

AN EVALUATION OF WORD PROCESSING FOR ESL WRITERS

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This paper offers an assessment of the promise and problems for ESL of computer-assisted writing using word processing. Both positive and negative effects reported in the published literature in ESL and native-speaker composition are reviewed, and the attempt is made to find explanations for the differing results of individual studies. In addition to the inherent properties of the medium, methodological and context effects are identified which help to account for the differential findings. These effects are attributable to variation across studies in one or more of the following variables: (a) the nature of the subjects, (b) the abilities and attitudes of teachers, (c) the setting for computer use, (d) the time-span of the research, (e) the type and amount of training for use of the software, (f) the instructional format for computer use, (g) the biases introduced by particular word processing software, and (h) the effectiveness measures applied to evaluate results. Considering the needs of ESL students in the area of writing and the results that can be predicted for word processing based on the nature of the computer medium, it is concluded that use of word processing seems justified as a medium for enhancing the creative revision process of ESL students, and recommendations are offered for pedagogy and research in ESL contexts.

Introduction

Although word processing software has been widely available in educational settings for less than a decade, this computer-based writing aid has already achieved the status of centerpiece in a virtual writing revolution. Like other revolutions, the revolution made possible by word processing has elicited strong views on both sides, as those who first tried out computer-assisted writing in native speaker composition classes were either wildly enthusiastic in their advocacy or vehement in their rejection of the new medium. Also like other revolutions, the strong opinions generated in the early stages have tended to abate under the calming and leveling influence of time and familiarity. By now, many educators have enough experience with this writing aid to have gained a measure of objective distance that allows them to examine

the medium carefully, with a professionally trained critical eye, rather than reacting out of a naive sense of excitement or fear. Thus, while a collection of articles on computer-based composition published in the first part of the previous decade bore the somewhat optimistic title, *The computer in composition instruction: A writer's tool* (Wresch, 1984), an edited collection that appeared in the last year of the decade bears the more advanced, evaluative title, *Critical perspectives on computers and composition instruction* (Hawisher and Selfe, 1989). The first blush of revolution has passed, and research on computer-assisted writing has come of age.

Word processing has spurred a considerable amount of research in native speaker composition, including a large number of comparative studies in addition to many detailed case studies and ethnographies (see Hawisher, 1989, for a review). In contrast, use of computers with non-native writers learning English as a Second Language (ESL) has not yet resulted in many published studies of any kind, neither large-scale comparative studies nor in-depth case studies or ethnographies. 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. Representative studies and discussion can be found in Harris (1985), Daiute (1986), Hawisher (1987), Bernhardt et al. (1989), and Haas (1989). Only a few of the reports that include discussion of word processing have so far focused on ESL students (Benesch, 1987; Blanton, 1987; Piper, 1987; Phinney and Mathis, 1988, forthcoming; Phinney, 1989b; Chadwick and Bruce, 1989; Pennington and Brock, forthcoming), or have compared the use of word processing by native and non-native writers (Phinney, 1989a).

The present paper evaluates the use and effectiveness of word processing for ESL students, drawing on research in native speaker composition and in ESL proper. In order to be able to make responsible recommendations regarding the use of word processing in an ESL curriculum, it is necessary to understand the factors influencing the success or lack of success of the medium under differing circumstances. In what follows, this purpose is served by an analysis of (1) the inherent properties of the computer medium and its application to writing, and (2) the possible moderating influence of a number of situational and methodological variables that were not systematically

controlled or examined for their effects in individual research studies conducted to date. A close examination of these factors provides a foundation for explanations of the differential results in the group of studies reviewed and for recommendations regarding the use of computers in ESL composition and future research in this area.

An Overview of Word Processing Capabilities and Research Findings

Properties of the Word Processing Medium

Word processing software turns the computer into an electronic typewriter in which text that has been input by typing on a keyboard appears on the computer's display screen and can be saved in a file in the computer's memory. Word processing allows many different kinds of modifications to written text before or after saving, such as deletion, insertion, and movement of pieces of text as long as several paragraphs. In addition to its function as writing implement, or *stylus*, a word processor—in the form of a blinking cursor on the computer monitor prompting the user to act—also serves as a physically present "audience" (Daiute, 1983), or stimulus, to begin and to continue writing. The ease of typing on computer, the act of pressing keys, the rhythm and the sound of this act, and the visual feedback on its results seem to produce unique interactive effects in the way of cognitive, tactile, and visual stimulation that encourage the user to continue the process of writing—both the physical act of spelling out words and the mental act of exploring a topic. A word processing program also makes it possible for the user to gain almost immediate access to large amounts of information—in a computerized dictionary, database, or previously stored user file—far beyond what humans are able to hold in their memories (Daiute, 1981) or to manipulate easily without the machine.

In addition to some general psychological attributes of the computer, a word processor combines the properties of a typewriter, a variety of functions for modifying text, an on-screen representation of a text, a prompter, an expandable memory, and a printer to make the following unique combination

of features available to a writer:

- (1) the novelty of the computer;
- (2) the perceived objective distance of the computer from the written product;
- (3) the physical act of writing with an electronic keyboard;
- (4) the possibility of on-screen editing before a hard copy is made;
- (5) the ability to rapidly read and compare different portions of text through scrolling;
- (6) focusing of the user's attention by the cursor and the small portion of text displayed on one screen;
- (7) highly readable display of text on a computer monitor;
- (8) attractive copy onscreen for initial as well as final drafts;
- (9) attractiveness of printout;
- (10) the possibility of making multiple copies of a piece of writing;
- (11) the capability of putting down thoughts in non-permanent mode;
- (12) the capability of storing information in permanent mode.

Figure 1: Properties of Word Processing

These features, individually and collectively, offer a number of potential benefits for the ESL student writer, as enumerated in the next section.

Positive Effects for Word Processing

The novelty of writing on computer may encourage ESL student users to think of writing in English in a new or more positive way than when writing by ordinary means. The fact that a machine is aiding them in generating their work, and the perceived objective distance of the computer from the written product, may help student writers to gain a measure of objective distance from their own work, so that they do not feel threatened by the need for revisions and corrections to improve their drafts. The use of an electronic keyboard solves the problem of handwriting in English that handicaps many non-native writers and allows them to write freely, resulting perhaps in improved attitudes towards writing in English, greater quantities of writing, and possibly

improved quality of writing as well.

ESL writers may find that they can type on a computer keyboard at a speed faster than they can write by hand, especially for extended periods of time. Hence, the computer can function as a prewriting or brainstorming environment that allows the writer to put down a great quantity of ideas in written form before they are forgotten or altered in memory. The act of typing on a keyboard, or the speed with which it can be accomplished by experienced computer users, may even assist in the generation of ideas. Increased generation of ideas during word processing may occur at least in part as a side-effect of the slight time-lag between the speed of typing and the generation of a "train of thought"—a temporal gap which may allow memory traces to be formed and then built upon to develop additional connections among ideas and which may foster activation of higher levels of cognition. Moreover, the repeating cycle of physical and mental acts engendered by computer use can become a self-reinforcing, recursive psychomotor process. In this way, the use of a word processing capability may stimulate the generation and creative exploration of ideas through written language and so be a valuable aid in the writing process.

The ability to see changes in a piece of writing before they are finalized in a file or hardcopy also alleviates the fear that writers may feel about committing their ideas to paper. The possibility of extensive on-screen editing before a hardcopy is made may mean that writers who use a word processor feel less attached to non-final drafts, and so more willing to make changes in them to improve the quality of their final drafts, than they would be if each draft had to be rewritten or retyped from beginning to end. The scrolling feature makes it possible to compare different portions of text rapidly and so may invite more discourse-level revision to alter meaning or editing to improve mechanics. The focusing of the user's attention by the cursor and the small portion of text displayed on one screen promotes intensive reading and thought about the portion of the text that is displayed, thus inviting in-depth, meaning-oriented revision. The highly readable display of text on a computer monitor may also encourage more reading of one's own text and so more in-depth revision and/or surface-level editing. It also makes possible the collaboration of individual students in writing on-line, since the problem of

reading each others' texts is resolved. The attractive copy onscreen for initial as well as final drafts promotes a sense of pride in one's own work as a writer, while the attractiveness of the computer printout results in a sense of accomplishment when the final text is output as a hardcopy. The possibility of making multiple copies of a piece of writing opens the way for peer-oriented communicative writing activities and for integration of computer use and reading activities.

The fact that structural matters of local editing and formatting are easily taken care of may encourage attention to content development. The capability of putting down thoughts in non-permanent mode on the computer helps to allay the student writer's fear of making errors and invites the student to play with writing and to try out new ways of writing, with the assurance that anything written need not be saved in a computer file. The capability of putting down thoughts in permanent mode that can be stored in the computer's memory and/or printed out in hardcopy means that the writer does not need to fear losing ideas or blocking in anticipation that what will be written will not be fully formed, final copy. The capability of selecting permanent mode for every writing act and then altering what has been stored as a file in the computer's memory over one or many writing sessions reinforces the notion of the writing process as a sequence of stages in which the writer works and reworks material towards a final draft. Thus, in computer-assisted writing:

The text is as permanent or transient as the writer wishes to make it with the touch of a command key. The students' concept of a first draft is therefore likely to change, since he [sic.] can now produce several printouts and revise each one before arriving at a relatively satisfactory result. (Chadwick and Bruce, 1989, p. 18)

The fact that a great deal of information can be stored and then recalled quickly and transported into a developing text means that the computer can serve as auxiliary storage for the writer's limited memory. The computer's storage capacity makes it possible to manipulate a substantial amount of

information in constructing a paper, thus facilitating the student writer's gathering and integration of material to support and document a thesis. The capability of storing information in separate files may also help the developing ESL writer to view the structure of a paper independently of the specific information used to support a thesis.

Figure 2 summarizes the positive potentials of word processing which can be derived from an analysis of the properties of the medium outlined in Figure 1:

- Motivation to spend more time on writing
- Interactive effects that encourage the development of ideas
- Facilitation of discourse-level revision
- Facilitation of major revisions
- Promotion of attention to structure and content
- Pride in publication of work
- Elimination of the need for concern about handwriting or the physical appearance of a paper
- Provision of an environment for experimentation and planning without fear of permanency
- Stimulation of writing in quantity
- Capability of synthesis of large amounts of information
- Provision of an environment for developing an effective writing process
- Provision of an environment for communication and collaboration with peers

Figure 2: Positive Potentials of Word Processing

These positive potentials of word processing can be viewed as favorable psychological reactions to the properties of the medium that predispose writers to use it appropriately and productively. They therefore might be hypothesized as positive causal factors predicting to benefits in word processing research.

Researchers generally agree that word processing facilitates revision, as "writers can insert, delete, and substitute text with an ease hitherto unknown" (Hawisher, 1987, p. 145). A large number of the studies on word processing to

date have uncovered positive or mixed results in terms of revision or other measures of writing improvement (see review in Hawisher, 1989). A review of studies showing positive effects (Bradley, 1982; Monohan, 1982; Schwartz, 1982; Bean, 1983; Daiute, 1983; Madigan, 1984; Schwartz, 1984; Womble, 1984; Daiute, 1985a; Grabe and Grabe, 1985; Dickinson, 1986; Nichols, 1986; Selfe and Wahlstrom, 1986; Blanton, 1987; Dalton and Hannafin, 1987; Piper, 1987; Johnson, 1988; Phinney and Mathis, 1988, forthcoming; Bernhardt et al., 1989; Chadwick and Bruce, 1989; Phinney, 1989b; Pennington and Brock, forthcoming) indicates that word processing produced benefits in three main areas:

- (1) **Development of Ideas Through Written Language**
 - more time spent on writing
 - longer compositions
 - increased experimentation with language

- (2) **Revision Behavior**
 - facilitation of the revision process
 - increased number and types of revisions
 - more discourse-level revision
 - fewer surface errors

- (3) **Affective/Social**
 - reduced writing apprehension and improved attitudes to writing
 - improved attitudes about English
 - greater objectivity about own writing
 - increased sense of competence and self-esteem
 - more collaboration among student writers

Figure 3: Benefits Reported for Word Processing

As noted by Daiute (1985b), word processing offers benefits which are consistent with, and which may under favorable circumstances help to 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.

Negative Effects for Word Processing

Not all studies, however, have yielded positive effects for word processing in student writing. Some studies (e.g., Collier, 1983; Daiute, 1985a; Deming, 1987; Posey, 1986) found an increase in revision, but no increase in quality, associated with the use of word processing in contrast to pen-and-paper revision. The findings of other studies (e.g., Harris, 1985; Coulter, 1986; Daiute, 1986; Benesch, 1987) were negative for revision, as writers using word processing revised less than writers using traditional means. The explanations proffered in these studies for the lack of positive effects for word processing center on the following reasons:

- Premature completion of work
- Interactive effects that discourage the development of ideas
- Local rather than global revision
- Attention directed primarily to surface features
- Focus on structure at expense of content
- Premature publishing or overpublishing of work
- Preoccupation with physical appearance of paper
- Inhibited experimentation and planning
- Focus on quantity at the expense of quality
- Superficial synthesis rather than depth of analysis
- Ineffective writing process
- Isolation of student writers

Figure 4: Negative Causal Factors Attested in Some Word Processing Research as Contributing to Lack of Positive Effects

These negative factors can be seen as resulting from unfavorable psychological reactions to the properties of the medium and unproductive use of its capabilities. Under certain circumstances, the properties of the computer described in the previous section as potential benefits for writers can in fact have negative effects on students' writing, as discussed in the remainder of this section.

While for some users the novelty of the medium may be a real asset in terms of motivation to write, for others the computer may seem alien and unapproachable. Those who view the computer in this way may prefer to write by putting pen to paper—a more familiar and personalized act that represents the writer's thoughts in his/her own handwriting. Moreover, after many months of use, as the novelty of the computer wears off, the medium may seem dull and mechanical, thus losing any motivating feature that it might have at first possessed for the student user. If students develop these kinds of negative views of the computer, their attitudes may inhibit them from using it and work against the development of an effective writing process on the computer. In addition, the keyboarding requirement for computer use may be an obstacle to some potential users which inhibits or interferes with their writing, causing them to write less than they would with a pen and paper. In the words of Gerrard (1989):

The often-praised flexibility of word processing is only an advantage if writers use it. If they regard the word processor as a formidable typewriter, they will not experiment with their prose—especially if they are tentative about writing and about the computer. (p. 106)

Moreover, any physical difficulties which the ESL learner experiences on computer may be compounded by negative mental reactions to the machine, resulting in a spiraling sense of inadequacy inimical to the development of ideas.

The possibility of editing on-screen, coupled with the small area of text that is visible at one time may encourage local editing rather than global revision. This possibility is especially likely for the student writer who employs

the scrolling feature to hunt for specific sections of text rather than as an aid to reading and comparing different portions of text. The finished look of the screen display may direct the writer's attention primarily to surface features, while the attractiveness of the copy onscreen may cause a preoccupation by some writers with the physical appearance of a paper that prevents them from revising for meaning. The attractiveness of the screen display and hardcopy may encourage students to confuse formatting with revision, and to confuse any draft with a final draft, as long as it looks neat and well-formatted. The attention directed to local editing and formatting may mean that these structural aspects of a student's paper end up overshadowing matters of content development.

Thiesmeyer (1989, p. 86) contends that word processing is not necessarily better than pen-and-paper means for student writers who view clean copy as finished work:

Before computers, student writers might compose a rough draft by hand, mark it up for revision, then polish it while typing the final draft for submission. The word processor's ability to produce clean-looking copy allows today's student to submit what is in effect a rough draft, modified only by a few on-screen changes.

The printing capability may paradoxically encourage the student to spend less time on-line in anticipation of formatting and printing out an attractive hardcopy, thus reducing the amount of time spent writing and the likelihood of experimentation. Being able to publish multiple copies also encourages users towards premature completion of work and publication of less than quality material. In addition, visual fatigue from looking at the display screen or from typing on keys may inhibit some writers from writing as much, or as thoroughly, as they would by traditional means.

The capability offered by word processing of putting down thoughts in non-permanent mode may encourage writers to plan less, so that they produce regurgitative, unreflective, superficial writing. The capability of storing whatever is written may result in greater quantities of writing at the expense of writing quality. Although the computer can be a valuable aid for writing

papers in which information from a variety of sources must be included, students might have a tendency to increase the number of facts or supporting references at the expense of the depth of the analysis. The ease of writing in quantity and of storing information in computer files rather than on individual note cards may thus result in an ineffective writing process and in lengthy, poorly synthesized, mis-referenced or over-referenced papers.

Although the computer offers an environment for communicative activities and collaborative writing, if left to their own devices, many students will not exploit it in this way and will instead work at the computer in isolation from others. Indeed, the special attributes of the computer can to some extent eliminate the need for human contact and so encourage writers to spend more time working alone than they would otherwise. While word processing then offers the potential benefit for students of becoming self-sufficient writers, it can also promote a false sense of self-sufficiency which is actually a dependency on the computer and which ultimately results in isolating student users from their teachers and from each other (Pennington and Brock, forthcoming).

In sum, it has been argued that the properties of word processing which may contribute to favorable results in one study may contribute to unfavorable results in another study. Therefore, the properties of word processing, though offering potential benefits for writers who make good use of the medium, may not be beneficial in all circumstances. If the same properties of computer-assisted writing can result in both positive and negative effects for word processing, the question then arises as to what other factors might determine whether or not writers make good use of word processing capabilities. In the next section, a variety of situational and methodological variables are examined to try to provide a satisfactory answer to this question.

Situational and Methodological Variables in Word Processing Studies

Differential findings in the word processing research may be due to a number of situational and methodological variables in the reported studies, as

summarized in Figure 5: (a) the varied nature of the subjects, (b) the varying abilities and attitudes of the teachers, (c) the properties of the setting for computer use, (d) the varying time-span of research, (e) the quantity and quality of the training for use of the software, (f) the appropriateness of the instructional format used for implementing word processing, (g) biases introduced by particular word processing software, and (h) non-equivalent measures of effectiveness. Each of these factors, as examined below, can be viewed as introducing a potential source of error or measurement bias into the research on word processing that makes the results of individual studies difficult to interpret or to generalize.

- (a) Subjects
- (b) Teachers
- (c) Setting
- (d) Time-Span
- (e) Training
- (f) Instructional Format
- (g) Software
- (h) Effectiveness Measures

Figure 5: Situational and Methodological Variables in Word Processing Research

(a) **Subjects.** While the benefits of word processing enumerated above are potentially available to native and non-native writers regardless of their level of skill or education, some differences in results for different individuals and populations of students are starting to emerge. The results of the relatively large-scale study conducted by Bernhardt et al. (1989):

...suggest differences in adaptation to the technology, with some students (112 of 146, or 77%) becoming comfortable with the computer and finding ways to make it work as a revising tool.... There does not seem to be a simple relation of machine to improvement; instead, one group takes ownership of the computer and uses it to good purpose,

while a second group does not. (pp. 125–126)

In several studies, the effects and the manner of use of word processing have been shown to vary depending on the individual characteristics and experience of the user, both native (Bridwell et al., 1985; Selfe, 1985; Nichols, 1986; Hermann, 1987) and non-native (Benesch, 1987; Piper, 1987; Phinney and Mathis, 1988 and forthcoming).

Students who are conservative in learning style, or who are insecure about their language, their academic abilities, or their writing skill may take less advantage of the potential of the computer medium in their writing process than will risk-takers or those who are confident in their linguistic, academic, and writing skill. As a result, the former type of student may show minimal effects of word processing, whereas the latter type may benefit greatly from use of the computer for writing. ESL students whose English proficiency is limited, who are deficient in academic skills, or who are classified as basic writers can be expected to improve less, all other things being equal, than ESL students who are advanced in their English proficiency, academic skills, and writing ability.

Lutz (1987) found that experienced and professional writers used the computer to revise their work extensively. Word processing may have less effect on the revision of those inexperienced as writers (e.g., non-literate or semi-literate adults) and/or as computer users (Phinney, 1989a). However, certain effects of word processing may be more or less pronounced for less experienced (basic or ESL) writers. For example, basic writers may exploit the word processor primarily for local revision or editing, while more experienced writers may use word processing to help them revise or edit at the discourse level. Hawisher (1989) suggests that word processing “[frees] basic writers from the laborious task of writing by hand” (p. 53), an effect noted for ESL students as well (Berens, 1986b). As Phinney (1989a) states: “For second language students, the computer also appears to reduce the fear of errors and to reduce worries about legibility” (p. 87). Specific benefits of word processing for ESL students have been attested in a study by Phinney (1989b): “For this population, using a computer reduced overall blocking and problems with late work while improving students’ perception of their ability to deal with

complex material and their overall attitude towards writing in English" (p. 12).

(b) **Teachers.** Teachers differ in their ability, experience, and attitudes with respect to both the teaching of writing and word processing. In research comparing 24 sections of introductory college composition taught by the same twelve teachers and in which half of the sections used word processing and half did not, Bernhardt et al. (1989, p. 126) found that the individual teacher made the biggest difference in student outcomes, no matter which method of instruction was used: "Though the data favored the use of computers considered in isolation, the covariate analysis showed stronger effects for teacher and for the interaction of the teacher with the method of using computers." This result implies that teachers who receive low evaluations from students cannot be expected to achieve especially good results with computers in their classrooms.

Thiesmeyer (1989) maintains that a teacher's enthusiasm about the technology can introduce a *halo effect* in the students, who may be further prone to a *Hawthorne effect* having to do with their "special" status as computer users:

In any assessments we make of computer assistance in writing, we need to be especially alert for post hoc fallacies. If writers exhibit better attitudes toward writing after word processing and we wish to claim the new attitudes important, we should be very sure we know their sources. In many reports I have seen, it is entirely possible that the change is owing to increased energy and enthusiasm shown by writing instructors, or to a sense of being specially privileged by access to new technology, and not to any uses of word processors as such. (p. 87)

Likewise, a teacher's lack of enthusiasm or inexperience with computers may introduce a negative bias into research on word processing that prevents students from benefitting as much as they would under more favorable circumstances.

(c) **Setting.** Some variables in the setting of the research may inhibit subjects from fully exploiting word processing—e.g., if all work at the

computer must be done after class or if students have to wait for a turn at the terminal. In the Bernhardt et al. (1989) study, where access to computers was provided in a lab setting: "Students overwhelmingly stated that lack of access to computers was the worst thing about writing with the computer" (p. 123). In her study of intermediate ESL student writers, Piper (1987) found that some students preferred to work alone without the computer rather than be forced to share a computer with other students. Setting variables such as the location of the computers may play a part in determining the outcomes of studies on computer use. As Gerrard (1989) relates:

The public nature of writing in a lab or classroom outfitted with computers may not suit all students, especially those who are self-conscious about their work or even their typing.... For some students, composing may be impossible in a noisy, distracting room. (p. 105)

Other factors such as the readability of the display screen may influence research results. As an example of this, Haas and Hayes (1986) found in a study of the writing of faculty members that the highest quality written products were produced at terminals with the largest screens.

(d) **Time-Span.** The relatively short time of exposure by students to word processing may explain the lack of positive results in some studies (Phinney, 1989a, p. 84). Except for some attitudinal benefits of word processing, most of the benefits of this computer aid are necessarily not apparent in the short term, as it takes some time to master the commands and for the use of the medium as an electronic typewriter to become relatively automatized. 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 word processing studies. In the studies where word processing 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. While increased revision may be a relatively short-term effect for

some, it seems to be a longer term effect for many.

Attitudinal benefits have been attested in comparative studies of word processing where the period of the research was at least eight weeks (see studies reviewed in Hawisher, 1989), including those studies whose subjects were ESL students (Phinney, 1989b; Pennington and Brock, forthcoming). However, other kinds of effects of word processing may take longer to become apparent in students' work: "It may be that one semester is simply not long enough to encourage discernible growth in writing with computers, especially when dealing with word-processing novices" (Hawisher, 1989, p. 54). 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)

Some longer term studies with native English high school basic writers (Pivarnik, 1985; Cirello, 1986) show positive effects in terms of quality. It is possible that the lack of positive effects in revision and particularly in measures of writing quality in some studies is a result of the relatively short-term nature (less than one semester) of most of the research on word processing conducted to date. Even full-semester studies will not be long enough to show certain kinds of results, as noted by Bernhardt et al. (1989):

The literature on testing for student learning over the space of a term—whatever the experimental treatment and whatever skill is considered the dependent variable—is equivocal at best. The effects of computers on writing ability may not be a matter of quick transfer, but of subtle and incremental evolution over the life of a writer.... The real results of introducing student writers to computers may be realized over the long term, as students continue to grow as writers and become increasingly

proficient at using machines to enhance their writing processes and products. (p. 131)

(e) **Training.** It is also possible that differences in the amount, type, or quality of training offered to students in how to use the computer accounts for some of the variation in results across different studies. The lack of positive effects in some of the research could be related to the subjects' lack of knowledge of how to most effectively exploit word processing in their writing. Without adequate training, use of word processing may simply reinforce whatever (ineffective) writing strategies students already make use of or whatever techniques they happen to discover while learning how to employ the word processing software. The need for special instruction in how to use the computer to improve the writing process of native and non-native writers is a concern that has been voiced by many (e.g., Rodrigues, 1985; Berens, 1986a; Johns, 1986; Daiute, 1985b, 1986; Phinney, 1989a). In the questionnaire responses returned from the twelve classes that made up the computer-using group in the Bernhardt et al. (1989) study: "The most typical advice students offered to their teachers or lab assistants was that they should better help students learn how to use the various commands and the available software" (p. 123).

Instruction in how to implement a process approach using word processing 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).

(f) **Instructional Format.** The instructional format for exploiting word processing in individual studies undoubtedly relates to the results obtained. A comparison of the studies reviewed in Hawisher (1989) indicates, for instance, that negative effects in terms of (a) composition length and (b) amount of revision and/or quality of writing obtained when subjects worked with a spelling checker and a word processor (Kurth, 1987) or when they wrote first drafts by hand and then applied word processing (Miller, 1984; Duling, 1985). As another example of the differential effects of instructional format, tutorial instruction appears to produce positive effects in terms of writing quality in a semester (King et al., 1984) or less (Pennington and Brock, forthcoming), while other modes of instruction in the context of word processing may take longer than a semester to show positive effects for writing quality (Pivarnik, 1985; Cirello, 1986).

Nearly all of the previous quantitative research conducted on word processing by native student writers took place in a context of process-oriented instruction (Hawisher, 1989, p. 47). This natural tendency to use a mainstream process approach in research on the use of word processing by student writers has also obtained in most of the research so far conducted on ESL student writers (Piper, 1987; Phinney and Mathis, 1988 and forthcoming; Phinney, 1989b). When the focus is not on writing process, the results of computer use do not appear to be so positive, as indicated in a recent study by Pennington and Brock (forthcoming). Through this comparison study of the use of word processing in two very different contexts, it was found that two ESL students exposed to a combination of word processing and process-oriented tutorial input made approximately 60% "deep-level" as opposed to 40% "surface-level"

revisions and increased the number of words in non-initial drafts of compositions substantially. In general, the increase in number of words from first to last draft in the compositions of the process subjects was reflected as an increase in the number of sentences per paragraph—an increase that can be taken to indicate increasing “discourse-depth” in the development of individual paragraphs. In contrast, two ESL students exposed to a combination of word processing and text analysis feedback made 15% or fewer “deep-level” revisions and either decreased or only slightly increased the number of words in non-initial composition drafts. Moreover, the process-oriented subjects were able to internalize many of the tenets of the process approach and to increase their independence in editing, whereas the text analysis subjects became increasingly dependent on the text analysis feedback. The Pennington and Brock (forthcoming) study thus shows that great differences can be obtained for word processing under sharply differentiated conditions.

(g) **Software.** As noted in Pufahl (1984) and Hawisher (1989), the type of word-processing program used in investigations may influence the results in a negative (or positive) way, as certain programs—e.g., those with an abundance of control characters—are much more difficult to learn and to use than others. Gerrard (1989) notes: “A program that is difficult to use distracts writers from their writing. This would frustrate anyone but may well overwhelm basic writers.” (p. 104)

Thus, use of certain programs may cause students to spend more time and energy wrestling with the medium than actually working on their writing. “Complicated formatting procedures may also encourage students to focus on the appearance of their text to the exclusion of content” (Gerrard, 1989, p. 104). Moreover, use of certain programs may bias results in one direction rather than another, as “different programs might well facilitate some writing strategies to the exclusion of others” (Hawisher, 1989, p. 57). For example, a “windowing” or “notes” capability such as that used in the Haas (1989) study allows students to make the fullest use of the word processing medium to develop ideas during the writing process, which may be partially explanatory for her major result, *viz.*, that pre-planning by subjects was less in word processing composing mode than in pen-and-paper mode.

(h) **Effectiveness Measures.** The type of measure applied to assess the effects and effectiveness of word processing should be appropriate to the treatment employed. By this criterion, one is justified in skepticism regarding the negative findings of those studies of computer-assisted writing such as Posey's (1986) in which subjects' writing ability was measured based on hand-written rather than computer-written posttests, since not all improvements made in writing process or skill on computer would necessarily be expected to transfer to hand-written work. If subjects had the option of writing posttests by hand or on computer, as was the case in the Bernhardt et al. (1989) study, then the selection of the computer might serve as an independent measure of the effectiveness of computer use and so provide a criterion for dividing subjects into subgroups in the analysis of results. This is in fact what was done in the Bernhardt et al. (1989) study, where the computer-using subjects were divided into subgroups of (1) those who did not successfully adapt to the computer (those selecting pen-and-paper for the posttest) and (2) those who successfully adapted to the computer (those selecting the computer for the posttest). The findings showed that the computer-using students who elected to do revisions in their posttests on computer significantly outperformed those in the computer group who preferred to revise at the end of the period of the study with pen and paper.

As noted by Bernhardt et al. (1989): "The important gains for [the computer revisers] would be obscured were their scores simply averaged with those of the smaller group who chose not to revise with the computer on the posttests" (pp. 125-126). Thus, an analysis of subgroups of users and their preferences can yield a quite different picture of computer use and effectiveness than aggregate data, as can other kinds of fine-grained or complex types of analysis such as the covariate analysis in the Bernhardt et al. (1989) study, which uncovered strong effects for teacher and for the interaction of teacher with computer use.

One can argue that effectiveness measures in word processing studies ought to be appropriate to the goals of a process approach to writing, going beyond surface measures involving mechanics or sentence-level clarity to discourse-level measures involving content and organization. In addition,

measures of improvement in individual writing skills or in the overall writing process—e.g., in revision behavior or outcomes such as those described in the widely used Faigley and Witte (1981) classification system—are particularly apt for assessing the effectiveness of word processing, which lends itself to developing writing as a multi-stage process in which revision is a central skill.

Assuming that increased revision leads eventually to improved quality—and this assumption is a basic tenet of the process approach to writing—one can see that the ultimate benefits of word processing in the writing curriculum cannot be assessed in the short-term. Under the assumption that increased quantity eventually leads to improved quality, effectiveness for word processing 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, number of sentences in drafts, clausal density of T-units, etc. An increase in the quantity of revision according to any of these measures can be viewed as a desirable first-order effect of word processing. By this criterion, the research reported in Collier (1983), Daiute (1985a), Posey (1986), and Deming (1987) showing an increase in revision but not in writing quality can be taken as a short-term effect of word processing that is potentially positive for long-term effects in writing quality.

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, or medium-term, effect of word processing. 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 word processing. Another way of measuring the effects of word processing on revision and ultimate writing quality is to look at how much a subject is able to improve a paper in going from a first draft to a second draft. As indicated in the Bernhardt et al. (1989) study, improvement scores for amount or type of revision, or for other other measures of writing quality—rather than scores on one-shot impromptu essays—can show up substantial differences in performance of subjects assigned to use or non-use of the computer, as well as

in performance of individuals or subgroups differentiated according to preference for use or non-use of the computer.

The Potential of Word Processing for ESL

As Stein (1986) has pointed out, non-native writers may be deficient in their knowledge of writing conventions and the grammar of their second language, both syntax and lexicon, as well as in their writing process. Moreover, like basic writers, they do not possess automatized strategies for applying their knowledge during the writing process in order to express their exact meaning through selection of a particular word, sentence structure, or order of sentences within a paragraph. Thus, in order to achieve success in ESL composition, a non-native writer must develop not only a base of knowledge about English and its rhetorical conventions, but a set of procedures for applying that knowledge while composing (Pennington, 1990).

While word processing cannot aid the non-native writer in achieving the first goal, that of developing a linguistic and rhetorical knowledge base, it offers a medium for working within the process approach to teach writers the strategies they can use to put knowledge about the target language into practice as they compose. It thus promotes independence and self-sufficiency in writing by providing a means for implementing creative revision and elaboration of ideas. In addition, use of the computer may help the language learner more than pen and paper to automatize composing routines and thought patterns connected with the writing process. The utility of word processing therefore lies in providing an environment in which to practice and develop an individual writing process.

As the effects of word processing on student writing are being investigated more extensively, it is beginning to become apparent that writing with a word processor may not be equivalent to writing with non-technological aids. There is some evidence that word processing may promote a different kind of writing process than writing by ordinary pen-and-paper means. Of the subjects in the Bernhardt et al. (1989) study who were exposed for sixteen weeks to word processing: "Most stated that using the computer caused them to change the way they planned, organized, wrote, revised, and edited their

papers" (p. 123). As Phinney (1989: 85) notes: "There are significant differences between revising with a hard copy and revising on-line which may push the writer toward one type of revision [rather than another.]" Research by Haas (1989) has pinpointed some differences in planning by writers using word processing as compared to pen-and-paper means. In Haas' study, the word processing subjects: (1) did less planning before writing and (2) exhibited more local, sequential planning and less higher-level, conceptual planning than subjects using pen and paper.

This lack of planning overall and of higher-level planning in favor of local planning does not necessarily, however, equate to a poorer writing process or product. As Haas (1989: 201–202) conjectures:

Possibly writers "make up for" repressed planning with word processing in other ways. In a pilot study, we found that while writers planned less in word processing conditions, they reread their texts more extensively than they did in the pen and paper condition...Further research should explore not only reasons for less planning with word processing, but also the impact of this decreased planning. Although most researchers agree that in general better writers plan more, the relationship of planning to text quality has not been established. It is not clear, for instance, if the differences in planning evidenced here would result in texts of lower judged quality.

Bernhardt et al. (1989) found that while the first drafts of the word-processing subjects were judged to be of lower quality than those writing with pen and paper in their study, the revised papers of the former group were judged to be of somewhat higher quality than those of the latter group. Bernhardt et al. (1989) speculate: "Perhaps becoming familiar with the machine's usefulness as a revising tool encouraged students to write quick first drafts, which they knew they could revise later" (p. 125). It is possible that the word-processing subjects had adopted a new approach to writing, one in which the effort involved in initial planning was replaced by subsequent cognitive effort directed at revision. This approach would seem particularly well-suited to the

properties of the word processor that facilitate redrafting.

The results seem to indicate a difference in overall approach to writing when word processing is used. Moreover, they may indicate differences in cognitive processing engendered by computer-based writing. Hawisher (1989), citing a case study of the use of word processing by two novelists (Catano, 1985), speculates that word processing may actually “foster synthesis of [a writer’s] ideas” (p. 55). As Haas (1989) believes: “Technological contexts—like social contexts—may have a powerful role in shaping writers’ cognitive processes, a role we are only beginning to understand” (p. 204). The computer offers the user additional resources of information storage and retrieval to supplement the limited capacity of the human memory to retain and manipulate information in the relatively short-term and new ways of realizing ideas in written form through word processing and its associated functions and peripherals. With the aid of its auxiliary memory and special manipulative features, writers may develop new insights not possible without computer-aided writing environment. As Perkins (1985) maintains:

By reducing onerous mechanics, the new symbolic technologies may free us to attend in new ways and aspire to new levels of cognition. One might put it this way: The written word extended the reach of thought by helping us to circumvent low-level limitations of human short-term memory. Information-processing technologies might further extend the reach of thought by helping us to circumvent the low-level limitations of human computational ability, including not only computation with numbers but with words and images. (p. 12)

This function may be of special importance for non-native writers, who must manage a greater cognitive load in communication than is required when communicating in one’s native language. They are therefore generally less able than those writing in their native language to hold many types of information in mind and to manipulate this information into a coherent text. Because of memory limitations and lack of experience in the second language, they may be less able than native writers to call up ready-made schema into which they can fit units of information to make paragraphs or longer discourse units.

Word processing may aid ESL writers by allowing them to develop an organizational schema for a paper independently of the information needed to instantiate it.

Approaches to writing that may be engendered or facilitated by word processing can be of particular value for non-native writers. Also, the settings of computer use may adapt themselves well to the needs of ESL students or may open up new ways of fostering the goals of communicative language teaching. For example, it is very unlikely that all students in an ESL class will have achieved the same level of writing development in their first language, and, as a result, a group of ESL students generally represents a wide array of writing levels and problems. Since their writing experience and problems tend to be so varied, individualization of work in a writing lab set-up with teacher acting as tutor may be an excellent arrangement for training the skills of ESL student writers. Moreover, the possibility of networking on computer with other students as audience for their ideas and/or respondents to their writing can add an important dimension of communicative language teaching for the second language classroom.

Conclusion

Summary of Findings

To date, computer-assisted writing has generally met with positive acceptance by teachers and students alike. As Phinney (1989) notes:

The greatest effect of computer-assisted composition appears to be the change of attitudes towards writing. Almost every study has reported that students enjoy using a computer to write and that they feel a sense of mastery and accomplishment in learning to use the software. (p. 85)

Attitudinal benefits are important and can have a far-reaching social impact in the composition classroom:

These positive attitudes toward computer composing...tend to contribute to a spirit of cooperation rather than competitiveness with a classroom. This resulting change in social interactions among students and instructors might be capable of creating an improved classroom culture, if we can act upon it. (Hawisher, 1989, p. 64)

In terms of other measures of its value in educational contexts, computer-assisted writing has received mixed reviews. An overview of studies of computer-based writing aids 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, other aspects of the context of use, and the way in which the effects of the computer on student writing are measured.

Under some circumstances, word processing does not appear to produce any positive effects as compared to pen-and-paper means. However, when used for one or more semesters, or with the addition of a process-prompting program or individualized tutorial assistance, word processing seems to produce positive results in terms of increasing the effectiveness of writing process and improving the quality of written products. It also may engender different ways of approaching the act of writing in a second language that will make it possible for the ESL writer to draw more on knowledge that s/he already has about how to write, and to divide the writing process into individual acts or stages that focus successively on content, organization and language.

Recommendations for Pedagogy

In the present day, it seems advisable to offer a word-processing option for ESL students. If such a decision is taken, then the following guidelines are recommended:

- Allow students to select a word processing section of an ESL writing course at the point where they have achieved at least an intermediate level of general English proficiency and are writing essay-length assignments;
- Provide an orientation to use of the computer to ensure that students will be comfortable and motivated to use it and will not be put off by the typing requirement;
- Assign experienced ESL writing teachers or tutors who are well-trained in computer use to work with students on an individual basis;
- Provide ample time for individuals to work at computer terminals with large and clear display screens, preferably in separate carrels or in a computer lab set up with dividers to provide relatively private workspaces;
- Incorporate peer work into the computer curriculum through electronic networking and/or off-line feedback sessions;
- Offer a curriculum that progressively develops computer-based writing skills within a process approach over more than one semester;
- Choose word processing programs that are easy to use and that offer resources such as "windows," process-prompts, special formatting options, or printing features that encourage students to increase their involvement with writing.

Figure 6: Recommendations for Word Processing with ESL Students

Recommendations for Research

If research is to be conducted on word processing in an ESL context, the findings of previous research should serve as a guide for future investigations. Drawing on the present research review and the recommendations of Hawisher (1989, pp. 58ff), the following guidelines are offered:

(a) **Subjects.** For reliable and valid results to obtain in word processing studies, researchers should select subjects who are similar in general language proficiency, writing ability, knowledge of and attitudes towards computers,

and word processing skill, or else systematically investigate differences in these inter-subject variables. "Specific studies should be designed to distinguish subgroups among students using computers to tease out the differences between those who adapt well to the technology and those who do not" (Bernhardt et al., 1989, p. 131).

(b) **Teachers.** In order for the results of comparative research on the effectiveness of word processing to be valid, instruction in word processing and in writing process must be provided to students by motivated, highly trained teachers or tutors. Moreover, as Bernhardt et al. (1989, p. 131) recommend:

...we should study and attempt to isolate what it is that determines how well individual teachers adapt to a lab environment, recognizing that we should not expect all teachers to be comfortable and successful in a lab setting. We should study how teachers change their strategies when they are free to adapt instruction to a lab setting by removing the constraint of double preparation. This suggests open, naturalistic investigation of teachers in lab settings to hypothesize and define variation and adaptation.

(c) **Setting.** The setting for word processing must be agreeable to students and provide a reasonable degree of availability, privacy, comfort, and ease of use. Differences in setting effects for the same teacher or the same population of students should be investigated.

(d) **Time-Span.** In order to investigate the effectiveness of word processing in improving students' writing process and ultimately their writing quality, the time-span of the research should be a minimum of one semester. Systematic comparison of results for shorter and longer time periods would be of great value, as would longitudinal studies that follow subjects for a semester or more, measuring the degree and type of writing change and improvement at specified intervals.

(e) **Training.** If the goal is for student writers to apply word processing in the development of their writing skills, special instruction in how to exploit word processing for that purpose will increase the chances of success.

Comparison of different time periods and approaches to training would be of value to educators who need to determine the best way to ensure a smooth implementation in which all students will successfully adapt to word processing. Researchers might also extend the results of previous studies by systematically investigating individual adaptation to the word processing medium in the absence of any explicit training in its use.

(f) **Instructional Format.** Comparisons of instructional approaches that combine different proportions of classroom instruction with individualized work in a computer writing lab would be useful, as would research designed to explore the effectiveness of structured approaches to the use of word processing. For example, research might investigate the utility of teaching ESL students to fit data already available in files to different organizational schemes or of structuring the writing process to ensure a progression of drafts, each of which addresses a different aspect of the writing process (e.g., content, voice, audience, organization, discourse grammar, word choice, mechanics).

(g) **Software.** Research on the effectiveness of word processing with ESL students should make use of simple programs or involve informed use of a program that has a certain bias in terms of the writing strategies required to work with the program or introduced as a by-product of working with the program. Comparative studies are needed on the differential effects of simple versus more complex programs that offer special features which make them more difficult to use but which might be of value to student writers.

(h) **Effectiveness Measures.** The effects of word processing should be assessed by a variety of measures of attitude, writing skill, and quality of written work, using holistic and analytical instruments, descriptive and inferential statistics, and detailed case-study and ethnographic analysis. The kinds of changes in writing process and quality promoted in students who adapt well versus those who do not should be measured differentially. The computer itself offers an excellent environment and tool for regulating the course of the research (e.g., by providing time-limits or prompts) and for storing, tabulating, and analyzing data (e.g., specific keystrokes, number of words, length of composing sessions, and the rhythm of composing made up of periods of pausing and writing. Bridwell et al. (1984) have also advocated using the computer to stimulate retrospective analysis of a writing session, by

having sections of text play back on the screen at the same speed with which they were produced, as the student describes what s/he was thinking at that time.

Perhaps even more important, educators need to start closely examining the kinds of processes—involving learning, cognition, and language—that are occurring in the context of the computer. It is beginning to be apparent that the computer has the capacity to influence the way in which users learn, their mental processes, and their oral and written communication. The uses of the computer by deaf students to “talk” to each other (Peyton and Batson, 1986) and by elementary school students to network with other students (Levin et al., 1985) are two examples of how computer use is defining new kinds of “literacy events” (Heath, 1982) that blur traditional distinctions between oral and written language and that are shifting the boundaries between the two modes of communication. While we will certainly wish to promote those computer-centered or computer-stimulated events which seem beneficial to students, we are at the same time obligated to discontinue those that appear to be ineffective or counterproductive, such as use of word processing without process-oriented guidance or reliance on the computer for error-correction (see Pennington and Brock, forthcoming, for discussion).

As educators, we need to carefully investigate the emergent literacy events that are evolving in the environment of the computer and that are changing the way that people write, discuss, learn, and organize ideas. We want to exploit these exciting capabilities but at the same time must find out what exactly their attributes are before we rush headlong to develop them in our students. Based on an examination of the information available at the present time, word processing appears to offer many potential benefits for writers and especially for non-natives who are not fully proficient in English. Therefore, educators would seem to be justified in extending the trials of word processing in the ESL writing curriculum.

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