

Six Advantages of Computer-Mediated Text for Reading and Writing Instruction

DAVID REINKING

Few writers, once exposed to word processing, ever return completely to more conventional methods of composing, revising, and editing text. The advantages of a computer over pencil, paper, and typewriter are intuitively obvious to most writers almost immediately. Educators also have begun to take note of these differences. Word processing and typing (keyboarding) skills have become a part of the curriculum in many schools.

Word processing as it has typically been defined, however, is only a subset of a larger set of applications which might be called computer-mediated text. Computer-mediated text is any application of the computer which places the immediate display of written text under the direct control of a computer program (Reinking, 1985a). Considering the advantages of computer-mediated text, instead of word processing alone, permits a more comprehensive analysis of how the computer interacts with the entire spectrum of written language processes.

For example, underlying the easily recognized advantages of word processing may be more fundamental advantages which have

implications for reading as well. Thus, despite the widespread enthusiasm for word processing, we are only beginning to discover the unique advantages of computer-mediated text. In this article, I present six advantages of computer-mediated text which I feel have significance for both reading and writing instruction. Although a longer list of advantages might have been generated, an attempt has been made to list those which encompass a wide range of applications and which define fundamental differences between computer-mediated text and more conventional forms of reading and writing. After the listing of each advantage, its significance for reading and writing instruction will be discussed along with illustrative applications.

Advantage One: Computer-mediated text enhances the ability of readers and writers to interact with written text.

Writing. Typical word processing functions illustrate this advantage for writers. For example, revising text by rearranging sentences and paragraphs is easier when the text is mediated by a computer. This capability allows writers to revise easily what they have written and this in turn may stimulate experimentation with alternate forms and styles. Writers are probably more likely to take

risks because the computer expands opportunities to manipulate prose. The ease with which the text can be manipulated also makes revision an on-going process, as opposed to a set of discrete drafts resulting in a final product. Teachers can, therefore, feel freer to make suggestions to students. Suggestions to revise a manuscript are probably better received by students because even major revisions are relatively easy to carry out with the aid of a word processing program.

Other possibilities for interacting with one's own writing are possible but not widely available. In the future, word processing programs might permit the writer to easily change every passive sentence construction to the active voice. Similarly, the writer could request that the computer generate a list of synonyms for a particular word. The computer also could substitute these words one at a time into a particular sentence enabling the writer to more aptly select the appropriate word.

Reading. Although not as familiar as word processing applications, there are some examples of how computer-mediated text might enhance a reader's interactions with the text. Reinking and Schreiner (1985), for example, developed a computer program which provided help to readers experiencing difficulty in understanding expository passages. Readers could request that the computer provide a less-technical version of the passage, define key vocabulary, elaborate on impor-

tant background information, and identify the main idea of each paragraph. McConkie (1983) also has described how interfacing a computer with appropriate hardware can permit a reader to hear an unfamiliar word pronounced when it is touched on the computer screen. These applications illustrate how computer-mediated text can expand readers' options for interacting with text. Readers may become more active and persistent in their attempts to read and understand text when they have these or similar opportunities to derive meaning from what they are reading.

Advantage Two: Computer-mediated text permits external control of written language processes.¹

Writing. Teachers normally have little control over what their students attend to while writing. Guidelines and suggestions may or may not be followed since the writing process is normally covert and teacher intervention usually occurs after, not during, some stage of the writing process. Computer-mediated text, however, allows the teacher via a computer program to exercise some control while a student is writing. One example of this advantage would be having the computer display an asterisk in place of an overworked adjective like "nice" or "pretty" when a writer attempts to type these words. The asterisk could serve as a reminder to look for a more descriptive word. Another activity which makes use of this advantage is "in-

visible" writing. To prevent some writers from excessive pre-editing, the computer saves the text which is entered, but does not display the text immediately on the computer screen, thus reducing the likelihood of pre-editing.

Reading. Since most reading in school is independent reading, teachers also have little control over what students do while they are reading. For example, students may ignore graphic aids or avoid responding to periodic comprehension checks despite their teachers' admonitions to use these helps. The computer, however, can make certain reading behaviors difficult to avoid. Wilkinson (1983) has summarized this advantage in terms of framing and pacing. In short, the computer can regulate the text to which readers are exposed and for how long it is presented to them. The reader's ability to access subsequent text also can be linked to a number of contingencies. For example, Anderson, et al. (1974) used a computer to restrict students' access to a new reading assignment until they had achieved a criterion score on questions covering content in a previous reading assignment.

This advantage represents somewhat of a dilemma for educators. On one hand, the computer makes available unprecedented control over what readers do while reading. At the same time, there is currently little guidance as to how this control can be used to the best advantage. Nonetheless, this capability may

have more important implications for reading and learning from text.

Advantage Three: Computerized text can lessen the drudgery associated with some aspects of reading and writing.

Writing. For most students, the enjoyable part of writing is being creative. Attending to the mechanical aspects of writing like grammar and spelling is less enjoyable for many students. Computer-mediated text can lessen this drudgery by managing many of these functions automatically. Spelling checking programs are coming into widespread use and programs which monitor grammatical constructions and punctuation are beginning to appear. For those who make use of these programs, it will no longer be necessary to read and reread a manuscript for typing mistakes, spelling errors, or inappropriate grammatical constructions. An added advantage of these programs is that they highlight errors which may have gone unnoticed by the writer, and some offer the writer advice if it is requested. With the aid of spelling checking programs, for example, even accomplished writers have discovered they have been misspelling a word for years.

The computer also may reduce the tedium associated with researching a topic by making information more accessible. Computer searches have become commonplace in many large libraries and these reduce greatly the time and effort required to obtain informa-

tion related to a particular topic. Some schools and individual students already subscribe to large databases which make such searches more convenient.

The net effect of these technological improvements is that they allow a writer to compose at a speed which is closer to thought. While composing, the writer need not be unduly distracted by the more mechanical, and often less interesting, aspects of writing. At the same time, using a word processing program seems to heighten young writers' concern for these factors when they later choose to focus on editing their work (Daiute, 1982).

Reading. Under certain conditions reading may also be characterized as drudgery. Reading unfamiliar or difficult material, for example, can be frustrating because comprehension may require elaborate and sometimes distracting attempts to acquire meaning from the text. This condition is typical of school related reading for many students who lack the high degree of motivation needed to persevere in the face of comprehension difficulty. Despite individual differences in tolerance for difficulty, many readers choose simply to avoid this drudgery whenever possible. A book or article may be abandoned if it requires too much effort to understand even if it contains information which interests the reader. Even highly motivated and competent readers tend to avoid tedious intrusions during reading, like looking up an unfamiliar word in the dictionary.

Similarly, younger readers may give up reading a text which contains many words that are difficult to decode, even if they are interested in the content.

Computer-mediated text may affect these reading behaviors by providing immediate on-line help to readers experiencing some difficulty. The examples mentioned in which the computer provided the pronunciation of unfamiliar words (McConkie, 1983) or provided specified help to a reader experiencing comprehension difficulty (Reinking & Schreiner, 1985) both illustrate how this could be done.

Other ideas that are being explored include providing the reader with an on-line dictionary. Some of these efforts involve interfacing a computer with a video disk to enhance the quality and range of visual images which might accompany definitions (e.g., Miller, 1979). Readers may be more likely to pursue difficult aspects of a text when such on-line helps are easily accessible and directly relevant to the text being read. Rickman (1985) suggested that this might explain why intermediate grade readers in her study pursued the meanings of unfamiliar words more frequently when definitions were provided immediately by the computer.

Advantage Four: Computer-mediated text can provide individualized help and guidance during independent reading and writing activities.

Writing: Teachers frequently do not have the time or the oppor-

tunity to individually counsel students engaged in writing. More often, students submit a finished product to the teacher who then evaluates their efforts. Although teachers prefer to offer more individualized guidance during the writing process, providing this help is not always feasible. Computer-mediated text, however, can simulate the kind of guidance teachers would give if they could more closely monitor students' work at various stages of their writing.

The Writer's Workbench (MacDonald et al., 1982) is a series of programs developed at Bell Laboratories which illustrates this advantage. Among other things, these programs can pinpoint frequently misused or wordy phrases and suggest alternate constructions. Another program compares the first and last sentence in each paragraph to test for coherence. A program called "Style" quantifies certain stylistic information like sentence length and type. The latter information then can be used by another program to compare a summary of the author's style to a good example of the same type of writing. Although such powerful programs are not yet widely available, they illustrate how computer-mediated text could provide on-going editorial assistance to an individual writer.

Some teachers already are making use of computer programs which can assist individual students at the invention stage of writing. Several existing micro-computer programs (for example,

Burns & Culp, 1980) assist writers in deciding on a topic and help them develop their ideas. The computer is used to simulate a dialogue between a teacher and a student in which the computer, in the role of the teacher, asks leading and clarifying questions. To a degree, these programs also enable the computer to respond appropriately to the answers provided by the student.

Reading. The widely used Directed Reading Lesson (DRL) is based on the premise that students will benefit from the help, guidance, and modeling of appropriate reading behaviors which a skilled teacher can provide. When the teacher is unavailable, however, only weak forms of this help (such as previews and inserted questions) can be embedded in the text itself.

Computer-mediated text offers opportunities to increase the guidance and help which is available during independent reading. For example, in conjunction with a question a reader is having difficulty answering, the computer could locate and highlight portions of the text which are relevant to the question. Or, the computer could monitor readers' responses to particular types of questions and adjust the nature of the questions to better suit each student's needs. With the aid of a computer, the text itself can be adjusted to meet the needs of an individual reader. L'Allier (1981), for example, demonstrated that poor readers can comprehend as well as their

better reading peers when the computer monitored their reading performance and revised the text accordingly.

Advantage Five: Computer-mediated text can contribute to the development of purposeful communication in school and thus it can bring together reading and writing activities.

Reading and Writing. Kirby and Kirby (1985) have pointed out limitations of reading and writing activities as they typically occur in school:

Researchers in reading and writing are finding substantial differences between school-assigned and unassigned out of school writing and between reading for answers and reading for pleasure. Writers and readers who engage in only school-sponsored applications are preoccupied with errors, with surface meanings rather than larger textual meanings...They take fewer risks in reading and writing and see these acts as divorced from their personal experience (p. 345).

The typical separation of reading and writing instruction in the curriculum exacerbates these limitations.

One way of confronting these limitations is to create opportunities for meaningful communication within a school environment. The computer may play an important role in achieving this goal because it can stimulate reading and writing activities which are carried out for real communicative purposes. With the aid of a computer,

teachers can generate a variety of activities which encourage students to interact with each other as well as with the teacher.

One example of how the computer can enhance reading and writing activities is a series of programs known collectively as *Quill* (Collins, Bruce, & Rubin, 1982). Besides providing word processing capabilities, these programs enable students to "publish" their work, send messages to each other, accumulate knowledge in an information exchange, and create reading and writing games for other students. *Quill* and similar programs provide the opportunity to generate new reading and writing activities which would be difficult to implement without the aid of a computer.

Another application illustrates how the computer can shift the focus of a writing activity from completing an assignment to communicating information to other students. As an alternative to the traditional book report, teachers can have students use a computer database to find a book they might want to read. Instead of writing a report for the teacher to correct, students can be reviewing books for each other. Reading and writing activities are logically connected in this application.

Finally, the computer can be viewed as a unique device which expands options for written communication (Reinking, 1985b). Levin, Boruta, and Vasconcellos (1983), for example, described their efforts to implement a computer network which enables

students in California and Alaska to send messages to each other. As such networks become more common, students will be able to practice reading and writing with "electronic pen pals."

Advantage Six: Computer-mediated text facilitates the gathering of new data concerning written texts and processes of reading and writing.

Writing. One of the earliest applications of the computer to written language was an attempt to establish the authenticity of papers which may have been written by Shakespeare. The computer was used to compare characteristics of the disputed text to those which Shakespeare undoubtedly wrote. The value of the computer in this task was that it enabled scholars to analyze both texts along a number of stylistic dimensions simultaneously (for example, average word length, spelling patterns, and the proportion of the text employing a particular construction). Similarly, the computer provides authors with interesting new information about their own writing. *The Writer's Workbench* programs cited above are a current example. In the future, writers attempting to write a journal article, for example, can use the computer to compare their efforts with several well-written journal articles. The computer can quantify the stylistic differences between the two and make suggestions for improvement based on this information.

Computers enable a teacher or researcher to gather information

about how a writer approaches a task. Bridwell, Nancarrow, and Ross (1983), for example, adapted a word processing program so that it would record each action taken by a writer composing at the computer. Later researchers were able to infer writing strategies and styles by comparing writers' actions. Writers also were asked to explain their strategies while watching an "instant replay" of their actions on the computer screen. Similar programs can become an important diagnostic tool by enabling teachers to gain insight into the strategies employed by their students during various writing activities.

Reading. When a student is reading conventional text on printed pages, there are few convenient ways to find out what is going on inside the reader's head. Reading, like other complex cognitive activities, is essentially covert. Yet, it is impossible to investigate the reading process and difficult to help a reader having problems without speculating about the internal strategies employed. Computer-mediated text expands options for collecting data which may shed light on internal processes and it can do so without some of the disadvantages associated with other methods (such as introspective protocols which interfere with normal reading.) (Reinking, 1985c).

Computer-mediated text, for example, enabled Reinking and Schreiner (1985) to make various help options available to readers having difficulty comprehending

text and to record their selections. Although not their primary purpose, analysis of these data permitted speculation about readers' strategies as well as characteristics of the text. Similarly, McConkie (1983) was able to infer that readers were learning to identify new words because the computer recorded the fact that after several exposures they no longer requested the computer's help in pronouncing them. Gathering data in this way may prove to be useful for researchers as well as for diagnosticians.

A Final Word

A listing of advantages tends to play down how the advantages interact and overlap. For example, without external control (Advantage Two) and enhanced interactions (Advantage One) it would not be possible to gather new kinds of data concerning reading and writing processes (Advantage Six). Several important correlates of these advantages must be omitted in this brief overview. The potential of the computer to create communication contexts (Advantage Five), for example, may lead to less threatening learning environments and a new role for the teacher. Teachers and students may interact more like a master and apprentice emphasizing more the processes of reading and writing as opposed to focusing primarily on the final product.

The advantages outlined here are intended to encourage further speculation about how computer-mediated text may affect reading

and writing instruction. Perhaps the most significant implication of these advantages is that they may require educators to examine more closely their perceptions of reading and writing in schools and the role of the computer in affecting written language processes. Computer-mediated text, for example, may increase the feasibility of whole language experiences in reading instruction. Regardless of the ultimate effects of the computer on reading and writing instruction, the widespread use of computers for communicating written information dictates an immediate need for a thoughtful and informed response by educators.

Footnote

¹The capability to control learner choices often is an overlooked educational advantage of the computer. In fact, the computer's capability to provide a wider range of choices to the learner is often cited as an advantage. There is, however, a body of literature which suggests that, in many instances, closing options to the learner is more beneficial than opening options (cf. Carrier, 1984 and Tennyson, 1980).

References

- Anderson, T.H., Anderson, R.C., Dalgaard, B.R., Biddle, W.B., Surber, J.R., & Alessi, S.M. (1974). An experimental evaluation of a computer based study management system. *Educational Psychologist, 11*, 184-190.
- Bridwell, L., Nancarrow, P.R., & Ross, D. (1984). The writing process and the writing machine: Current research on word processors relevant to the teaching of composition. In R. Beach & L. Bridwell (Eds.), *New directions in composition research* (pp. 1-19). New York: Guilford Press.
- Burns, H., & Culp, G. (1980). Stimulating invention in English composition through computer-assisted instruction. *Educational Technology, 20*, 5-10.

Carrier, C. (1984). Do learners make good choices? *Instructional Innovator*, 29, 15-17.

Collins, A., Bruce, B.C., & Rubin, A. (1982). Microcomputer-based activities for the upper elementary grades. In *Proceedings of the Fourth International Learning Technology Congress and Exposition*. Warrenton, VA: Society for Applied Learning Technology.

Daiute, C. (1982). Word processing. Can it make even good writers better? *Electronic Learning*, 1, 29-31.

Kirby, D.R., & Kirby, K. (1985). The reading-writing connection. In L.W. Searfoss & J.E. Readence (Eds.), *Helping children learn to read* (pp. 338-353). Englewood Cliffs, NJ: Prentice-Hall.

L'Allier, J.J. (1980). *An evaluation study of a computer-based lesson that adjusts reading level by monitoring on task reader characteristics*. Unpublished doctoral dissertation, University of Minnesota.

Levin, J.A., Boruta, M.J., & Vasconcellos, M.T. (1983). Microcomputer-based environments for writing: A writer's assistant. In A.C. Wilkinson (Ed.), *Classroom computers and cognitive science* (pp. 219-232). New York: Academic Press.

MacDonald, N.H., Frase, L.T., Gingrich, P.S., & Keenan, S.A. (1982). The writer's workbench: Computer aids for text analysis. *IEEE Transactions on Communication*, 20, 1-14.

McConkie, G.W. (1983, November/December). *Computer-aided reading: A help for illiterate adults*. Paper presented at the meeting of the National Reading Conference, Austin, TX.

Miller, L.A. (1979). *Automated dictionaries. Testing, Teaching and Learning*. Washington, D.C.: The National Institute of Education.

Reinking, D. (1985a). *Reading, computers, and a new technology of print*. Manuscript submitted for publication.

Reinking, D. (1985b, May). *The computer as a communication medium*. Paper presented at the meeting of the International Reading Association, New Orleans, LA.

Reinking, D. (1985c, November). *Using microcomputers to gather on-task processing data*. Paper presented at the meeting of the Georgia Educational Research Association, Atlanta, GA.

Reinking, D., & Schreiner, R. (1985). The effects of computer-mediated text on measures of reading comprehension and reading behavior. *Reading Research Quarterly*, 20, 536-552.

Rickman, S. (1985). *The effects of computer-mediated text on the comprehension and vocabulary learning of intermediate-grade readers*. Unpublished masters thesis, Rutgers University, New Brunswick, NJ.

Tennyson, R.D. (1980). Instructional control strategies and content structure as design variables in concept acquisition using computer-based instruction. *Journal of Educational Psychology*, 72, 525-532.

Wilkinson, A.C. (1983). Learning to read in to read in real time. In A.C. Wilkinson (Ed.), *Classroom computers and cognitive science* (pp. 183-199). New York: Academic Press.

On-Line Communication: A Revolution in Reading?

MICHAEL N. MILONE

Admittedly, the title of this article is pretty strong stuff. After all, in the long and glorious history of reading, revolutions have been scarce, to say the least. The first one took place about ten thousand years ago, when a merchant scrawled a packing list on wet clay and invented writing and reading in one fell swoop. Not long after (at least on a cosmic scale) came hieroglyphics, papyrus, the alphabet, paper, and typesetting. Not much has happened during the thousand or so years since a Korean printer invented movable type, with the possible exception of Gutenberg's violation of international patent law.

Within the past decade, however, a technological advance has spawned a development in reading that may influence visible language as much as did movable type. The technology, of course, is the microcomputer, and the development in reading is *on-line communication*.

What is On-Line Communication?

Simply put, *on-line communication* is the transmission of text material from computer to computer. Implicit in this definition is the assumption that a person is

operating one of the computers and is the end recipient of the information.

The text material can take any one of a number of forms: a letter transmitted through electronic mail, a reference from an on-line encyclopedia, an article from a newspaper published in a distant city, a monthly statement from an electronic banking service, or the list of items from an electronic shopping guide. Even at this relatively early stage in the development of *on-line communication*, the variety and quantity of information that is available electronically rivals traditional print materials. Each day, thousands of on-line services and bulletin board systems (BBS) churn out billions of characters of information for public consumption.

At first glance, *on-line communication* might seem to be the domain of techies and yuppies. These two groups certainly account for some of the users of on-line networks, but they are in the minority. Jane and John Q. Public are large consumers of on-line information, and the most frequent users are bank tellers, insurance professionals, and stock brokers, none of whom are typical technophiles. *On-line communication* has taken a dustier and is expanding into other branches of commerce and industry. And the consumer market is not being left behind; Com-

Michael N. Milone is an Adjunct Assistant Professor at the Ohio State University, Columbus, Ohio.