

USE OF COMPUTERS IN THE TEACHING OF ESL WRITING: EFFECTIVENESS OF TEXT ANALYSIS AND WORD PROCESSING

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This paper offers an assessment of the utility and effectiveness of text analysis and word processing in ESL composition. It includes a review of previous findings and a discussion of an investigation conducted by the authors on computer-assisted composition tutorials involving four non-native university students. In the investigation, two of the students revised their compositions based on surface-oriented feedback from a text analysis program reinforced by a tutor, and the other two revised according to an approach combining word processing and process-oriented input from the same tutor. The students using the text analysis program and receiving exclusively surface-oriented feedback produced a higher proportion of short sentences, shorter drafts, and fewer meaningful revisions than the students receiving process-oriented feedback. The findings of this and other investigations are reviewed in a context which addresses the nature of ESL writing and of these two different computer-assisted media. Focusing on questions of purpose, suitability, potential outcomes, and term of results, the authors conclude that use of word processing seems justified as a medium for enhancing the creative revision process of ESL students, while use of text analysis with this same population of students is less obviously justified.

INTRODUCTION

The field of computer-assisted learning has changed greatly since the late 1950's and early 1960's, when it first received trials on the campuses of several major universities in the United States. In the preface to a recent book overviewing this field, Pennington (1989) describes the early educational applications of the computer as intended "to maximize efficiency by standardizing and mechanizing the learning process" in order "to 'correct for' individual learner tendencies which make humans less than perfectly efficient information processors—in a sense, attempting to make learning 'learner-proof' (and 'teacher-proof')" (p. vii). These early instructional applications of computers, which perpetuated a once respectable but now repudiated behaviorist tradition, are generally unacceptable to teachers trained in the

educational humanism of the last two decades, with its emphasis on individual creativity and on learning as a process and not only as an end-stage.

In order for computer-assisted instruction to be justifiable in the present era, it must be consistent with principles of learning and instruction derived from the educational humanism that is the philosophical base of the modern curriculum. Hirvela (1989) expresses extreme skepticism regarding computer-assisted instruction, arguing that there is little in the medium that can be viewed as humanistic. Stevens (1989), on the other hand, describes a historical transition away from behaviorism in computer-assisted language learning (CALL) and towards uses of computers in the classroom that are consistent with humanistic goals such as learner creativity, individualization of learning, and facilitation of peer interaction in the classroom. Wyatt (1989) describes collaborative and facilitative uses of the computer in reading instruction that move the medium away from traditional behavioristic modes of instruction and towards "evolutionary" and "revolutionary" applications that encourage increasing user control, freedom of choice, and new types of learning experiences.

Many authors warn of potential dangers in the rush to adopt computer media. Hirvela (1989) warns of the danger "of language teachers becoming not only computer enthusiasts but hard-core zealots committed to the holy cause of CALL" (p. 304). Leech and Candlin (1986) say "we have to be wary of dangers which may arise from a naive or addictive enthusiasm for CALL, if it is allowed to develop without critical scrutiny" (p. xi). Educators must guard against a tendency to indiscriminately adopt whatever computer-based tools happen to be available in a particular area of instruction, then adjusting their goals and curriculum to suit the courseware. Uses of computers in education, like uses of other media and materials, must be decided based on a general review of their consistency with sound educational principles. And the use of courseware in an educational program should answer to the curriculum rather than the other way around. Decisions about computer use in educational curricula should also be based on the success or failure of approaches already implemented.

The present paper makes a contribution to the discussion of appropriate uses of computer-based aids with ESL students. Focusing on computer-based writing aids, it draws on research and theory in writing and related areas to

assess the effectiveness of word processing (WP) and text analysis (TA). Computer-based writing aids have been among the first of the newer generation of computer applications to gain widespread trials and a relatively high degree of acceptance within the educational community. Yet significant questions remain about the effectiveness of different kinds of aids in writing instruction and about the best ways to apply them in a writing curriculum. There is a growing but still small body of literature on the use and effectiveness of computer-based writing aids. Most of the published studies compare the effectiveness of word processing to that of ordinary, non-technological writing aids in the writing of native speakers of English (for representative studies and discussion, see Harris, 1985; Daiute, 1986; Lutz, 1987; Phinney, 1989). Only a small number of studies have so far been published which examine the use of computer aids by ESL students (for an overview, see Phinney, 1989), or which compare different approaches to computer-assisted instruction (Daiute, 1986; Wresch, 1987).

The paper begins with an overview of previous research and a discussion of the nature of these two types of software. The discussion then focuses on a study conducted by the authors comparing the effectiveness of TA and WP in developing ESL student writing at university level. The study found that two WP subjects, who received process-oriented guidance from a tutor, produced more meaningful revisions, in both quantitative and qualitative terms, than two TA subjects, whose work at the computer was guided primarily by feedback from the computer program. In the next part of the paper, the differential effectiveness of these two types of programs for training ESL writing is explored, and questions related to future research and practice with computer-based writing aids are addressed. It is concluded that while WP can readily be incorporated into the prevailing process-oriented writing curriculum, caution and skepticism are warranted in considering the use of TA to train ESL composition.

BACKGROUND ON TA and WP APPROACHES

To date, computer-assisted writing has received mixed reviews. A comprehensive overview of studies of computer-based writing aids (Phinney, 1989) indicates that their effectiveness in training composition students depends on the type of student working at the computer, the particular use to

which the computer is put, and other aspects of the setting in which the computer is used. Much of the research conducted on the utility of computer-assisted writing has focused on the amount and kinds of revision encouraged by WP. Several studies (e.g., Collier, 1983; Daiute, 1984; Lutz, 1987) found an increase in revision, but no increase in quality, associated with the use of WP in contrast to pen-and-paper revision. The findings of other studies (e.g., Harris, 1985; Daiute, 1986) were negative, as writers using WP revised less than writers using traditional means.

In spite of certain negative findings,¹ researchers generally agree that the act of revision itself is facilitated by WP, as "writers can insert, delete, and substitute text with an ease hitherto unknown" (Hawisher, 1987, p. 145). An overview of the studies showing positive effects indicates that WP:

- made revision easier, resulting in more and different types of revisions;
- altered revision behavior and increased time spent writing;
- overcame blocking and allowed students to be objective about their writing; and
- improved attitudes toward writing. (Phinney, 1989, p. 84)

There is also general agreement about certain attitudinal benefits of WP over traditional approaches to composition, as Phinney (1989, p. 87) concludes:

Improvement in the affective factors of attitudes toward English and toward writing, motivation to write, time spent writing, and perceptions about one's writing behavior appear to be the major benefits of computer-assisted writing. For second language students, the computer also appears to reduce the fear of errors and to reduce worries about legibility.

WP has not in all studies produced improvements in quality of writing or in quantity of revision. Nevertheless, WP provides benefits which are consistent with, and which may under favorable circumstances help to

¹ We will return to the question of mixed results for word processing and attempt to provide explanations for these below, in the section "Assessment of the Effectiveness of WP and TA in ESL."

implement, several goals of a process approach to composition (Murray, 1980; Taylor, 1981; Zamel, 1982; Urzúa, 1987) such as:

- promoting a positive attitude towards writing and building confidence in one's own writing;
- writing regularly and frequently; developing a piece of writing in stages, through successive drafts.

Computer-based TA is a more product-oriented computerized writing aid that has attracted some initial interest and research at universities (see Smith, 1989, for an overview). While WP is used to construct a piece of writing on-line, i.e., as the user works at the computer terminal, computer-based TA is accomplished on a finished draft after it has been generated through word processing. Computer-based TA analyzes the frequency and the distribution of certain items in a text and provides advice to the user for improvement, using the special attributes of the computer and some sophisticated programming routines. At the time of McDaniel's 1987 bibliography of computer-based writing aids (McDaniel, 1987), over two dozen such programs were widely available. There are surely many more TA programs in widespread use at the present time.

The most basic of these TA programs provide the user with a report of the number of words, sentences, and paragraphs in a text. Such programs are likely to be of little value in composition instruction but may provide useful comparative information to teachers and researchers. The more sophisticated type of TA program, or set of programs, offer an analysis of natural language in terms of grammar, punctuation, word choice, sentence length and variety, as well as descriptive counts of number of words, sentences, and paragraphs of a text. The most advanced of these TA programs—which require the power of a mainframe computer—parse sentences, analyzing individual sentences to discover which parts of speech are filled by the words that occur in a particular context. These advanced TA programs have been designed specifically to assist writers, though they also provide valuable comparative data for research or assessment purposes.

TA programs are one type of program in the larger category of writing analysis programs that includes outlining programs, "idea generators" and

“process-prompting” programs of various kinds (for descriptions of the different types of writing analysis programs, see Phinney, 1989; Wresch, 1988). One of the best available sets of programs in this larger category of writing analysis tools is Wresch’s *Writer’s Helper* software, published by Conduit. As Wresch (1988) points out, there are several different motivations for applying computer analysis to student writing. First, such analysis can help teachers improve “students’ knowledge of standard conventions in spelling, punctuation, and grammar” (p. 13). Second, use of writing analysis programs in school can help prepare students for using them in business, where they are currently popular, according to Wresch. Third, Wresch believes that these programs can foster students’ independence from the teacher—“perhaps a sufficient reason for using writing analysis programs in itself” (p. 13). However, as will be seen below, the first and third of these motivations for use of writing analysis programs may not in fact be applicable to the use of TA programs with ESL students. The second motivation is also of doubtful utility for ESL students—or others—who are not bound for business careers.

The best known and most complex TA programs are Bell Laboratories’ *Writer’s Workbench* and IBM’s *Critique*. In spite of the considerable enthusiasm that these programs often inspire in teachers new to the computer medium (see, for example, Kiefer and Smith, 1983; Reid and Lindstrom, 1983; Reid, 1986; Kiefer, 1987; Creed and Kau, 1988), they both have inherent limitations from the perspective of writing pedagogy. First of all, even the most sophisticated programming has not succeeded in eliminating significant types and numbers of errors in the analysis routines of the larger TA programs. Massive programs such as *Writer’s Workbench* and *Critique* not infrequently misanalyze sentences, thus offering incorrect feedback to the user.²

A second limitation of these programs involves the restricted choice of linguistic features that have been programmed in as the focus of the computer’s analysis of written texts. The *Writer’s Workbench* programs are grouped into three subsets of programs called *Proofreading*, *Style* and *Organization* (Cherry et al., 1983). The *Proofreading* programs check for errors

² Dr. Robert Chandler (personal communication, 1988), who has used *Critique* with his composition classes at the University of Hawaii, estimates that it is 15-25% inaccurate in its analyses. In the first author’s informal tests of *Writer’s Workbench*, using famous pieces of writing, the programs were found to be grossly inaccurate in at least 30% of the analyses, frequently misclassifying words and phrases as belonging to an incorrect grammatical category.

in spelling and punctuation, consecutive repetitions of lexical items, faulty phrasing, and split infinitives. The *Style* programs offer statistical analyses of the text, primarily in terms of readability indices. It also highlights abstract words and underlines all occurrences of *be* verbs. In this way, the programs flag such constructions as nominalizations, passives, and expletives, which *Writer's Workbench* advises the user to consider eliminating. The *Organization* programs provide an outline of a piece of writing by displaying only headings and first and last sentences of paragraphs.

Critique, which makes use of powerful routines for parsing sentences (Creed and Kau, 1988), represents an improved approach to TA (Smith, 1989) and appears to make fewer errors in its analyses than does *Writer's Workbench*. In these respects it is an advance over the Bell Laboratories program. However, the types of feedback offered to the user do not represent a radical departure from the types of analyses provided by *Writer's Workbench*. In addition to flagging possibly misspelled words, sentence fragments, and missing punctuation, *Critique* offers prescriptive advice—e.g., on length and complexity of sentences—and summative analyses of several types, including: readability level, number and length of sentences and paragraphs, and number and percentage of sentences of various types —e.g., simple, complex, active, passive, short (fewer than 11 words), long (more than 24 words).

The analyses of these TA programs offer feedback to the user in three areas:

- (a) surface-level errors, or editing concerns (e.g., the *Writer's Workbench Proofreading* programs);
- (b) a select group of prescriptive concerns (e.g., passive voice, "long" sentences);
- (c) global characterizations of a piece of writing (e.g., number of words and average length of sentences and paragraphs, general organization of sections and paragraphs).

Thus, it seems fair to say that the major TA programs are oriented away from writing process and towards written products and their characterization in terms of certain prescriptive and descriptive conventions. In general, the emphasis is on end-stage and surface-level concerns, rather than on early- or middle-stage writing concerns involving meaning and generation of ideas. It is

important to keep these inherent limitations in the design of TA programs in mind when assessing their potential utility in writing instruction.

The bulk of the published research exploring computer-based TA has come out of work at Colorado State University with native English speakers (Kiefer and Smith, 1983; Kiefer, 1987) and ESL students (Reid, Lindstrom and Larson, 1983; Reid, 1986) using *Writer's Workbench*. Though computer-based TA is clearly a surface-oriented approach to instructing composition, Kiefer (1987, p. 25) claims that the use of computer-based TA may encourage writers to go beyond surface-level editing to make "deep" content revisions, such as changes in meaning, focus, and voice. However, in Kiefer's (1983) study and in other studies conducted at Colorado State University, students received feedback from *Writer's Workbench* as well as from instructors and/or peers. It is therefore difficult, if not impossible, to isolate the effect of the computer-based TA on the subjects' writing—a fact that the researchers themselves admit (Reid, 1986, p. 173; Kiefer, 1987, p. 75).

The utility of computer-based TA in the writing curriculum is thus still open to question, and additional research is needed to isolate the effects of this medium on students' writing. Studies comparing the effect of TA when used as a stand-alone medium and when used in conjunction with human feedback would be valuable. It would also be of value to directly compare the effects of the mainly product-oriented medium of TA to the mainly process-oriented medium of WP. In this way, the special features of TA can be set in sharper relief against any effects in student writing that may be due to the nature of WP and to other process-oriented aspects of the writing curriculum. The study described in the next section is a first attempt to accomplish this differentiation of TA from WP and process-oriented approaches to writing.

A COMPARATIVE INVESTIGATION OF THE EFFECTIVENESS OF TA AND WP

One study examining the effects of TA and WP in ESL instruction was conducted at the University of Hawai'i (for detailed reports, see Brock, 1988; Pennington and Brock, forthcoming). In this study, two contrasting approaches were employed in individual tutorials with two groups of university students.

Each group contained one Chinese and one Korean male student who had volunteered for the study and who were taking an ESL section of freshman composition concurrently. The subjects, who were randomly assigned to the two groups, were closely matched in writing ability, according to an evaluation of their writing based on an analytic scoring instrument administered just prior to the period of the study. The first approach centered on use of *Critique*, while the second approach implemented a process approach using WP without TA. The TA students received strictly product-oriented, surface-level feedback matching the emphasis of the *Critique* program and centering on the machine-generated feedback. In sharp contrast, the WP students received process-oriented feedback. All students used the same word processing program to generate text, and all were exposed to weekly individual tutorial sessions of approximately equal length conducted by the second author at the computer terminal.

The following research questions guided the study:

- (1) Do the drafts in the two groups differ in length or overall structure?
- (2) How do the revisions made by the two groups compare?
Specific questions of interest drawn from previous research with TA programs are the following:
 - (a) Do the TA subjects edit more thoroughly than those subjects not exposed to the type of feedback provided by TA?
 - (b) Do the TA subjects increase their independence in editing through use of the program?
 - (c) Do the TA subjects go beyond surface-level editing to make revisions affecting content or ideas?
- (3) What attitudes are exhibited by the subjects towards their experiences with the computer?

Over a period of nine weeks, subjects in the study wrote three drafts of three compositions on self-selected subtopics of the general theme "World Problems and Solutions." All drafts were written using WP during the sessions with the tutor, and drafts were later analyzed based on a hand-coding of types of revisions and a computer analysis provided by the TA program, as described below. Attitudes were assessed at the beginning of the study and

throughout the nine weeks based on tape-recordings of the sessions and observations of the subjects by the tutor. In addition, written responses were obtained via an attitude questionnaire administered at the end of the study.

In order to sharply distinguish between the treatments, a set of contrasting tutoring protocols was developed based on the types of feedback provided by the TA program and by process approaches to composition as advocated by such authors as Murray (1980), Taylor (1981), Zamel (1982), and Raimes (1983). These protocols were as shown in Appendix A.

For the TA subjects, the role played by the tutor was one of observer and technical facilitator, allowing the TA feedback to be the primary intervention strategy used to create second and third drafts from a first draft on three compositions. The second group used WP as a means to generate, organize, and refine ideas. Unlike the TA subjects, the WP subjects interacted with and received feedback from the tutor from the beginning of the writing process to the end. The focus was on the process of writing: that is, the act of writing itself was viewed as a way of discovering meaning (Murray, 1980), and the tutor acted as a facilitator of this discovery process (Carnicelli, 1980; Sommers, 1982).

Revisions between drafts were highlighted and coded according to categories adapted from Raimes (1985) and developed by the authors. The categories for coding revisions were of two major types, *surface-level editing*, i.e., changes not affecting meaning, and *deep-level revision*, i.e., changes affecting meaning (for detailed discussion of the coding categories and procedures, see Pennington and Brock, forthcoming). Table 1 summarizes the kinds of changes made by subjects in both groups:

	Surface-Level Editing	% of Total	Deep-Level Revisions	% of Total	Grand Total
Subject 1	72	85%	13	15%	85
Subject 2	140	97%	4	3%	144
Subject 3	64	42%	88	58%	152
Subject 4	28	41%	41	59%	69

Table 1: Total Number and Types of Changes

As is immediately apparent from Table 1, the process subjects (Subjects 3 and 4) made more revisions affecting meaning than the TA subjects (Subjects 1 and 2) did. Subject 3 made the largest number of changes (a total of 152), 42% of which were surface-level editing changes i.e., changes classified as not affecting meaning—and 58% of which were deep-level revisions—i.e., changes classified as affecting meaning. Although the fewest changes between drafts (69) were effected by Subject 4, the other member of the process group, the percentages of the two major categories of changes are almost identical to those of Subject 3: 41% surface-level editing changes and 59% changes affecting meaning. A much higher proportion of changes made by the TA group—more than double the percentage for the process group—were classified as surface-level editing. The compositions of Subject 2 contained the second greatest number of changes (144), of which 97% were surface-level editing changes and only 3% were deep-level revisions. The compositions of Subject 1, the other member of the TA group, contained a total of 85 changes, 85% of which were surface-level editing changes and 15% of which were deep-level revisions.

The *Critique* analyses of compositions written by subjects in this study provided a total of 240 suggestions for revision. Of these 240—excluding incorrect analyses of spelling errors, as when a rare word or brand name not included in the program's dictionary was encountered, only 18 (7.5%) were incorrect. Of these 18, half were accepted by the subjects and incorporated into their compositions. Only 13% of the changes made by Subject 2 were changes not prompted by *Critique*, and only two (out of a total of 18) of these were revisions which altered meaning. 31% of the changes made by Subject 1 were not prompted by *Critique*. Of these, only five (out of a total of 26) altered meaning.

In addition to the analysis of types of revisions made by subjects, a *Critique* summary analysis was performed on each of the drafts of all subjects. A comparison of the summary analyses provided by *Critique* highlights some significant differences between the two groups, as illustrated in Table 2:

Subjects using text analysis: Compositions 1-3

	Draft 1	Draft 2	Draft 3
Total number of paragraphs	4.7	4.7	4.7
Total number of sentences	32.3	32.5	34.0
Total number of words	533.7	535.7	532.0
Total number of short sentences*	6.7	7.2	7.8
Total number of long sentences**	3.8	4.0	3.3
Ratio of short to long sentences	1.8	1.8	2.4

Subjects using process approach: Compositions 1-3

	Draft 1	Draft 2	Draft 3
Total number of paragraphs	4.3	4.7	4.7
Total number of sentences	24.2	32.0	36.5
Total number of words	490.8	657.3	744.7
Total number of short sentences*	1.2	1.8	2.7
Total number of long sentences**	7.0	9.0	10.2
Ratio of short to long sentences	.2	.2	.3

* Sentences of ten words or less

** Sentence of 25 words or more

Table 2: Average Length of Compositions Across Drafts

The average differences across the two groups displayed in Table 2 accurately reflect gross differences in the performance of individuals between groups. For instance, both subjects in the process group wrote more on average than both subjects in the TA group, increasing the length of successive drafts substantially, from a high average of 400 words for Subject 3 to a low average of 100 words for Subject 4. Compositions written by the two TA subjects either decreased in length or increased by only ten words or fewer from the first to the third drafts.

As Table 2 indicates, the increase in number of words in second and third drafts of the process subjects was achieved by increasing both the number of sentences and the length of sentences. The process subjects exhibited an average increase of 12.3 sentences from first to last draft, an increase of

approximately 50%, while the number of sentences produced by the TA group increased on average by only 1.7 from first to third draft. In addition, the process subjects showed an average increase of 3.2 in the number of long sentences across drafts, while the TA subjects showed a slight increase and then decrease across drafts in the average number of long sentences. The compositions of all subjects exhibited a small increase in the average number of short sentences from first to third drafts.

The difference between the two groups in terms of preference for short sentences (TA subjects) or long sentences (WP subjects) already existed in the subjects' first drafts and was enhanced during the study, as can be inferred from the figures in Table 2. The preference for shorter sentences on the part of the TA subjects may be in part a bias introduced by the program, which labels long sentences as "difficult" and in need of revision. If so, then it is interesting that this effect had already been introduced following the orientation and training session for these subjects, by the time they wrote their first drafts. Of course, it is also possible that the difference in the two groups is due to chance, i.e., to chance resemblance of Subjects 1 and 2 to each other and of Subjects 3 and 4 to each other.

The increase in number of words in the compositions of the process subjects is primarily reflected not in a greater number of paragraphs, but rather in a greater number of sentences per paragraph and secondarily in an increased length of individual sentences. As concluded by Pennington and Brock (forthcoming, p. 26):

The preference by the process group for longer sentences and the increased length of compositions from first to third drafts perhaps represents an effect of word processing in the context of the process approach, both of which encourage experimentation with language, elaboration of ideas, and generation of content in a train-of-thought process. Longer sentences may be an indicator of attention to levels of thought and meaning below the surface level (and thus also a possible indicator of lack of attention to monitoring or editing). The general increase in the size of paragraphs and sentences across the drafts of the process subjects represents an increase in the amount of material in two of the linguistic-rhetorical units that are central to written discourse. This increase in amount of linguistic material per

sentence and per paragraph can be taken to be a rough indicator of an increase in the amount of information per discourse unit, for units larger than lexical items and not larger than paragraphs. Although the quality of drafts was not measured in the present study, an increase in the size of these discourse units can be viewed as progress in elaboration of ideas through development of material already generated in previous drafts. This result is particularly intriguing in light of evidence, as cited in Wresch (1988, p. 16), that words-per-paragraph and words-per-sentence ratios may correlate positively with independent assessments of essay quality.

In contrast, the fact that the number of words and paragraphs did not increase in successive drafts of the TA subjects indicates that the amount of information in the compositions remained relatively constant from one draft to the next. As observed by the tutor, the TA subjects did not revise through a process of elaboration of ideas or development of content but rather through a process of editing content already generated. It would appear, therefore, that while the combination of WP and process-oriented conferencing enhanced the creative revision process in this study, the use of computer-based TA in combination with WP appears to have inhibited creative revision for Subjects 1 and 2, at least in the short term, thus providing possible counterevidence to the effectiveness claims made in some previous studies.

Over the course of the study, the TA subjects appeared to become increasingly dependent on guidance from the TA program. Though the tutor repeatedly alerted them to the fact that the program sometimes analyzed sentences or words incorrectly, both students tended to make the changes suggested by the program, whether correct or incorrect. They appeared more interested in satisfying the requirements of the computer program—i.e., in having a sentence reparsed after a change had been made and then having no error message appear—than in examining the validity of the program's suggestions. Thus, rather than writing for meaning, these subjects were writing to meet the standards of the external, computer-based monitor. In contrast to the behavior of the TA subjects, the process subjects were able to internalize many of the tenets of the process approach and focused to a large extent on meaning in revising their compositions, while attending to surface-level editing as well.

The initial reaction of subjects using TA was similar to that reported by Kiefer and Smith (1983), i.e., they were fascinated by the program's ability to parse their sentences and to highlight misspellings, ungrammatical constructions, and subject-verb disagreement. Both Subject 1 and Subject 2 exhibited favorable attitudes towards the program at the conclusion of the period of the study, though the initial enthusiasm of Subject 1 waned somewhat during the course of the investigation, as comments he made to the tutor during the nine weeks indicated. Since his main complaint had to do with the fallibility of the TA program's feedback, it is possible that this subject would have had a more positive experience overall if he had had more guidance from the tutor in distinguishing correct from incorrect analyses. Subjects using the WP program and writing from a process approach expressed positive attitudes about the ease with which changes could be made in their compositions with the assistance of the computer as compared to more traditional modes of writing. Both also expressed a belief that the time spent with the computer and receiving feedback from the tutor had proved helpful in their writing. The consistently positive attitudes of subjects in the process group appear to stem from the combined effects of WP and the process-oriented feedback offered by the tutor. Without the tutor, it is possible that the subjects would not have exploited the WP in the same manner and to the same extent as they did in this particular investigation.

In general, the results of the study are favorable as regards the process-oriented subjects and unfavorable as regards the TA group. Referring back to the original research questions, the results can be summarized as follows:

- (1) Do the drafts in the two groups differ in length or overall structure?

The two TA subjects wrote shorter drafts and shorter sentences than did the two subjects in the process-oriented group.

- (2) How do the revisions made by the two groups compare?

Specific questions of interest drawn from previous research with text analysis programs are the following:

- (a) Do the TA subjects edit more thoroughly than those subjects not exposed to the type of feedback provided by TA?

No clear trend emerges to differentiate the two groups in terms of thoroughness of revision, if defined in terms of number of revisions. However, if defined in terms of depth of revision, the process group revised more thoroughly than the TA group.

- (b) Do the TA subjects increase their independence in editing through use of the program?

The TA subjects appeared to rely increasingly on TA analyses for their revisions and in that sense to become less independent in their editing.

- (c) Do the TA subjects go beyond surface-level editing to make revisions affecting content or ideas?

The TA subjects made few revisions affecting content or ideas.

- (3) What attitudes are exhibited by the subjects towards their experiences with the computer?

All subjects believed that the treatment they received in the study improved their writing, though one of two subjects using TA became less positive about the program during the course of the study.

Studies of the use of WP and TA by a population of ESL students outside a tutorial context would provide valuable comparative data. Studies replicating the present investigation and involving a larger number of subjects are also needed.

ASSESSMENT OF THE EFFECTIVENESS OF WP AND TA IN ESL

An examination of computer-based TA leads to several hesitations. First, it is difficult to justify using a program with student writers, particularly those who are not native speakers, that generates erroneous feedback. Second, one can argue that the type of feedback generated by programs such as *Writer's Workbench* and *Critique*, even when correct, causes students to focus on prescriptive and surface concerns exclusively or too early in the writing process. Third, there may be a tendency for increasing, rather than decreasing,

dependency on outside feedback in some students using TA tools such as *Writer's Workbench* and *Critique*. Thus, a case can be made that computer-based TA is in many respects antithetical to the goals of the modern, humanistic writing program.

If the user of one of these TA programs is a student writer, particularly a non-native, erroneous feedback may not always be understood as incorrect and so might be inappropriately followed during revision. On the other hand, if the student recognizes that the program is offering incorrect advice and chooses not to follow its suggestions, this realization might lead to frustration with the program and confusion about the purpose of making this tool available to composition students. Either way, the use of computer-assisted text analysis seems counterproductive for the student who needs to develop an effective writing process.

Because of hardware requirements, TA must generally be made available to students in a lab setting for independent work, under minimal supervision. Under such conditions, it is doubtful that students, particularly non-native writers, can make proper use of the TA tools. It is not enough to instruct students not to conduct a TA analysis until the final draft stages and to consider the possible invalidity of the TA feedback. Students left to their own devices may not have the knowledge or the discipline to wait until the third or fourth draft to do a TA analysis of a composition and to weigh the TA feedback for validity and usefulness in individual cases.

As the study reported above demonstrates, there is a danger in CAI of the user losing control to the program, possibly as a result of "the peculiar yet powerful appeal of the computer itself. There appears to be almost a seductive aspect to the computer" (Hirvela, 1989, p. 304). The possibility of this loss of control is particularly likely in students new to the medium, who are apt to view the computer as awe-inspiring and authoritative. This effect may be less likely with certain programs, with more advanced students or other populations of users, or under certain conditions of use that would encourage independent thought and evaluation of choices.

A criticism leveled against computer-based TA (e.g., by Wresch, 1987, p. 67) is that the post hoc feedback encourages writers to simply tailor their writing to fit the suggestions of the program, rather than helping them develop revision strategies to enhance the clarity of ideas and the quality of writing. In this sense, computer-based TA is analogous to teacher-generated feedback

written on a student composition instructing the writer to make certain changes to improve quality. In both cases, an external authority can be relied upon to furnish ready, albeit relatively superficial, corrections and other suggestions as to how to proceed in revising the material. As in the analogous situation of working with an authoritative human editor, the student may become increasingly dependent on the external authority, rather than beginning to develop and learning to rely on an internal monitor. This phenomenon of increasing dependency on an externally supplied monitor is perhaps most likely in the case of non-native writers, who, even more than immature native writers, lack a knowledge of linguistic and stylistic canons that guide writers when they compose in the target language.

Non-native writers may be deficient in two kinds of knowledge: **declarative knowledge**, i.e., content knowledge of the target language and its rhetoric, and **procedural knowledge**, i.e., knowledge of heuristic procedures for applying declarative knowledge during linguistic production (Anderson, 1982). In addition to their lack of declarative knowledge of syntax, lexicon, and rhetoric in the target language, non-native writers—like immature native writers—lack the procedural knowledge required for putting their declarative knowledge into practice during the composing process. This means that they do not have strategies for applying the declarative knowledge in a particular case, i.e., for using the canons of the target language to express exactly the shade of meaning intended through paragraph arrangement, word order, word choice, verbal and nominal morphology, etc. Moreover, for the non-native writer these strategies are not routinized.

Thus, a non-native writer needs to develop not only a linguistic and rhetorical knowledge base, but also a repertoire of procedures used by writers to apply that knowledge in making decisions about their writing during the composing process. In addition, non-native writers need practice in applying that procedural knowledge to develop automatized strategies and routines for generalized use in composing. At best, TA can aid the non-native writer in achieving the first goal, that of developing a linguistic and rhetorical knowledge base. However, internalization by the user of the standards of the target language and its rhetoric cannot be directly accomplished by use of a TA program. And the evidence we have from the study reported above is that the use of TA may actually work against the goals of internalization of this

knowledge base and increasing independence and self-sufficiency in writing. In contrast, WP promotes independence and self-sufficiency in writing by providing a medium for implementing creative revision and elaboration of ideas. It thus offers a medium for working within the process approach to teach writers the strategies they can use to put declarative knowledge about the target language into practice. The utility of WP therefore lies in providing an environment in which to practice and develop an individual writing process.

Though there are some immediate benefits of TA and WP in terms of attitudes, most of the benefits of these approaches are necessarily not apparent in the short term. This is in part a natural effect of the time it takes to master the basic mechanics of the software and then to explore additional applications beyond the basic usage. The fact that it takes time to master the use of computer aids may help to explain the negative findings in terms of revision behavior and the lack of positive effect on writing products in some WP studies. In the studies where WP reportedly did not result in increased revision, lack of practice or lack of knowledge may explain the findings. It may be that the subjects did not have sufficient exposure to the computer during the course of the research to have learned to take full advantage of the potential of the medium or that they were not sufficiently aware of the various ways in which it could aid in their revising.

As the study described above suggests, explicit instruction in the use of WP to exploit a process approach may improve a student's revision behavior. Such instruction may be provided by a human tutor or by the computer itself:

Perhaps the greatest potential lies in software designed especially to teach the writing process. This software, which often uses dialogue heuristics for prewriting, content generation, organization, and revision, allows the computer to act as a partner in a writing conference.... These programs...are interactive and often incorporate aspects of the student's responses (topic or phrases) into the questions.... Such prompting programs help the student recall the steps involved in writing, stimulate content generation, and help students focus on aspects of their writing that need revising. (Phinney, 1989, pp. 92-93)

In her study of junior high school writers, Daiute (1986) found that use of a process-prompting program significantly increased the number and type of revisions made in word processing. Disk-based exercise files can also be created which assist non-native students in learning and exploiting word processing in their own writing. "Such files often function as templates, providing writing heuristics, suggestions for strategies in content generation and organization, revision and editing exercises, and exercises which teach various aspects of the software" (Phinney, 1989, p. 87).

One can assume that it takes time—probably more than a semester for many students—for the effects of WP to start becoming apparent in their work. This assumption receives empirical support from research with ESL students using word-processing in a freshman composition course:

After two semesters, it is clear that a semester course, with three hours of class time a week, is barely sufficient to effect changes in even the most enthusiastic students. Our own experience with computerized writing indicates that writing processes continue to be altered by the medium three to five years after the initial plunge. (Phinney and Mathis, 1988, pp. 15-16)

Thus, while increased revision may be a relatively short-term effect for some, it is a longer term effect for others.

Assuming that increased revision leads eventually to improved quality—and this assumption is the most basic tenet of the process approach to writing—one can see that the ultimate benefits of WP in the writing curriculum are relatively long-term for the majority of users. Under the assumption that increased quantity eventually leads to improved quality, effectiveness for WP is supported by a finding of a significant increase in the quantity of revision. An increased quantity of revision might be measured by observational evidence of increased revising behavior—however defined—or by product-oriented measures such as number of composition drafts, number of changes in drafts, number of words in drafts, and/or number of sentences in drafts. An increase in the quantity of revision according to any of these measures can be viewed as a desirable first-order effect of WP. If the quality of revision can also be shown to improve—e.g., through an increase in deep-level revisions or in number of words per sentence or per paragraph—this can be seen as an

increase in a second-order effect. These medium-term effects of increased quantity and quality of revision can be taken as predictive of an eventual long-term effect of improved writing quality for those who continue using WP. It is therefore neither necessary nor very realistic in WP research to expect improvements in writing products except in relatively long-term studies, i.e., those that follow the same users for a year or more.

It is not clear whether any parallel medium-term benefit can be adduced for TA. For example, would use of shorter sentences by users predict to better writing eventually? Would increased attention to surface-level errors or even a decrease in these types of errors predict to good writing in the long run? There is no evidence to indicate that a student's writing will improve, either as a direct effect or an indirect by-product of attention to these features of writing. In fact, it can be argued that increasing length of sentences from first to later drafts is an indicator of elaboration of ideas and so a desirable attribute of a student's developing writing process. As to surface-level errors, it can be noted that the whole motivation for process-oriented writing instruction is to move students away from a focus on surface-level concerns in non-final stages of writing.

If the main benefit of TA is in helping to develop the student's internal monitor, then this is necessarily a very long-term effect, considering the experience with the language that is required for native writers to develop such a monitor. If the main benefit of TA is not the development of the student's own internal monitor, then what is it? It is difficult to imagine any other justification for using TA in an ESL writing curriculum that has a process orientation. If the curriculum is oriented instead towards writing products, then this orientation needs justification in terms of how it benefits the ESL student and avoids a return to outmoded behavioristic educational practice that seeks to "correct" human learning.

CONCLUSION

Many educators are now justifiably excited about the potential of computers in the language curriculum, as many current applications represent significant contributions to educational practice. At the same time, there are still many

applications of the medium that do not obviously reflect current thinking in education about the importance of creativity and the individual's learning process. Consequently, before rushing to adopt a "new" computer-based instructional tool, educators must consider whether the tool helps to further their curricular goals and whether it can be effectively applied in the present-day educational environment. In some cases, skepticism regarding such a tool may be warranted, as an old idea is dressed up in new, electronically enhanced, garb or pressed into service in an area of education where it does not necessarily belong.

As Leech and Candlin (1986, p.1) remind us:

Innovations in educational technology, especially those, like CALL, which offer challenges not only to the established roles of teachers and learners, the nature of materials and the organization of classrooms, but indeed to the language curriculum as a whole, need to be provided with an educational rationale if they are not to become fashionable instruments of a self-promotive *avant garde*. In short, they need to be critically examined for their educational potential, their classroom costs and benefits.

If TA or WP are to be used appropriately and evaluated fairly in an ESL educational context, the following issues need to be considered:

- What is the purpose of TA (WP)? What are the aims of using TA (WP) with non-native writers?
- What is an appropriate way to use TA (WP) in ESL writing instruction?
- What kinds of outcomes can be expected or predicted for students using TA (WP) based on the inherent characteristics of the medium and of the students who employ that medium in their writing?
- How long can we expect it to take for effects of use of the medium to become apparent?

The questions of purpose, suitability, potential outcomes, and term of results must be addressed in studies of the effectiveness of TA, WP, and any other available approaches to computer-assisted composition. Based on a

preliminary examination of these issues and the information available at the present time, educators would seem to be justified in extending the trials of WP in the ESL writing curriculum, while exercising care and caution before proceeding to implement TA with the same population of students.³

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³ The conclusions we draw here based on our limited research with *Critique* would appear to be generally applicable to some other TA programs. The second author has recently conducted research on another TA program, *Grammatik III* (Brock, 1989). Using this program to analyze ESL student compositions, he found that it was only 60%-70% accurate and could be criticized for the same pedagogical flaws which we cite here for *Writer's Workbench* and *Critique*.

APPENDIX A: Instructional Protocol

For subjects using text analysis, the tutor:

Will

Discuss suggestions offered by the TA program (though not offering advice)

Help the subject understand the analysis offered by the TA program by explaining program metalanguage

Make sure the subject knows how to use the program thoroughly

Help the subject input whatever changes he accepts from the TA analysis

* The emphasis is on using TA from beginning to end, focusing on using the computer's analysis for decisions concerning revision and clarification of drafts. When asked about issues content, organization, or any issue raised by a subject that has not been raised by the TA program, I'll ask, "What does the program say?"

Will Not

Discuss matters of content, organization, transitions, or coherence

Point out any problem area not flagged by the TA program

Engage in pre-writing or other tutoring activities designed to aid the writer in clarifying his ideas

* The emphasis is on using the computer as the primary, if not the sole, writing tutor. My role is simply to facilitate the subjects' use of the computer and to observe the types of revisions that occur when TA is used by an ESL writer.

Appendix A: Instructional Protocol (cont.)

For subjects using process approach, the tutor:

<u>Will</u>	<u>Will Not</u>
Engage in pre-writing exploration of ideas, i.e., "talking out" ideas	Correct punctuation, spelling, grammar
Encourage "free writing"	Correct fragments or run-ons
Ask questions that help to generate and refine ideas	Require action verbs, delete <u>be</u> verbs, expunge passives
Ask about focus, audience and purpose	Require variety in sentence length
Ask students to "nutshell" ideas and purpose	Correct case usage or subject-verb agreement
Work on organization of ideas	Combine sentences
Ask students about logical progression of ideas	Cross out instances of wordiness or repetition
Ask questions about word choice (only) if meaning is unclear	Correct or suggest idioms
Discuss introductions and conclusions	Fix mixed metaphors or non-parallel constructions
Work on coherence of ideas and transition between ideas in a general way	Place misplaced modifiers
	Correct tense or person shift

Appendix A: Instructional Protocol (cont.)

* The key is to always encourage the subjects to use the computer to insert, delete, and move ideas. The focus is on using the computer to generate, organize, and refine ideas. The emphasis is thus on the process of writing used to generate, organize and refine ideas.

* Correct any matters of mechanics or style that do not obscure meaning. Sentence-level problems are not considered important unless they confuse or obstruct meaning. When asked about these kinds of problems, I'll ask, "What do you think is best?"

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