)	–	–	1 (1.5%)	2 (3.1%)	6 (9.3%)	1 (1.5%)	24 (37.5%)
	2.5-3.4= Medium	1 (1.5%)	5 (7.8%)	3 (4.6%)	4 (6.2%)	1 (1.5%)	10 (15.6%)	1 (1.5%)	8 (12.5%)	2 (3.1%)	35 (54.68%)
	3.5 or higher =High	–	1 (1.5%)	1 (1.5%)	–	3 (4.6%)	–	–	–	–	5 (7.81)

To investigate whether there existed a statistically significant difference between 64 items of the Writing Strategy Inventory in both pre- and post-tests, a series of Mann-Whitney U tests were run. The results revealed that in the pre-test, item 18 which belonged to the construct of *planning* was significantly different from the other items ( $Z = -1.993, P = .046$ ). In the post-tests, items 1 ( $Z = -2.005, P = .045$ ), 25 ( $Z = -2.626, P = .009$ ), 54 ( $Z = -2.033, P = .042$ ), 55 ( $Z = -2.008, P = .045$ ), and 35 ( $Z = -1.998, P = .046$ ) were found to be significantly different from the other items. These items belonged to categories of *planning* strategies, *language-related* strategies, *organization* strategies, and *writing experience* respectively. The results have been presented in detail in Table 5.

**Table 4. Degrees of metacognitive awareness of writing strategies in the conventional class**

Print Class		Researching St.	Planning St.	Support St.	Revision St.	Language-related St.	Organization St.	Content-related St.	Attitude	Writing experience	Total
Pre-test (n=13)	2.4 0r lower= Low	3 (4.6%)	6 (9.3%)	6 (9.3%)	–	–	3 (4.6%)	2 (3.1%)	6 (9.3%)	2 (3.1%)	28 (43.75%)
	2.5-3.4= Medium	1 (1.5%)	3 (4.6%)	3 (4.6%)	3 (4.6%)	3 (4.6%)	8 (12.5%)	–	5 (7.8%)	1 (1.5%)	27 (42.18)
	3.5 or higher =High	–	1 (1.5%)	2 (3.1%)	1 (1.5%)	1 (1.5%)	–	1 (1.5%)	3 (4.6%)	–	9 (14.06)
Post-test (n=14)	2.4 0r lower= Low	3 (4.6%)	5 (7.8%)	6 (9.3%)	–	–	1 (1.5%)	1 (1.5%)	4 (6.2%)	3 (4.6%)	23 (35.93)
	2.5-3.4= Medium	1 (1.5%)	4 (6.2%)	4 (6.2%)	4 (6.2%)	2 (3.1%)	10 (15.6%)	2 (3.1%)	8 (12.5%)	–	35 (54.68%)
	3.5 or higher =High	–	1 (1.5%)	1 (1.5%)	–	2 (3.1%)	–	–	2 (3.1%)	–	6 (9.37%)

A series of paired samples t-tests were in addition run between the scores obtained from pre- and post-tests to see whether there was a significant difference between these two sets of scores for each technology-assisted and conventional classes. The results appeared to be significant just for the technology-assisted environment ( $t [17] = -2.414; p = .027$ ) as presented in detail in Table 6. In the technology-assisted class, the results of the paired samples t-tests happened to be significant for constructs of *language-related* ( $t [17] = -3.258; p = .005$ ) and *organization* strategies ( $t [17] = -3.618; p = .002$ ) and *writing experience* ( $t [17] = -2.531; p = .022$ ).

To compare the reported use of the writing strategies in two technology-assisted and conventional classes, a series of independent t-tests were conducted between the obtained scores.

**Table 5. Comparison of the mean scores for the items of the writing strategy inventory**



Tests	Constructs	Items	Class	Mean-rank	Sum of ranks	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Pre-tests	W2: Planning	Item 18	Tech-assisted	13.39	241.00	70.000	-1.993	.046
			Conventional	19.62	255.00			
Post-tests	W2: Planning	Item 1	Tech-assisted	13.72	247.00	76.000	-2.005	.045
			Conventional	20.07	281.00			
	W5: Language-related	Item 25	Tech-assisted	19.92	358.50	64.500	-2.626	.009
			Conventional	12.11	169.50			
	W6: Organization	Item 54	Tech-assisted	18.76	319.00	72.000	-2.033	.042
			Conventional	12.64	177.00			
		Item 55	Tech-assisted	13.75	247.50	76.500	-2.008	.045
			Conventional	20.04	280.50			
W9: Writing experience	Item 35	Tech-assisted	19.08	343.50	79.500	-1.998	.046	
		Conventional	13.18	184.50				

The results demonstrated statistically significant difference just for the construct of *Language-Related strategies* ( $t [30] = 2.280$ ;  $p = .030$ ) with the technology-assisted class enjoying a higher mean ( $M = 33.19$ ,  $SD = 5.23$ ) in comparison with the conventional class ( $M = 29.19$ ,  $SD = 4.48$ ).

**Table 6. Comparison of the mean scores of the writing strategy inventory between pretests and post-tests**

Constructs		Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	
Language-related St.	Tech-assisted	W5_PR_ST-	27.1250	18	7.14927	1.68510	-3.258	17	<b>.005</b>
		W5_PO_ST	33.1944	18	5.23321	1.23348			
	Conventional	W5_PR_ST-	27.6346	13	6.18854	1.71639	-.718	12	
		W5_PO_ST	29.2308	13	4.66309	1.29331			
Organization St.	Tech-assisted	W6_PR_ST-	31.3889	18	5.96349	1.40561	-3.618	17	<b>.002</b>
		W6_PO_ST	36.6616	18	4.92015	1.15969			
	Conventional	W6_PR_ST-	33.6591	8	6.62430	2.34204	-1.383	7	
		W6_PO_ST	36.0682	8	4.91768	1.73866			
Writing experience	Tech-assisted	W9_PR_ST-	22.4630	18	11.07853	2.61123	-2.531	17	<b>.022</b>
		W9_PO_ST	27.5741	18	8.04059	1.89518			
	Conventional	W9_PR_ST-	24.3846	13	6.69279	1.85625	.010	12	
		W9_PO_ST	24.3590	13	8.01903	2.22408			
Total	Tech-assisted	WT_PR_ST-	64.1493	18	7.16473	1.68874	-2.414	17	<b>.027</b>
		WT_PO_ST	67.9253	18	6.12655	1.44404			
	Conventional	WT_PR_ST-	65.3846	13	5.32154	1.47593	-.535	12	
		WT_PO_ST	66.1959	13	4.93234	1.36799			

Nevertheless, for the rest of the constructs, i.e., Researching, Planning, Support, Revision, Organization, and Content-related strategies and Attitude and Writing Experience no significant difference was observed.

## DISCUSSION

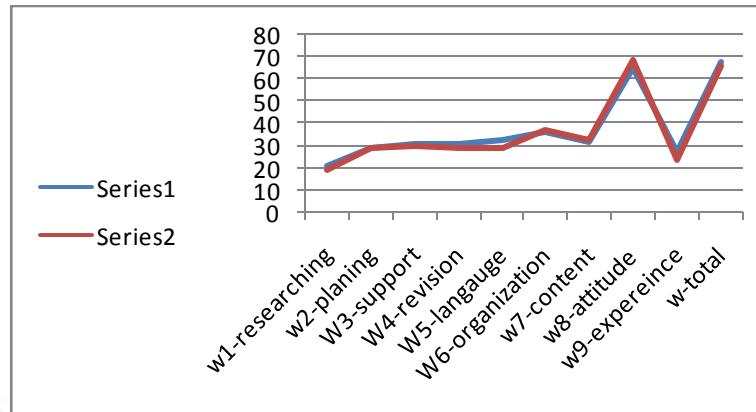
The purpose of this study was to shed light on how writing strategies employed by Iranian EFL learners in a technology-assisted classroom differed from those in a conventional setting. The results revealed that in both electronic and print mediums, the participants demonstrated a moderate awareness of writing strategies with 54% of reported strategies with a mean score between 2.5 to 3.4.

Considering the subcategories of Writing Strategy Inventory in the post-tests, the participants reported the highest mean scores for the constructs of *attitude* and *organization* in both print and electronic environments with the strategies in the conventional setting



enjoying higher values. The lowest reported mean in the post-tests, in addition belonged to *researching* strategies followed by the construct of *writing experience* in both mediums.

In the pre-tests, nevertheless, the highest means were reported for the constructs of *attitude* and *content-related* strategies in both contexts with the print setting enjoying higher means. The lowest means belonged to the constructs of *researching* and *writing experience* in both mediums with the print environment having the lower means. On the whole, the overall pattern of writing strategy use in both mediums was the same (Figure 1).



**Fig 1: Comparison of the mean scores in print and electronic mediums in the post-tests**

The results of the paired-sample t-tests conducted between the pretests and posttests in both environments revealed that merely in the technology-assisted class, there was a statistically significant difference between not only the total mean scores but also the mean scores of the constructs of *language-related* and *organization* strategies and the construct of *writing experience* with the post-test manifesting higher values. In other words, the treatment in the technology-assisted writing class had a significant impact on enhancing the metacognitive awareness of *language-related* and *organization* strategies of the participants as well as their *writing experience*.

In addition, the results of the independent sample t-tests in order to compare the reported use of writing strategies in both technology-assisted and conventional venues demonstrated that there was a statistically significant difference just for the construct of *language-related* strategies. After the treatment, the participants demonstrated greater use of *language-related* strategies in the technology-assisted writing class.

This finding is indeed in line with that of Sullivan and Pratt (1996) who found small but significant increase in the writing ability of their participants in their comparison of a computer-assisted writing class using networked computers for writing with a traditional class. These results also corroborate the findings of Robinson-Staveley and Cooper (1990) who reported significant performance differences for students who used word processing for their writing projects. Areas in which students showed gains included fewer mechanical problems, greater average sentence length, greater number of complex sentence structures, and overall higher scores on final products.

This result also agreed with the findings of Fang (2010) who demonstrated that a majority of his students benefited from using computer-mediated feedback to revise their essays. Moreover, interview data of his study revealed that the computer-mediated feedback had a positive effect on the development of their writing skill, particularly in suggesting changes for form rather than content.

Some findings of this study, however, turned out to be contrary to similar studies that examined the effects of word processing on L2 writing. Although the revision capacities of Microsoft word processor – such as spell- and grammar checking, block moving, block deleting, formatting, thesaurus, and storage of information – are maintained to have the potential to facilitate operations such as text generating, revising, and editing (Li, 2006), the results of the independent sample t-test conducted between the mean scores of the strategy of *revision* in both technology-assisted and conventional classes did not yield any significant differences. Though the mean score in the electronic environment ( $M = 30.93$ ;  $SD = 5.05$ ) appeared to be higher than that of print ( $M = 28.73$ ;  $SD = 5.87$ ). This finding is in contrast to that of Snyder (1993) who asserted that reviews of research on word processing indicated an increase in revisions, fewer mistakes, and more correction.

The current study provided some insights into the nature of writing strategy use in both electronic and print medium for EFL learners. With the rising use of ICT technologies in education, it is increasingly believed that the concept of literacy is going under dramatic changes (e.g., Reinking, 1995; Coiro, 2003). "Today, the definition of literacy has expanded from traditional notions of reading and writing to include the ability to learn, comprehend, and interact with technology in a meaningful way" (Pianfetti, 2001, p.256).

While literature on the nature of reading process in the electronic medium is rather abundant (e.g., Cobb & Stevens, 1996; Chun & Plass, 1997; Garrett, 1991; Isbell & Reinhardt, 2002; Nyns, 1988; McDonell, 2003; Son, 1997; Wang, 2005), a little is known about the nature of technology-based writing. Concerning the skill of reading comprehension, for example, Marandi and Mokhtarnia (2008) found significant differences in the metacognitive awareness of overall, problem solving, and support reading strategies for hypertext and printed-text reading processes. However, no significant difference was found for the metacognitive awareness of global reading strategies.

Regarding writing strategies, the results of the independent t-tests revealed significant differences just for *language-related* strategies in two technology-assisted and conventional classes. This finding in fact suggests that technology-assisted writing should not be treated



the same way as the conventional writing; therefore, teachers are required to provide relevant assistance regarding the requirements of this medium; as Rimor and Kozminsky, (2002) asserted that electronic environment deserves special emphasis due to the fact that it is considered an “ill defined” environment in which the strategies employed are not explicit or predefined.

An additional implication of this study could pertain to the domain of computer-based assessment of writing. With the increased influence of high-stake tests such as computer-based and Internet-based TOEFL on the academic and educational life of students, more care is needed to be paid to adequately prepare students for such important tests. According to MacArthur and Schneiderman (1986), factors such as the developmental stage of the writer, the previous exposure to computers, and the amount of keyboarding proficiency, and access to word processors over an extended period of time bear a significant impact on the success of technology-assisted writing if it is accompanied by responsive instruction.

On the whole, the application of ICT technologies in language classrooms and more specifically writing classes, in spite of difficulties such as the availability and cost-effectiveness of new technologies including the Internet connection and the willingness of teachers to apply them, bears great potentials to enhance the quality of language education including the teaching of writing skill, provided that the educationalists and curriculum developers pay due attention to the pre-requisites of such paramount decisions.

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