
Title	Impact of information technology and constructivist learning tools on the learning of written English
Author(s)	Shanti Divaharan and Philip Wong
Source	<i>ERA-AME-AMIC Joint Conference, Singapore, 4-6 September 2000</i>
Organised by	Educational Research Association of Singapore (ERAS)

This document may be used for private study or research purpose only. This document or any part of it may not be duplicated and/or distributed without permission of the copyright owner.

The Singapore Copyright Act applies to the use of this document.

IMPACT OF INFORMATION TECHNOLOGY AND CONSTRUCTIVIST LEARNING TOOLS ON THE LEARNING OF WRITTEN ENGLISH

Shanti Divaharan & Philip Wong
National Institute of Education
Nanyang Technological University
Singapore

Abstract: The objective of this research study was to determine whether the introduction of IT-based writing activities in a constructivist classroom setting improves students' written English. The research involved students from three streams, namely the Express stream, Normal Academic [N(A)] stream and the Normal Technical [N(T)] stream. A total of 103 students from the secondary level were involved in this research study. 37 students were from the Express stream, 38 from the N(A) stream and 28 from the N(T) stream. The research was conducted using a survey data sheet, a questionnaire and classroom observations. The research study was conducted in three stages: (1) Pre-intervention stage (no IT-based writing tools were introduced). (2) Intervention stage I (IT-based writing tools were introduced with scaffolding). (3) Intervention stage II (IT-based writing tools with no scaffolding). The findings of the study imply that using IT-based writing tools does improve students' written English in the various grammar components. Improvement was also evident in the students' final written product. Within the three streams, the N(A) stream saw the greatest improvement. In addition to contributing to the improvement of the students' written English, the constructivist classroom setting has helped students to become independent learners.

Introduction

The purpose of this study is to combine IT in the form of word processing software and constructivist learning tools in a novel way to initiate a conducive and productive learning environment. Such a conducive learning environment would enable them to overcome the basic pedagogic problem in written expression – i.e. handwriting and on the higher-level, revising skills - which is the complex and tedious but pedagogically essential task of continuous revision of their written work using the old pen and paper technology. The objective of this research paper is to ascertain whether:

1. IT-based word-processing software combined with constructivist learning tools enhance students' written English compared to the traditional method;
2. Students have wholly internalised the prior learning skills and ability needed to write fluently using computers and are then to transfer this learning to another given writing scenario (i.e. develop on independent writing capability); and that
3. There is a significant trend and impact of using IT and constructivist learning tools within the various educational school streams [namely Express, Normal (academic) and Normal (Technical)].

Background

Problems in Writing

Very few students are truly enthusiastic writers. In addition to their lack of motivation, students have to juggle with some essential components of written expression that are important for fluent construction of sentences (*Gupta, 1998*). Handwriting, capitalization and punctuation, spelling, vocabulary and word usage, sentence structure and paragraph structure and production and quality are the main components in written expression (*Bradley-Johnson & Lesiak, 1989*). These components can be further divided into two main groups. The first is the lower order writing skills consisting of handwriting, spelling and, capitalisation and punctuation. Handwriting is important because good, neat and legible handwriting makes reading easier giving rise to less miscommunication. In addition, illegible handwriting would frustrate the reader, thus making the reading task a chore. If capitalisation and punctuation are not mastered, then the reader may misunderstand the intended meaning. Also, correct spelling is an important component to consider as the reader must be able to easily read and understand the words written by the writer. The second is the higher order writing skills consisting of vocabulary and word usage, sentence structure and paragraph structure and, production and quality. Vocabulary and word usage are essential to convey appropriate and concise meanings of the intended message. Similarly, sentence and paragraph structures are extremely critical, as they provide clear organisation that makes it easy for the reader to comprehend the intended meaning. Of significance to the eventual assessment and grading of English language writing tasks are the production and quality components of English language written expression. Production and quality issues are imperative factors in the communication of a meaningful message.

It can thus be inferred that pen and paper writing mediums are not as flexible and, hence, do not meet some of the higher order writing skills requirement to teach writing (*Flower & Hayes, 1981*). In order to teach writing, some level of flexibility is needed for the students to organise, review and present their ideas without having to worry about the arduous and cumbersome task of correcting it on paper. A tool, like the word processor, is a welcome change as it provides flexibility and permanence with its reflective learning capability and quality compared to the use of paper and pen (*Coombs & Smith, 1999*).

Arresting the Problem in Writing

Use of IT in a Constructivist Classroom Setting

Constructivism argues that learners should be constructors and producers of personal knowledge rather than receivers and repeaters of inert, or transmitted, knowledge. When learners actively construct knowledge, it is more meaningful, applicable and memorable (*Jonassen, 1996*). A classroom learning environment infused with IT-rich resources provides a wider scope and opportunity for active learning rather than the traditional classroom. There is instant access to a greater wealth of information (*Perkins, 1996*). Hence, students are given the opportunity to take increased responsibility for their own learning. Better effects can be reaped by incorporating Information Technology (IT) as an integral component of the curriculum combined with "traditional" print materials used as a complement to computer-based information. Although constructivists differ in their views as to how much scaffolding should be provided, teachers involved in this study scaffolded students

learning by explaining, verifying and clarifying their understanding, encouraging student participation and modeling desired behaviours to induct students into a constructivist classroom learning environment.

Benefits of Using Word Processor as Writing Tool

The benefits of incorporating IT into a constructivist classroom environment does not suggest that traditional classroom tools such as pencils, notebooks and texts are not important. However, it must be noted that these tools are inadequate for learning tasks that require children to create, assemble and modify ideas. IT can be used as an aid to solve this problem by providing flexibility and fluidity (*Perkins, 1996*), through its non-linearity and its ability to facilitate revision, expansion and correction anytime between conception of the writing task and delivery (*Underwood & Underwood, 1990*).

Opportunity to Concentrate on Higher Order Writing Skills

One of the benefits of using the word processor as a writing tool is that it appears to be of greater benefit to the lower ability students. Gupta (*1998*) and Cochran-Smith, Kahn and Paris (*1990*) claim that computers support some of the multiple processes in writing such as letter formation and spell checking. This enables students to fully concentrate on generating and expanding ideas. An obvious visual benefit gained from the use of a word processor is that presentation dramatically improves, freeing students from worrying about the lower order writing skills because these are supported through the use of a word processor. However, to be cautious, there are some doubts about enthusiastically attributing such praises to the 'prowess' of the word processor. Although consistent results suggest that students write longer texts, (*Daiute, 1986*) evidence suggests that they add texts at the end rather than attempt to revise their existing texts.

Nonetheless, research results are predisposed to the fact that writing using computer-aided word-processing tools does have positive results for lower-ability students. Findings from a study conducted by Gupta (*1998*) illustrated that there was significant improvement in the area of spelling albeit not perfect. The choice of vocabulary of the students became more sophisticated and varied. Significant improvement was seen in the sentence structure and overall organisation of the composition. The only area that remained unaffected was grammar. Gupta (*1998*), and Parker and David (*1983*) attribute the significant improvement in students writing abilities to the editing facilities and utilities available in the word-processor used.

Ease of Revision

In addition, the fluidity of the word processor as a writing medium supports and promotes the task of drafting and re-drafting to produce a more successful written piece of work (*Perkins, 1996; Parker & David, 1983*). It is an obvious fact that the written piece normally goes through various stages of drafting before it is perfected and ready for presentation (*Underwood & Underwood, 1990*). In the short time given to them, clearly, drafting and re-drafting can be an arduous task in a traditional pen and paper classroom setting. Therefore, students tend to circumvent and avoid this essential re-drafting task.

Graves' and Haller's (*1996*) findings indicate that by the end of the first year of introducing IT-based learning environment, writing skills, especially in the area of

development, organisation and clarity improved. There were also notable and significant improvements in peer revising and editing aspects of the writing tasks.

Promotes Collaborative Learning

Contrary to popular belief, computers also have the potential to encourage group discussions (*Jonassen, Peck & Wilson, 1999; Bruce, Michaels & Watson, 1985*). Peer review helps students to develop their compositions, especially when they give feedback to their fellow student writers about their written work. They can also learn about how to improve their work and think more critically (*Reid, 1993*). Text on the screen as opposed to text on paper provides opportunities for discussions about grammar, syntax and style (*Parker & David, 1983*). The general trend is for students to move towards taking greater charge of their own learning (*Perkins, 1996; Parker & David, 1983*).

As Joe M. Peters (*1996*) claims that “The use of word processors ... in the classroom can help organise student activity and scaffold the cognitive and social processes involved in students’ literacy practice (Moller, 1993). Today’s technology and technologies of the future are student-centered and designed to facilitate instruction through interactive mediation processes. The use of these technologies promotes social processes that are considered necessary in students’ development. The computer becomes a mediation tool that acts as a more competent peer, allowing for internalisation of information and development of tools for future learning.”

The Study

The study was conducted in a new co-educational secondary school. Since it is a new school, the student population is from only one level.

Sample

The students are from secondary one Express, Normal Academic and Normal Technical streams. Both male and female students were included. There were 37 students from the Express stream, 38 from Normal Academic stream and 28 from Normal Technical stream. A total of 103 students participated in this study. The students in each of the streams and classes are of mixed abilities, as they were posted to their classes by random assignment. The sample consists of students from the various racial groups with the proportion of Chinese students more than the Malay students and the minority group being the Indian students.

Procedure

The study was conducted after the students had been in the school for about six months. The wait time was to allow for students to comfortably settle into the new learning environment and to get to know their classmates for a better interactive learning environment. During the six-month wait period, the students attended the essential prior learning training sessions for the prescribed computer course, where they received training in the basic word-processing and presentation tools. A needs analysis indicated that majority of the students have not had any form of exposure to using the word-processor for actual writing assignments. The actual study was carried out in the following manner.

Table 1
Stages of the Study

<i>Description</i>
Stage I: Pre-Intervention stage: This stage features a non-IT based classroom setting. Word-processing or scaffolding was not introduced in this stage. This stage is characterised by the traditional classroom teaching method.
Stage II: This stage features an IT-based English lesson. The word-processor was introduced at this stage as a writing tool. Scaffolding was used as a teaching strategy to complement the constructivist classroom teaching and learning environment introduced at this stage. The types of scaffolding that were applied at this stage of the study are clarifying doubts, providing guidelines, inviting student participation, offering explanations and verifying student understanding.
Stage III: This stage features the continued use of the word-processor as a writing tool with constructivist teaching methods in the classroom. However, scaffolding support was removed.

The data was collected using two instruments. The Analysis of Students' Language Ability by Teachers (ASLAT) has six main components, all of which are an integral aspect of writing. The various components are preposition, articles, subject-verb agreement, tenses, format and vocabulary. The teachers were required to mark the students written work and to assess the students' potential in these areas using a rating scale of 1 to 5. 1 being poor and 5 being very good.

The Students' Attitude towards IT-based English (writing) Lessons (SAIEL) was designed with the aim of determining students' attitude towards an IT-based learning environment, especially for IT-based English writing lessons. The questionnaire was given to students in stages coinciding with the end of the various stages of the study. A reliability test was conducted for the questionnaire. Since the coefficient alphas range from 0.66 to 0.89, i.e. $0.66 < \alpha < 0.89$, then, the instrument is considered to have high internal consistency reliability (Aron & Aron, 1997; Huch & Cormier, 1996).

Data Analysis

The data collected was analysed using Microsoft Excel Spreadsheet programme and the statistics was obtained through the SPSS (® SPSS, Inc.) ver 9.0 programme. Descriptive statistics was applied and the mean, standard error and range were derived from the analysis. In addition, a paired t-test was conducted for pre-intervention and intervention stage I, and for intervention stage I and intervention stage II. The t-test was conducted to see if there was any significant improvement in the students' written English using the word-processor in the following grammar components: preposition, articles, subject-verb agreement, tenses, format and vocabulary.

Results

The following tables show the summary of results derived from the ASLAT survey data sheet, summary of the results of the paired t-test and the summary of results from the SAIEL questionnaire. The results have been presented for all the three streams.

Table 2
Summary of Results of Paired Samples t-test for the Express Stream

<i>Grammar components</i>	<i>Significance (2-tailed)</i>	
	<i>Pre-intervention & Intervention (I)</i>	<i>Intervention (I) & Intervention (II)</i>
Preposition	.324	.160
Articles	.711	.487
Subject-verb Agreement	.822	.014*
Tenses	.661	.006*
Format	.048*	.003*
Vocabulary	.110	.000*

At 0.05 significance level, it can be seen that that the significant results can be detected for intervention stage II in the areas of subject-verb agreement (p=.014), tenses (p=.006), format (p=.003) and vocabulary (p<.001).

Table 3
Summary of mean results for the six focus area [SAIEL] [Express]

<i>Focus areas</i>	<i>Pre-Intervention</i>	<i>Intervention 1</i>	<i>Intervention 2</i>
Attitude	3.24	3.84	4.08
Understanding task	3.96	4.00	4.04
Peer revision	3.60	4.00	3.56
Enjoyment	3.00	3.84	3.96
Format	3.68	3.72	3.88
Spelling	3.40	4.08	4.36

From the table, it can be deduced that all the focus area had a higher mean for intervention stage II as compared to the pre-intervention stage, with the exception of peer revision.

Table 4
Summary of results of paired-samples t-test for the N(A) stream

<i>Grammar components</i>	<i>Significance (2-tailed)</i>	
	<i>Pre-intervention & Intervention (I)</i>	<i>Intervention (I) & Intervention (II)</i>
Preposition	.000*	.011*
Articles	.000*	.000*
Subject-verb Agreement	.000*	.002*
Tenses	.023*	.003*
Format	.000*	.090
Vocabulary	.003*	.000*

At 0.05 significance level, it can be seen that significant results can be detected for intervention stage I in the areas of preposition (p<.001), articles (p<.001), subject-verb agreement (p<.001), tenses (p=.023), format (p<.001) and vocabulary (p=.003). Significant results are also evident for intervention stage II in the areas of preposition (p=.011), articles (p<.001), subject-verb agreement (p=.002) and vocabulary (p<.001).

Table 5

Summary of mean results for the six focus areas [SAIEL] [N(A)]

<i>Focus areas</i>	<i>Pre-Intervention</i>	<i>Intervention (1)</i>	<i>Intervention(2)</i>
Attitude	3.40	4.08	4.40
Understanding task	3.96	3.96	4.32
Peer revision	3.68	3.64	4.08
Enjoyment	2.72	4.08	4.36
Format	3.64	3.72	4.12
Spelling	2.88	4.56	4.48

From the results presented, it can be inferred that the mean for intervention stage II was higher for all the six focus areas when compared to the pre-intervention stage.

Table 6

Summary of results of paired-samples t-test for the N(T) stream

<i>Grammar components</i>	<i>Significance (2-tailed)</i>	
	<i>Pre-Intervention & Intervention (I)</i>	<i>Intervention (I) & Intervention (II)</i>
Preposition	.787	.018*
Articles	.787	.355
Subject-verb Agreement	.109	.047*
Tenses	.003*	.259
Format	.005*	.003*
Vocabulary	.002*	.059

At 0.05 significance level, it can be seen that significant results can be detected for intervention stage I in the areas of tenses ($p=.003$), format ($p=.005$) and vocabulary ($p=.002$). Significant results are apparent for intervention stage II in the areas of preposition ($p=.018$), subject-verb agreement ($p=.047$) and format ($p=.003$).

Table 7

Summary of mean results for the six focus area [SAIEL] [N(T)]

<i>Focus areas</i>	<i>Pre-Intervention</i>	<i>Intervention (1)</i>	<i>Intervention (2)</i>
Attitude	3.63	4.25	4.44
Understanding task	3.94	4.19	4.13
Peer revision	3.38	3.81	4.06
Enjoyment	3.38	4.13	4.38
Format	3.75	4.00	4.25
Spelling	3.25	4.06	4.19

It can be deduced that the mean for the six focus areas is higher for intervention stage II when compared to the mean results of the pre-intervention stage.

Table 8

Summary of performance by streams (Average mean score)

<i>Stages of intervention</i>	<i>Pre-intervention</i>	<i>Intervention (I)</i>	<i>Intervention (II)</i>
Express Stream	3.57	3.66	3.91
Normal Academic stream	2.75	3.46	3.81
Normal Technical stream	3.01	3.26	3.40

The average mean scores for the various streams does indicate that there was improvement at intervention stage I and intervention stage II. A strong impact can be seen for the Normal Academic stream as compared to the Express and Normal Technical streams.

Conclusion

The focus of this paper is to study the impact of Information Technology (IT) and constructivist learning tools on the learning of written English. Specifically, the research study was conducted to ascertain whether IT and constructivist learning tools and procedures enhance students' written English compared to the traditional method; students have internalised the ability needed to write using computers as tools and are able to apply it to another given scenario; and, there is a trend in the impact of IT and constructivist learning tools within the various streams tested.

The findings of the study suggest that the use of the word-processor in a constructivist classroom environment does improve students written English ability. The Express stream students not only welcomed the new medium of writing but also enjoyed using it. The findings strongly suggest that students felt encouraged to improve their writing, thus reflecting an improvement in their writing ability. The Normal Academic stream students adapted quickly to the new medium of writing and, thus, improvement in the quality of their writing was reflected during Intervention stage I. The quality of writing improved for the Normal Technical students as well. The analysis of the findings thus leads to a conclusion that students from all the three streams benefited from the introduction of the new medium of writing.

In addition, the findings imply that the students are able to successfully learn through a constructivist learning environment. They became independent learners who were able to take responsibility for their own learning. However, scaffolding should have been removed more gradually for the Normal Academic and Normal Technical students, in order to better study the impact of a constructivist learning environment. However, this was not possible due to time constraint and led to the interesting results obtained in this unique study of this kind of problem. Although students from all the three streams benefited from using the new learning environment and the new medium of writing, the findings suggest that the Normal Academic students benefited the most. This implies that a combination of the word processor and constructivist learning environment is of greater benefit to the weaker students drawn from the Normal Academic and Normal Technical stream than that of the Express stream students.

There are other possible areas of research, which stem from the experience of this research study. Future research could focus on 'comfort level' of the students in using new writing mediums as well as analysing the quality of writing produced. However, future research needs to be done over a much longer time frame.

Reference

- Bradley-Johnson, S., & Lesiak, J.L. (1989). *Problems in Written Expression: Assessment and Remediation*. NY, USA: The Guilford Press.
- Bruce, B., Michaels, S., & Watson-Gegeo, K. (1985). How computers can change the writing process. *Language Art*. 62, 143-149.
- Cochran-Smith, Marilyn, Kahn, J., & Paris, Cynthia L. (1990). Writing with a felicitous tool. *Theory into Practice*. 29, 235-245.
- Coombs, S.J., & Smith, I.D. (1999). Integration of critical and creative thinking skills into Singapore's IT postgraduate teacher training programme. *Change Transformations in Education Journal*. 80-92, 2(2), November, 1999.

- Daiute, C. (1986). A case study of collaborative writing. In J.Hartley (Ed.), *Technology and writing*. London: Jessica Kingsley Publishers Ltd.
- Flower, L., & Hayes, J. (1981). A cognitive process theory of writing. *College Composition and Communication*. 32, 365-387.
- Graves, G., & Haller, C. (1996). The effect of Secondary School Structures and Traditions on Computer-Supported Literacy. In C.L. Selfe & S.Hillgoss (Eds.), *Literacy and Computers: The complications of Teaching and Learning with Technology*. (2nd ed.). NY: The Modern Association of America.
- Gupta, R. (1998). Writing with a different tool. In C.S. Ward & W.A. Renandya (Eds.), *Computers and Language Learning*. Singapore: SEAMEO, Regional Language Centre.
- Jonassen, D.H. (1996). *Computers in the classroom: Mindtools for critical thinking*. Columbus, OH : Merrill/ Prentice-Hall.
- Jonassen, D.H., Peck, K.L., & Wilson, B.G. (1999). *Learning with Technology. A Constructivist Perspective*. New Jersey, USA: Prentice-Hall.
- Parker, R.P., & David, F. A. (1983). *Developing Literacy: Young children's use of Language*. Newark, Del: International Reading Association.
- Perkins, D.N. (1996). Foreword. In B.G. Wilson (Ed.), *Constructivist learning environments*. Englewood Cliffs, NJ: Educational Technology Publications.
- Peters, J.M. (1996). Vygotsky in the future: Technology as a Mediation Tool for Literacy Instruction. In L.Dixon-Krauss (Ed.), *Vygotsky in the classroom. Mediated Literacy Instruction and Assessment*. New York, USA: Longman Publishers.
- Reid, J.M. (1993). *Teaching ESL writing*. Englewood Cliffs, NJ: Regents / Prentice Hall.
- Underwood, J.D.M., & Underwood, G. (1990). *Computers and Learning. Helping Children acquire thinking skills*. UK: Basil Blackwell.