A STUDY OF ONE COMPUTER-DRIVEN TEXT ANALYSIS PACKAGE FOR COLLEGIATE STUDENT WRITERS

DISSERTATION

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

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Denton, Texas

December, 1988

This study examines the effects of the computer-assisted text analysis program, WRITER'S WORKBENCH, on writing performance, levels of writing apprehension, students' writing processes and attitudes about using the computer and WORKBENCH for writing. A sample of 275 subjects enrolled in freshman composition were divided into an experimental group (N = 200) who used WORKBENCH in a mandatory computer lab component in addition to their composition course and a control group (N = 75) who received only the course, itself. Because random selection of participants was not possible, a Nonequivalent Control Group design was utilized.

Holistic scoring of pre and posttest essays revealed a significant improvement in writing among both groups as a result of the treatments, but there was no significant difference in writing gains between the group using WORKBENCH and the group who did not (p = .942). Similarly, though both groups demonstrated a small decrease in writing apprehension after instruction, there was no significant
difference in the degree of decrease between the two groups (p = .201). Also, the data did not support a relationship between writing performance and apprehension.

A 40 item questionnaire was given to the experimental group to determine: 1) attitudes about writing with a computer, 2) how students use WORKBENCH, and 3) students' attitudes about WORKBENCH. Some highlights of these findings are that narrow majorities enjoyed and were comfortable using the computer and WORKBENCH, but substantial minorities dissented or were uncertain. While 60% felt happier with their essays after using WORKBENCH and preferred using a computer to write, 89% of students felt word processing represented the greatest advantage and SPELL was the next most popular feature.

Personal interviews conducted with 13 of the most and least apprehensive WORKBENCH users revealed that some students ignored the WORKBENCH analyses, and highly apprehensive students experienced more frustration with the computer, employed different writing processes, used WORKBENCH less often and less skillfully, and expressed more dissatisfaction with the computer.
ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the many areas at Colorado State University, especially the Department of English, the Statistics Laboratory, and the computer support services, who cooperated in this study. Dr. Dawn Rodrigues and Dr. Charles Smith deserve special recognition; without their untiring encouragement, support, and assistance, this research could not have been accomplished.
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CHAPTER I

INTRODUCTION

More than four decades of social, economic, and educational change have challenged the resourcefulness of writing educators. Simultaneously, society's expectations have made these educators subject to increasing public, legislative, and professional scrutiny and demands for fiscal and instructional accountability. But this interest has also served to acknowledge that "our age demands competence in writing," as Daly (1975b) expresses it, and intensified the search for effective instructional responses.

The writing process, however, is as complex as the reasoning capacity of the human brain, itself (Ross and Bridwell 1985, Schwartz 1987, Thiesmeyer 1987, Wallraff 1988, and Linden 1988). Thus, Selfe (1984) expresses the frustrations of writing instructors in general when she contemplates the "mythic proportions" of the "heroic task" of guiding 200 students representing a variety of majors and abilities each year through the "wickedly complex maze we call the writing process." As college English teachers have
always known: there are "too many students and too little
time to do this job well" (1984).

Two recent and interrelated developments within the
profession appear to offer promise to writing educators:
the slow accumulation of a new body of composition research
and the utilization of the speed and power of computer
technology.

A major breakthrough in the teaching of writing
has been made possible by the convergence of two
recent developments in science and technology.
Cognitive science, which brings together the
disciplines of cognitive psychology, artificial
intelligence and linguistics has begun to provide
us with the theoretical means for constructing
formal process theories of human cognition. Thus
we now have many of the tools needed for con-
structing a process theory of writing. At the
same time, technology is being developed to
manipulate and edit text. Soon this technology
will be relatively inexpensive and commonplace.
It should be possible to merge these two develop-
ments into a computer-based 'Writing Land' for
teaching and assisting people in writing. This
would be an environment with writing tasks and
games that can provide the basis for a computer-
based writing curriculum (Collins and Gentner
1980).

Certainly, rapid changes within computer technology
itself have fueled experimentation in computerizing writing
instruction. Today's microcomputers, selling for $2,000 -
$3,000 (or less), contain the same memory (or more) and
operate three times faster than the IBM 360-40 mainframe
which cost about $497,000 and required expensive service and
operation procedures in the sixties and seventies (Wresch
1984). However, Wilkinson and Patterson (1983) observe that
advances from cognitive science have been "slow to find their way into the courseware actually available for use on classroom computers." And as late as 1975 Nold lamented that a group of professionals who "undertake calmly and surely the study of Latin, Greek, Russian, Chinese, Swahili, or Gaelic often balk at the much simpler task of learning the more logical, far less capricious, language of the machine" (Wresch 1984). Perhaps this is partially explained by Arthur C. Clark's adage that "any sufficiently advanced technology is indistinguishable from magic" (Marcus 1984). A more likely explanation, however, is that writing has long been considered a process of creative invention and execution quite apart from quantification, whereas as Cohen (1984) points out, it is still intrinsic to computer science that "what we haven't quantified, computers can't calculate."

Gradually, though, writing professionals have familiarized themselves with computers, and instructional programs have emerged. There are now prewriting programs based on Aristotle's topics, Burke's pentad, and Pike, Becker, and Young's Tagememnic matrix (Burns 1984), and creative problem-solving heuristics (Rodrigues and Rodrigues 1984); text analysis programs such as WRITER'S WORKBENCH (Kiefer and Smith 1984) and HOMER (Cohen 1984); a variety of word processing programs such as those used at the University of
Minnesota (Bridwell & Ross 1984) and elsewhere; drill and practice programs such as COMP-LAB (Southwell 1984); and ambitious attempts to integrate prewriting, wordprocessing, and revision aids such as WANDAH at UCLA to assist student writers at all stages of the writing process (Von Blum & Cohen 1984).

These are but a few of the software programs available, and the increasing use of computers in composition stimulates the growth of more software (Barker 1986). Organizations such as the National Council of the Teachers of English and the College Conference on Composition and Communication provide workshops to encourage and assist instructors to design software. Publications such as Collegiate Microcomputer and Computers and Composition publish articles and reviews about software, and companies such as IBM and Apple provide generous equipment grants (Barker 1986). Indeed, the computer industry views higher education in general as a "lucrative market for products" (Turner 1987).

Selfe (1984) identifies one of the primary features of computer technology that English instructors find attractive: its potential to provide effective instructional assistance and thereby provide teachers with valuable time to perform other instructional tasks better. After introducing WORDSWORTH II at Michigan Technological University,
she found instructors reported explaining concepts less frequently and needing fewer personal conferences with students. Students, she claims, find the computer an enjoyable, private, and patient instructional aid that does not "yell" as teachers do when frustrated (1984). Other advantages commonly attributed to computer-assisted writing instruction are "individualized instruction, timely assistance and feedback, effective use of student time, a sense of fluidity of ideas, and a freedom to produce text" (Wresch 1984). And some have suggested that unlike television which eroded literacy, this new technology represents "a new medium" of "print-on-television" or "videotext" which is more dependent on literacy than even print media (Marcus 1984).

But the rapid development of computer assistance in writing raises many questions and problems, as well. For example, Bridwell, Nancarrow, and Ross (1984) note the prevalence of optimistic testimonials in the literature and the lack of concrete evidence supporting the computer's performance:

Many composition instructors, seeing the initial promise of word processing microcomputers for writers, are eager to proclaim their value from the academic rooftops - to students, to fellow faculty members, and perhaps most fervently, to departmental budget directors. But our review of relevant literature suggests that little research has yet been done to substantiate that claim.
While recognizing their weaknesses, Burns (1984) maintains these early programs are the products of "technological pioneers," and we stand on the threshold of a "second generation" of innovation. But what pedagogical theory should these represent and what standards should they uphold (Barker 1986)? As Bridwell & Ross (1984) indicate, we need to "continue to study the effects of computers on the developing writing abilities of our students," to ascertain "not just what computers can do, but what they should do," and to adopt "an objective and sometimes critical stance toward the computer in the writer's world." The present study, therefore, will objectively study the effectiveness of one computerized writing instruction program, Bell Laboratories' WRITER'S WORKBENCH as modified and operated by Colorado State University.

Statement of the Problem

This study is concerned with computer assistance in English composition instruction, particularly computer-driven text analysis and editing programs.

Purpose of the Study

The purpose of this study is to determine the effects of utilizing Colorado State University's adaptation of Bell Laboratories' computer-assisted text analysis program, WRITER'S WORKBENCH, as a laboratory added to a standard, one
semester, first-year English Composition course in a large state-supported university. Specifically, the study compares two groups of students -- one (the experimental group) utilizing WRITER'S WORKBENCH in addition to their composition course, and the other (the control group) experiencing the composition course only -- on the following primary measures:

1. Comparative gains in writing performance on summary-response essays written prior to and following the respective treatments.

2. Comparative scores in frequency and/or intensity of writing apprehension between the beginning and completion of the two treatments.

3. The possible relationship between writing gain and degree of writing apprehension.

In addition, the study will seek to determine and describe:

4. Students' attitudes about using WRITER'S WORKBENCH and its usefulness as a writing aide.

5. Students' writing processes and how they use WRITER'S WORKBENCH.

Research Questions

In this study, answers to the following research questions are sought:

1. What are the comparative effects of instruction on gains in writing performance on summary-response
essays written before and after instruction by students from the experimental and control groups as indicated by an independent panel of trained writing judges using holistic scoring techniques?

2. Does completion of one semester of English composition result in a significant reduction of writing apprehension as measured by a pre and post-instructional administration of the Daly-Miller Writing Apprehension Test?

3. Are there significant differences in the reduction of writing apprehension as measured by the same instrument between the experimental group using WRITER'S WORKBENCH and the control group which does not over the course of the same one semester of instruction?

4. Is there a significant relationship between gains in writing performance and levels of writing apprehension?

5. What are the students' attitudes about using WRITER'S WORKBENCH and whether or not it contributes to improvements in their writing as measured by a self-report questionnaire and personal interview?

6. What writing processes do students follow and how do they use WRITER'S WORKBENCH?
Limitations

Parts of this study are subject to the normal limitations of self-report data collection. In addition, while large sample sizes are used, there may be sub-groups that are not large enough to obtain significant statistical data. Where this occurs, however, their responses will be reported in a percentage format if necessary.

Basic Assumptions

It is assumed that all instructors of the sections of Composition 150 involved in this study adhered to the curriculum and syllabus prescribed by the English Department at Colorado State University. It is also assumed that instructors' individual styles were not a variable involved.

Significance of the Study

This study focuses on the effects of computer-assisted text analysis writing programs (WRITER'S WORKBENCH in particular) on improvement of students' writing, on levels of writing apprehension, on students' writing processes, and on students' attitudes about using the computer and WRITER'S WORKBENCH as writing aides. The literature emphasizes the need to improve writing instruction throughout higher education.

The literature also indicates there is great interest and involvement in computer-assisted composition instruction
in higher education, but that computer-assisted instruction involves considerable investment on the part of colleges and universities both in financial and human resources. While the literature suggests there is great promise in computer-assisted composition instruction, much of the literature also acknowledges that more objective research needs to be conducted. Furthermore, much of the literature suggests that current computer-assisted software for composition may not be consistent with the findings of recent basic composition research and that further studies on the impact of computer-assisted instruction on student writing gains, attitudes, and writing processes are necessary. Indeed, as one commentator has remarked, computer-based "Writing Land" is "largely unexplored" territory (Oliver 1984b).

Previous studies of WRITER'S WORKBENCH have used small numbers of participants and limited attitudinal variables. The present study involves a large population of students (N = 275 approximate) and several variables and research methodologies in order to provide multiple measures of the effects of computer-assisted text analysis. Therefore, this study is significant in that it may indicate whether computer-assisted text analysis programs such as WRITER'S WORKBENCH (a) contribute to improvements in students' writing, (b) affect students' apprehension of writing,
(c) affect students' writing processes, and if so, how, and
(d) affect students' attitudes about writing and using
computers as writing tools.

Definition of Terms

The following terms are defined for the purpose of this study.

1. **Writing Apprehension**: A disposition to be unduly anxious or apprehensive about producing written communication. The tendency to perceive writing as a "troublesome, uncomfortable, and even fearful experience" (Daly 1985a).

2. **English Composition 150**: The usually mandatory one semester expository writing course for freshmen at Colorado State University.

3. **Computer-Assisted Instruction**: The use of computers in the instructional process which usually provide students with programmed sequences of learning material or guidance under computer control (Russell 1983).

4. **Artificial Intelligence**: The branch of computer science concerned with exploring how computers can perform human mental processes such as problem-solving and language acquisition (Wresch 1984b).
5. **Computer Hardware:** The computer and any other mechanical devices attached to it (Wresch 1984b).

6. **Computer Software:** Computer programs, "soft" since they are easy to alter, whereas the machine itself is "hard" to modify (Wresch 1984b).

7. **Text Analysis Programs:** Those computer-assisted programs designed to provide students with specific information about their written products, usually centered on surface weaknesses such as diction and stylistic analyses, in order to prompt students to edit and revise more thoroughly and accurately.

8. **WRITER'S WORKBENCH:** A package of text analysis programs developed by Bell Laboratories (but modified by Colorado State University) including ORGANIZATION, DEVELOPMENT, FINDBE, DICTION, SUGGEST, VAGUENESS, SPELL, PUNCUTATION, GRAMMAR, PROSE, PASSIVE, NOMINALIZATION, STYLE, and ABSTRACT used to help students critique, edit and revise their written products (Kiefer and Smith 1984 and Kiefer 1985). (See detailed description of each in Appendix A.)

**Summary**

Recent developments in cognitive science, computer science, and composition research appear to offer promise to
writing educators concerned with improving writing instruction for their students. Text analysis programs such as WRITER'S WORKBENCH are one form of computer-assisted instruction which may provide several instructional advantages.

However, the literature indicates that further research is necessary to measure the actual effects of computer-assisted instruction in writing. The purpose of this study, then, is to measure the effects of WRITER'S WORKBENCH on 1) gains in student writing performance, 2) levels of students' apprehension about writing, and 3) students' attitudes about using the computer as a writing tool, about using WRITER'S WORKBENCH, and about how these influence their writing processes.

This study is significant in that by using a large population and several variables and research techniques as recommended by the literature it promises to contribute to the knowledge base needed in order for writing professionals to determine the effectiveness of programs such as WRITER'S WORKBENCH and to make curricular and instructional decisions appropriately. Further, it will provide colleges and universities additional data for decision-making regarding the considerable investment in financial and human resources computer-assisted instruction represents.
Organization of the Study

The remainder of this study is divided into four chapters. Chapter II contains a review of the literature that is related to 1) composition research, both cognitive and affective; 2) the evaluation of writing programs; and 3) computer-assisted writing instruction. Chapter III describes the methodology that is used for data collection and treatment of the data. Chapter IV provides detailed analyses of the collected data and a discussion of the findings. Chapter V includes summaries of the study and the data findings, conclusions, implications, and recommendations for future research.
CHAPTER I REFERENCE LIST


A review of the literature of composition research and computer-assisted composition instruction provides the background information upon which this study is built. This literature review discusses: a) the historical origins of problems in writing instruction; b) the findings of a recently growing body of composition research, both cognitive and affective; c) the history, aspirations and problems associated with computer-assisted instruction in writing; and d) the implications of all these on the design of evaluations of writing programs. The literature concerning each of these topics is discussed as it pertains to the purposes of this study. More specifically, the literature stresses the importance of teaching people to write, the complexity of the pedagogical task, the necessity for further research and the need for this research to be multi-methodological, including both cognitive and affective measures.

Historical Origins of Problems in Writing Instruction

Beginning with the end of World War II, American higher education transformed itself from an essentially elitist to an egalitarian entity (Witte and Faigley 1983). Institu-
tions relaxed entrance standards to admit war veterans and other new students. Industry's needs and the equalization of educational opportunity spurred the growth of two-year community colleges (Thornton 1960), but the problem of how to teach these "new" students soon became apparent (Rouche 1968 and 1974, Doherty 1979). This egalitarian trend most affected the teaching of basic skills such as reading and writing (Witte and Faigley 1983), and the documented annual declines in verbal scores on the Scholastic Aptitude Test beginning in 1963 among high school populations (Herrman 1986) aggravated the problem.

For over a decade, articles in the popular press (see Newsweek 12/8/75 and 9/21/87 for example) have expressed public concern of a "literacy crisis" and helped fuel a "back to basics" movement. Kozol (1985) reports as many as 60 million Americans are functionally or marginally illiterate. Finally, two national reports in 1983 — A Nation at Risk and High School: A Report on Secondary Education — found students' inability to write a woeful and critical problem (Hague and Mason 1986).

White (1985) argues the fact that writing instruction has not been done well is one of the "chronic problems" of American education. Writing ability is directly related to learning and thinking and is central to the democratic political theory which undergirds our notion of public
education, and with over one million students enrolled annually in freshman composition courses alone, White stresses that this national investment is "serious business" warranting the most refined research, evaluation, and instruction. Sharples (1985) adds that written language is important in that it "is the medium through which society's values are expressed, its literary culture recorded, its shared knowledge stored." Witte and Faigley (1983) argue that in contemporary America writing is an important vocational skill and report a study in which college educated workers indicated spending between 23% and 29% of all work time writing. They conclude that "writing is an important and frequently used skill across all major categories of occupations that college graduates are trained to enter."

Thus there is evidence that writing instruction is important, that it has not been done well, and that improvement is needed. As indicated in Chapter I, many believe that a combination of composition research and computer based instruction will lead to improvement.

Basic Composition Research

Etchison (1985) suggests that since the development of quality writing should be the evaluative criteria for all composition instruction, including computers, then how computers are used in instruction should be based on the
best research and theory available about the writing process. Therefore, in order to evaluate the use of computers in composition instruction it is first necessary to understand the findings of composition research. A review of this literature indicates that the field is relatively new and dynamic, that by necessity it is complex and multi-disciplinary, that further research is important, and that this research must necessarily be multi-methodological and encompass both cognitive and affective concerns.

The Cognitive Dimension of Composition Research

Serious scholarship in composition is a relatively recent activity; Sommers and Collins (1985) mark its beginnings with the publication in 1963 of Braddock, Lloyd-Jones, and Shoer's Research in Written Composition in which these authors found that the teaching of formal grammar had negligible -- or perhaps negative -- effect on the improvement of quality in writing. As late as 1961 Kitzhaber reported the two predominant approaches to writing instruction were through literature or rhetoric (Witte and Faigley 1983) and even the holistic scoring of writing was first pioneered by Educational Testing Service and reported by Godshalk, Swineford, and Coffman in The Measurement of Writing Ability (1966) scarcely more than twenty years ago. Reviewing the composition literature for her 1971 study, The Composing Processes of Twelfth Graders, Emig
concluded that little was known about how people actually write. The sources of knowledge upon which teaching was based were "unsystematic" and "often contradictory," and our knowledge of composing was merely "alchemy" (1971). Therefore, the teaching of writing proceeded as a "metaphysical or, at best, a wholly intuitive endeavor" (1971).

More specifically, dicta by authors of rhetoric and composition texts such as those by Plato, Aristotle, Cicero, Quintillian and thousands of more modern authors lacked substantiation, reflected a "pre-psychology age" in their disregard of how the mind works, and disagreed on the nature of the writing process (1971). Emig's work was one of the first to study the writing processes students actually employ.

More than a decade later Bereiter and Scardamalia (1983) also lament that composition research is "new and there is not much of it. It is not easy and there are...no magic keys to understanding it." Moreover, past and present composition research is in a "preparadigm stage":

There is no consensus about what needs explaining, what kind of inquiry will lead to explanation, or how one would judge whether something was or was not an explanation (1983).

These authors propose a six level framework or scheme of inquiry incorporating an interactive multi-methodological approach for synthesizing knowledge from composition research. To illustrate, Level 1, Reflective Inquiry,
involves the types of inquiries conducted by Elbow, Moffett and others who reflect on information already available from such resources as Aristotle's *Poetics* or the researchers own experience as a writer. Premises generated here would then be studied at Level 2 through empirical variable testing. While there are several problems associated with empiricism in composition, the goals of research at this level should be to provide a factual basis for improving Level 1 reflection or to provide subjects for inquiry at other levels. At level 3, Text Analysis, researchers try to extract descriptive rules, laws or principles about writing by studying written texts. Level 4, Process Description, includes interviews, case studies, or thinking aloud procedures in which researchers probe the patterns in writer's thoughts as they compose. Level 5, Theory-embedded Experimentation, draws theoretical constructs from all the previous levels and tests them by measuring their empirical implications in the same way experiments are conducted in physics. And finally, in Level 6, Simulation, researchers utilize role-playing, computer-simulation, or other means to discover "the nature of different composing strategies...by trying to simulate them" (1983). Findings should spiral up and down all levels, and conclusive knowledge should be based upon as many levels as possible (1983).
Defining composition research as the "investigation of writing behaviors, cognitive processes during composing, and the ways in which these...interact with written products and their contexts," Beach and Bridwell (1984) observe that the field is a "hybrid of disciplines" — cognitive psychology, text-structure linguistics, rhetoric, computer science and more — seeking to understand the "extremely complex process of writing." They, too, recognize that there are weaknesses and trade-offs involved in the selection of any one research tool. Therefore, Beach and Bridwell also propose a research scheme, but they are concerned that in addition to not understanding the writing process, composition research suffers from the lack of common agreement on what constitutes quality in writing.

Thus, there is no simple way to define or ascertain writing quality. Those who stipulate their own definitions of quality — rhetoricians, literary critics, text-structure linguists, information processing experts, and others — are working from their own unique assumptions (1984).

The purpose of their pyramidal research framework, then, is to unite the study of writing processes with that of written products and to enable the integration of new and old information from all areas including psycholinguistics, sociolinguistics, developmental studies, and language study (1984).

Earlier, however, Bereiter (1980) had indicated, research should aim to create an "applied cognitive-develop-
mental model" of the writing process and seek to discover what happens inside the writer. This model could then be related to instructional concerns.

These psychological models Bereiter envisions as ambitious and complex in order to account for the extremely complex and recursive nature of the writing process.

Even a casual analysis makes it clear that the number of things that must be dealt with simultaneously in writing is stupendous: handwriting, spelling, punctuation, word choice, syntax, textual connections, purpose, organization, clarity, rhythm, euphony, the possible reactions of various possible readers, and so on. To pay conscious attention to all of these would overload the information processing capacity of the most towering intellects (1980).

Flower and Hayes (1980) agree on the need to study the writing process, although they observe that few researchers have done so experimentally. These researchers have adapted protocol analysis from cognitive psychology to study the writing process (Swarts, Flower, and Hayes 1984). Using "thinking-aloud" protocols of writers in action, they seek to capture the moment to moment thinking of writers in order to record their cognitive processes and the development of their ideas (1984). They claim their method provides "a first approximate description of normal composition that can guide research and afford a valuable starting point in the search for more refined models" (Flower and Hayes 1980).

Based on their research, Flower and Hayes stress three major points about the writing process: 1) the act of
writing involves "juggling" a number of simultaneous constraints, 2) planning is the best strategy to accomplish this since it reduces the "cognitive strain" of a number of demands on conscious attention, and 3) writing does not always proceed through successive stages but rather is recursive with problems at one level altering other levels.

We know that when people write, they draw on a variety of mental operations such as making plans, retrieving ideas from memory, drawing inferences, creating concepts, developing an image of the reader, testing what they've written against that image and so on...As a dynamic process, writing is the act of dealing with an excessive number of simultaneous demands or constraints. Viewed this way, a writer in the act is a thinker on a full-time cognitive overload (1980).

Gould's research at IBM's T. J. Watson Research Center seeks to understand the psychological process of writing and to identify how technological systems can help improve communication (1980). He forms two conclusions. First, learned composing skills acquired over many years schooling appear to be central to performance whether in speaking, dictating, or writing. And second, "heavy revision may be limited to 'professional' writing...or people...whose careers are directly affected by how they formulate and communicate their thoughts in writing, often times to large, diverse, and relatively unknown audiences" (1980).

Sharples (1985) agrees that learning is a factor to be included in writing process models and suggests that life stages may be an important consideration, as well. Having
reviewed Kidder and Gleitman's work in the stages of language development, Piaget's stages of cognitive development, and Bereiter and Scardamalia's definitions of mature writing, Sharples maintains that as children mature, passing through these stages of cognitive and linguistic development, there is an effect on the quality of writing (1985). Citing Matthews work with poor adult writers, Sharples suggests that mature adults can be stuck at one or more of these levels of written language.

Current views of error and editing are important to understanding the writing process, also. Nutter (1982) questioned the view held by many that teaching correct forms of standard English terrorizes students with other than standard English linguistic habits. Based on a study of high school students' language use, Nutter suggested weaknesses "may represent a maladaptive pattern of behavior" which is a disadvantage in areas such as job interviews, legal proceedings, or dealing with bureaucracies (1982). Nutter concluded, teaching correctness is a legitimate goal; the problem lies rather in the punitiveness of the methods and attitudes (1982).

Rosen (1987) notes that society equates correctness in grammar and mechanics with the ability to write. Therefore, writing instructors, unwilling to appear as sanctioning error, respond in two dominant traditional ways: drill and
practice of grammar and mechanics and searching out and marking all errors on students' written products. However, Rosen also points out, recent research indicates that: 1) learning correctness is in part a developmental process with growth attained through error, 2) writers learn correct forms best at the time they need them to communicate, and 3) issues of correctness should be delayed until post-writing in the overall process (1987). Thus, instructors may focus too much attention on correctness at the expense of content and fluidity. Kucer (1986) adds that several researchers have found that poor, inexperienced writers exhibit a greater concern for surface features at early stages in the writing process (at the expense of content) than do able writers who also revise more thoroughly. Therefore, Rosen (1987) argues, students must be continuously engaged in composing and revising that is meaningful to the communication, and the responsibility to find and correct errors should be shifted to them.

Shaughnessy's 1977 study, *Errors and Expectations*, dramatically demonstrated that rather than being random, students' errors were systematic and stemmed from orderly, though incorrect, linguistic behavior. Her study went on to provide a taxonomy of such errors.

Hull (1987) distinguishes between revising, which may involve several levels of composing activity, and editing,
which focuses on surface features. She suggests error correction is a complex cognitive activity and that editing involves special reading skills which can (and must be) taught. Citing Shaughnessy's work, Hull maintains many of these errors are so regular they can be predicted (1987).

She observes that inexperienced writers use three strategies for correcting errors -- 1) consideration of meaning or context, 2) formal rules, or 3) intuition -- which they usually invoke inappropriately (1987). Therefore, Hull maintains students must be taught not to focus on all concerns at once, to defer corrections to a later stage so as to better manage constraints, and not to rely on unhelpful strategies (1987).

By way of summation, Steinberg (1980) agrees that writing instructors may focus too much on products and not enough on process ("like critics reviewing finished works of art--not teaching composition"). He also agrees that in contrast to the "romantic notion of writing being a mysterious, nonrational creative act," efforts at creating cognitive models of the composing process are positive (1980).

The Affective Dimension of Composition Research

As we have seen, composition research is attempting to answer Bereiter's (1980) call for a psychological model of the writing process to explain cognitive processes inside
the writer. However new and tentative these models are, there is also a growing body of research involving the study of writing apprehension and writer's block which suggests that what transpires within the writer emotionally and attitudinally is equal in importance to cognitive processes and must be accounted for in process models and in research and evaluation designs.

Daly and Miller became interested in a condition they termed "writing apprehension" in 1974. The Daly-Miller Writing Apprehension Test was developed, tested, and refined in 1975 (Daly and Miller 1975b) and has subsequently been used to demonstrate that writing apprehension is a factor inhibiting the writing production of a good share of the population in a variety of ways.

Daly asserts that "an individual's attitude about writing is just as basic to successful writing as are his or her writing skills."

A positive attitude about writing is associated with, and may even be a critical precursor of, the successful development and maintenance of writing skills (Daly 1985a).

Studies indicate persons with apprehension of writing have been found to be less willing to enroll in courses requiring writing, are more negative about their performance in past writing courses, hold lower expectations of success in courses requiring writing, are less likely to choose majors
or careers requiring writing, and exhibit less improvement from and less enjoyment of writing courses (Daly 1985a).

Also, correlates between writing apprehension and actual writing behavior have been shown, as well. Selfe (1985) has used case studies to compare the writing processes of high, middle, and low apprehensives in order to gauge the impact apprehension has on their approaches to composing. For example, she reports a study of a freshman female student who feared, hated, and dreaded writing. Observing her on a prescribed writing assignment, Selfe noted that the student's apprehension stemmed from her awareness of her limited writing skills, but ironically, it also blocked her from improving (1985).

While Daly and Selfe suggest that apprehensives tend to write differently, with lower quality, and demonstrate less functional knowledge of writing skills than less apprehensive writers, Rose (1984) cites studies by Bloom indicating some apprehensive writers are good writers. Bloom's case studies reveal apprehensive people who write well but who misconceive that others write better or easier and who often exhibit characteristics of perfectionism or procrastination (1984).

A similar phenomenon, writer's block, is not necessarily synonymous with writing apprehension; not all blockers are apprehensive and the two phenomena are not necessarily
linked causally (Rose 1984). Rose approached his 1984 investigations of writer's block -- the ''inability to begin or continue writing for reasons other than a lack of basic skill or commitment'' -- on the assumption that the variables associated with it were more cognitive than affective, motivational, or socio-political.

He hypothesized that six cognitive variables - each an improperly invoked writing process -- inhibited writing. His study revealed that low-blockers expressed seventeen times more functional rules than did high-blockers whose rules either conflicted with or did not help in the writing task. High-blockers also tended to be more spontaneous, employed less planning, and demonstrated fewer sentence to essay strategies. While everyone edited continually while writing, high-blockers did so at twice the frequency. And high-blockers invoked eight times more conflicting rules, plans, strategies, and assumptions about writing than low-blockers (1984).

Rose concluded that writer's block was much more than a low opinion of one's work or fear of evaluation, and that its origins were primarily cognitive (1984). Like Selfe, he drew conclusions for teachers. "Rules about grammar, about process, about style, about form should not be taught as dicta" but should be taught appropriately as propositions
dependent on the aims of discourse but not as the aims of discourse (Rose 1984).

Rose's central assumption that the sources of writers block are essentially cognitive (and therefore are corrected or treated by cognitive means) do not match the findings of psychologists, however. For example, Boice (1985) reviews and relates the psychological literature regarding writer's block to his own practice with blocked writers. He reports that a cognitive-behavioral paradigm seems most effective (1985). Because "writing is best done habitually and in regular amounts, regardless of mood and without awaiting inspiration" contingency management -- establishing goal-oriented writing periods and external rewards...is the effective change agent" (1985). Blocked writers also practice maladaptive negative self-talk demeaning their own abilities. Treatment must include making them aware of and changing this negative feedback.

Blocked writers are...like phobics whose real fear is of public embarrassment...The difference is that with, say, an agoraphobic..., we rarely attribute the cause of fear to some mystical force like lack of inspiration (1985).

Historically emotions such as anger, fear, and love have been associated with impairment of the thinking processes. With this in mind, Larson (1985) studied the effects of emotions on the writing products and processes of high school juniors.
Larson discovered two kinds of disruptive emotions in the total group: 1) overarousal -- ranging from nervous agitation to dread, and 2) underarousal -- ranging from apathy to boredom and depression. All students felt some degree of these disruptive emotions, usually episodic, but for some the distress was endemic (1985). He recalls,

Physiologically, anxiety is a state of extreme arousal, including increased adrenaline levels, rapid neural firing, increased heart rate, and greater muscle tension. In small amounts these changes can aid a person's functioning, but beyond a certain point they can become disruptive.

Cognitively, anxiety is associated with diffused and 'disintegrated' attention. Research shows that anxiety reduces one's capacity to hold things in short-term memory, thus effectively reducing the amount of information one can juggle and think about simultaneously.

Underarousal, on the other hand, was no less detrimental. Larson points out:

Laboratory studies indicate that boredom is usually associated with low physiological activation. Adrenaline levels are low; heart rate is slowed; there is a decrease in oxygen consumption. Cognitively, boredom is associated with decreased attentiveness and slower thought processes. People are less able to control their attention; vigilance and performance declines (1985).

In other words, anxiety and boredom threaten the very cognitive abilities most taxed by the writing process. Indeed, an independent reader could identify characteristics of these emotions in the students' papers (1985).

Larson also discovered that level of enjoyment was a strong independent predictor of grades (1985). The best
papers were produced by students who seemed to use internal strategies to make their writing enjoyable. And he points out,

Enjoyment is associated with optimal physiological arousal. Heart rate and oxygen consumption increase...muscle tone is heightened, and visual gaze is steadied. Cognitively, enjoyment is associated with clear attention and command over one's thoughts...A person is more likely to feel strong and competent. (1985).

Therefore, this psychologist insists, the "emotional aspects of writing should not be ignored" (1985).

He suggests that some instructional lessons may be found in studies of "optimal states" experienced during creative, challenging leisure activities. These are marked by a sense of enjoyment, flow, and absorption; people report focused attention and a sense of command (1985). The situations that produce these "optimal states," Larson observes, are marked by a clear perception of goals and a clear sense of how they will be accomplished. There is a balance between challenge and skills; if the challenge is too great, the result is anxiety, too small and the result is boredom (1985).

Rose (1985a) concedes that writer's block is not limited to the cognitive domain; in fact, it presents a "web of problems." Western thought has tended to separate affect and cognition, whereas they are complexly interwoven (1985a). Because "people act and react intellectually and
emotionally and do so in situations that trigger, shape and quell those behaviors," Rose also proposes that the complexities of writing behavior require a broad conceptual research framework composed of multi-methodological approaches capable of investigating contextual, affective, and cognitive aspects of the composing process (1985a).

Writing Program Evaluation Designs

Not surprisingly, then, the literature concerning the evaluation of writing programs recommends comprehensive evaluation designs. For example, White (1985) cautions against simplistic models to evaluate the success of writing programs:

> It is quite wrong to imagine that the only important goal of a writing instruction program is to improve the first draft writing products of individual students or that a successful writing program will necessarily (or only) make easily measurable gains in those products.

Since writing programs typically have many goals, each addressing different aspects of the complexity of improving student writing, evaluation designs should measure a wide range of these including "gain scores" on essays and student attitudes about writing among other criteria (1985).

After analyzing the designs and results of several ambitious evaluations of writing programs, Witte and Faigley (1983) conclude that evaluations of writing programs "must employ a variety of methods and procedures."
In a writing program products are simply the results of performances or processes. In writing courses and programs, we believe as much, if not more, attention ought to be paid to how products come to be as to products themselves...The intended effects of a writing program may also be reflected in the attitudes students hold -- attitudes about writing, about language in general, and about writing courses (1983).

Indeed, changes in attitude toward writing may be as important as improvement in written products for some students (1983).

Computers in Composition Instruction

There has been talk of a computer revolution in the classroom for twenty-five years, but in the early 1980's they were hardly present in English instruction (Wresch 1982). However, the use of computers in English instruction is not entirely new. Sparked by B. F. Skinner's 1964 article "Why We Need Teaching Machines," the earliest programs taught easily quantifiable operations such as spelling rules, capitalization, punctuation, and grammar through drill and practice following the programmed learning model (Wresch 1984b). In 1968, Page developed programs that analyzed essays for word, sentence, and essay length. Similarly, Miller, Marcotte, and Martin introduced a program to identify certain vague and specific words in 1969. Ellen Nold used advanced programming languages to develop programs that asked students questions regarding essay subject, audience, and organization, and which "partially" understood
the answers they input (1984b). These early programs were precursors of most of the programs available today.

Despite these early experiments, most English instructors scarcely thought computers to have a role in language instruction; computers processed numbers and were, therefore, considered the province of mathematics and science departments (Rubin 1983). But by 1985 Bernhardt and Appleby would consider the computer as intrinsically bound to changes being experienced by the discipline of English as a whole. And the past decade, has produced a growing interest in the feasibility of using computers to improve composition instruction.

Perhaps, then, it is to be expected that much of the literature surrounding this movement is exploratory in nature, and is largely characterized by software searches and reviews, bibliographic up-dates, reports of trial runs and teaching experiences, and conference lists and networking opportunities. But rapid developments within composition research and the use of computers in composition instruction have also stirred considerable controversy and much philosophical speculation concerning how computers change how we write, to whom, how often, how much, and with how the computer changes and/or serves us (1985).
The Computer Debate: Positive or Negative Change?

One aspect of controversy surrounding the use of computers in writing involves charges that how the computer is utilized is not consistent with the findings of composition research. Early theoreticians like Collins and Gentner (1980) were optimistic about the prospects of developing a model of the writing process through psychological experimentation and then embedding it in computer programs to aid instruction, although they were mindful of potential problems.

Anything less than a carefully detailed theory will not suffice. For example, if a theory of editing does not specify all the necessary conditions for making a certain change, then the advice such a system would give would often be inappropriate and annoying (1980).

Etchison (1985) agrees with Shuy's observation that there are two prevalent views of writing: 1) the reductionist view in which writing is broken down into discrete parts each of which is taught independently, and 2) the constructivist or holististic view in which these discrete parts can only make sense within the context of a whole piece of writing communicating a specified purpose to a specified audience (1985). He cites studies by Graves, Hartwell, Moffett, and Shuy which indicate that discrete element learning does not transfer to improvement in writing. Inconsistently, Etchison notes, much of the use of
the computer in writing instruction involves programs embracing the first view, and studies conducted by Ohanian and Kelly and Anandan suggest that computer-assisted grammar instruction fares no better (1985). Based upon what is known from writing theory, then, only if computers are used for holistic instruction and revision are they worthwhile (1985).

Rubin (1983) succinctly rephrases the point:

although texts can be analyzed and described at several levels...the vast majority of language arts software currently available focuses on... letters, words, or sentences.

Sommers and Collins (1985) share these concerns about software emphasizing sub-skills. They reiterate that writing research has shown that the writing process interweaves stages of generating ideas, shaping and connecting thought and language, revising these through addition, deletion, and development, and then editing for correctness in usage and mechanics.

Elias (1985) sees "serious problems" with computer programs used in English. Most available programs, including sophisticated text analysis programs such as WRITER'S WORKBENCH, stress error correction and reinforce the "student writer's naive and counterproductive view of the writing process as the gradual elimination of error" rather than developing a process approach.
The current generation of programs...joins a limited technology and an obscure purpose to create tools which suit an outmoded pedagogy (1985).

Another related aspect of the controversy regards the quality and pedagogical foundation of the software available. Part of the problem, according to Elias, is that computer programmers do not know how to teach writing, and writing instructors have not articulated to them what goes into good writing. As a result, many word processing programs are little more than "a souped up typewriter," and:

Teachers often complain that most commercially-available word-processing programs seem to be written for secretaries who transcribe text rather than for writers who create it (1985).

Olsen (1985) expresses concern over the "cottage industry" nature of instructor-developed software because without sufficient critical review, teachers are bewildered by exaggerated claims of effectiveness and the varying quality and standards in programs. Kemeny (1987) insists that computers are not a fad, that they positively affect what and how we teach, that they empower students, but that good software is desperately needed if the computer's "enormous potential" is to be realized. Likewise, Barker (1986) sees many serious issues in the design, development and distribution of teacher-made software which may deeply affect the use of computers in composition and the profes-

sion. Central to these are the pedagogical theories which underlie the software.

Bork, too, is concerned about the production of quality software. In his view, computers will become the "dominant delivery system" for education worldwide for several reasons. But there are problems. There is an inequitable distribution of computers among school populations, teachers do not know what to do with them, and most importantly, there is little good software. He recommends a nationally coordinated effort of computer software development modeled upon the process of curriculum development utilized by the Open University in England (Bork 1987).

Another aspect of the computers in composition controversy involves limiting features which may be intrinsic to computer hardware. For example, several commentators (Moran 1984, Hitchcock 1985, and Gallagher 1985) suggest that the limited amount of text appearing on the monitor screen may inhibit a larger vision of essay structure. Experienced writers who are accustomed to cutting and pasting their manuscripts together may see how word processing aids these organizational tasks, but younger writers born of the television and computer age do not necessarily see this (Hitchcock 1985). Gallagher (1985) cites evidence that the limited screen size does impair text coherence and that computer gadgetry distracts from productive writing.
Moran (1984) reminds us the effects of computers will be different for different writers. Perhaps because writers no longer make physical marks on paper, words may become electronically transient. Perhaps people will write to the screen and the self thereby affecting the sense of audience.

Gallagher reiterates Schwartz's fear that there is a danger the computer encourages "smokescreen revision -- the tendency to think that nice appearances cover up flaws in meaning and that facelifting changes are a substitute for changes in meaning" (1985). Zinsser (1985) also shares this concern.

Gallagher suggests computer-phobia or anxiety may inhibit the writing process for some students, while others, he worries, appear to write "too unreflectively" on the computer (1985). This could alter our concept of text and print, and teachers may have to instill the habit of questioning the computer's "efficacy and suitability" in every instance (1985). Perhaps people will form a "machine dependency" causing them to find writing without a computer frustrating and unproductive or to feel their continued improvement as writers linked to the use of a computer. Lack of access to computers, on the other hand, may widen the gap between advantaged and disadvantaged learners (Gallagher 1985).
Dinan, Gagnon, and Taylor (1986) claim that many teachers and administrators are concerned that computers may cause an adverse effect on students' attitudes and composing processes. While some teachers see the computer as a motivator (Kiefer and Smith 1984), these researchers fear that the burden of having to learn the computer while simultaneously learning to write may cause additional frustration exacerbating writing anxiety and intensifying fears of exposure, disapproval and failure.

Schwartz (1985) acknowledges these concerns and stresses how computers are introduced into writing classes is important. Three broad factors can influence students' receptivity: 1) the ease of operating the equipment and software programs, 2) the degree that they are accessible to students, and 3) the students' aptitude for word-processing (1985). Teachers must learn their students' attitudes about and experiences with computers and be aware that students learn programs at different rates (1985).

Yet as Olsen (1985) observes, if rapid technological change threatens our equilibrium, it also presents an "exhilarating opportunity" to reexamine the teaching and learning process. Thus many of these same authors are also optimistic that the computer provides certain advantages to composition instruction. For example, despite the potential risks and problems, Gallagher (1985) agrees with Schwartz
that given what we have learned from composing research, the computer appears "both psychologically and technologically suited to help the writer write more and risk more and achieve more fully developed writing." He recalls Flowers and Hayes observations about good and poor writers:

Good writers respond to all aspects of the rhetorical problem. As they compose they build a unique representation not only of their audience and assignment, but also of their goals involving the audience, their own persona, and the text. By contrast, the problem representations of the poor writers were concerned primarily with the features and conventions of a written text...Our expert writer simply [spent] more time than the novice in thinking about and commenting on the rhetorical problem, as opposed to spending that time generating text (1985).

Several features about computers and word processing seem to free students to concentrate on precisely what these researchers find poor writers ignore. However, Gallagher argues we need a...

detailed taxonomy of tasks which the microcomputer might help students to perform more efficiently, more accurately and better -- and then analyze very carefully just which of these tasks the microcomputer does and does not lend itself to (1985).

Admitting that there has been no demonstration of statistically significant improvement in student writing as a result of computers in instruction, Southwell (1984) believes they provide "important psychological benefits" for both teachers and students. First, computers can relieve teachers of tedious grammatical instruction, and they can
provide such instruction more effectively. They strengthen autotutorial instruction by providing immediate, directed feedback, and the interactive nature of computer-assisted instruction keeps students engaged in the learning process. Word processing makes revision easier, allows students to better see writing as a process, and enables them to better differentiate between mere surface editing and revision of content. Also, poor writers can work in private at their own pace without threat of exposure. These features create a "game-like quality" and increase motivation which is reflected in student reports that they enjoy writing on computers and believe them to be beneficial (1984).

How Computers Have Been Used in Composition and the Results.

In 1987, Selfe announced the last battles of the computer revolution in English Composition were over. Everyone, she claimed, realized there was a role for the computer, but unfortunately, no one was yet sure what it is, and most users were still experimenting at basic levels (1987).

Several authors (Schwartz 1982 and 1985, Wresch, 1982 and Southwell 1984b) have reviewed and classified these basic uses of the computer in composition. For example, Schwartz (1985) evaluated four broad classifications of computer applications. First, were software programs
providing text feedback such as readability formulas and other stylistic recommendations. Second, was the category of drill and practice, usually in basics. Third, were programs of simulations which attempted, for example, to help students construct writing from pre-programmed materials. And fourth, she listed tutorials which coached students in areas such as rhetorical invention. Lacking any evaluative criteria, Schwartz discussed how to find, choose, and implement software (1982). Since many think of word processing itself as an instructional tool, it should be added to this classification.

Ross and Bridwell (1985) claim a decade of research makes two observations commonplace: 1) writing consists of several different tasks which are recursive rather than proceeding in a fixed order, and 2) if properly programmed, computers can "somehow" help writing teachers. Holdstein and Redman (1985) suspect the small amount of research conducted in computer-assisted writing instruction often has overstated the positive. They report a survey indicating students using a computer for writing did not increase the number of times they revised their papers (1985). Moreover, they warn that attitudinal surveys constitute a "danger zone" for research because "the notion that computers are the wave of the future has been so drummed into students' heads that they continue to repeat platitudes about the
value of their computer experience even while writing of the many problems and difficulties they encountered" (1985).

Hult (1985) reports an experimental study in which she compared papers written by students using word processing with those without word processing. She found no essential differences in quality except that the word processing students, who had the advantage of a spelling checker, committed fewer spelling errors (1985). An attitudinal survey indicated that some, but not all, students enjoyed using the computer, that poor spellers appreciated the spelling checker, and that many students felt the computer reduced the drudgery of copying text.

In another study Hult (1985) demonstrates how optimism about computers may distort faculty appraisals of writing. She asked 30 university composition instructors to rate the same student essay which had no major errors and had originally been graded "C" by the instructor. Curiously, these graders rated the word processed version the highest, the hand-written second, and the type-written lowest.

By 1987 Bridwell-Bowles still regards the reviews of computer applications "mixed" but suggests that there appears to be a "halo" effect in that students enjoy using computers, and that by removing the "drudgery" of revising, word processing -- while it does not inherently teach
revision strategies -- allows teachers to require more revision. Therefore,

    Even without overwhelming positive empirical evidence, we believe word processing is the first step if those who teach writing are to remain consistent with what research on writing in general has shown (Bridwell-Bowles 1987).

It also allows students to write more and prepares them in the medium of the workplace (1987).

    Investigators at the University of Minnesota use computers as writing process research tools (Bridwell, Nancarrow, and Ross 1984 and Sirc and Bridwell-Bowles 1988). Students compose essays on a computer using the Recording Word Star program developed at the University, and the computer records all keystrokes, pauses, deletions, revisions, etc. By 1988 their research indicated that for experienced writers the efficacy of using a computer for writing depended on a writer's composing style (those who "wrote to discover" were least pleased with the computer). And with inexperienced writers, using the computer did not automatically lead to increased revisions and some revised less (1988).

    Kiefer (1987) recalls that while the literature is rife with positive testimonials, there is a paucity of good research on computers and writing. Hult (1988) states flatly that "no studies to date have shown an improvement in writing quality by students using computers as compared to
those not using computers." Both authors refer to Collier's study in 1983 and Harris' in 1985 which found that the use of word processing did not encourage revision in student writing. Hawisher (1986) reviews several studies on word processing and suggests that because the studies represent so many different methodologies; different varieties of student writing; and differing populations, hardware and software; and investigate differing variables, it is difficult to draw any conclusions other than most students prefer word processing and computers.

However, Collins and Price (1987) report observing great improvement among learning disabled writers as a result of using word processing. Nash and Schwartz (1987) report that a small number of students using word processing showed significant improvement in fluency, coherence, and use of evidence.

And, in a recent study of word processing, Vockell and Schwartz (1988) report that word processing students "showed a consistent pattern of gaining more than other students on measures of writing ability." Moreover, the most significant difference was in "general merit" suggesting that the improvement went beyond surface mechanics. Questionnaires revealed that word processing "saved" students an average of 35 minutes per essay by freeing them from recopying, and the researchers surmise these students used
this time to concentrate on larger issues such as idea development and coherence (1988).

Some Prominent Programs

Southwell's (1984a) description of the computer-assisted grammar instruction modules (COMP-LAB) in use at York College with "students whose writing exhibits severe problems of correctness and clarity" is an example of Schwartz's second classification, drill and practice. Each module adopts a developmental approach teaching standard written English as though it were a second language, each makes no assumptions, each incrementally teaches one concept at a time, and each offers practice in context (1984a). Southwell argues the programs provide three important advantages to instruction: the capacity for pedagogical structuring of lessons, exciting presentation, and the allocation of responsibility for learning to the learner (1984a).

Cox (1988) describes a drill and practice program designed to teach a three week unit on sentence patterns at Amarillo College that was positively received by students. Also, pre and posttest scores on sentence patterns were higher for the experimental group than non-computer users.

Rodrigues and Rodrigues (1984) describe the development of a computer program to stimulate ideas for writing through creative problem-solving heuristics. This is an example of
Schwartz's fourth category, tutorials. SEEN is another such example provided by Schwartz (1984a) herself. This program is designed to assist students to "create, support, and refine" an hypothesis about literature; acting as a tutor, it provides in the author's opinion, an option that works for some students (1984a).

Burns (1984) has created what is considered perhaps the most complete tutorial system. His INVENT series consists of three programs designed to help student writers early in the composing process. First, TOPOI, based on Aristotle's 28 enthymeme topics, is used in developing persuasive writing. Second, BURKE, based on Burke's dramatistic pentad, provides help with informative writing. And third TAGI, based on the tagememic matrix of Young, Becker, and Pike, helps students plan exploratory and informative writing.

Burns readily admits his programs' limitations. They require "a user's willing suspension of disbelief" since the programs cannot understand what the user enters as essay content, yet they ask questions as though they can. Still, Burns feels they provide positive interactive practice in a sort of "mental fitness center" in which writers can "exercise with specific methods of inquiry...about any topic" (1984).

Brady and Larson (1987) describe the development of an authoring system, ACCESS, which requires no programming
knowledge on the part of the instructor/user and which makes "software design and adaptation as readily available as written text production." This program, they hope, will give "design control back to instructors."

Some instructional software packages have made attempts to account for the recursive nature of writing by combining components of Schwartz's classification. Sharples (1985), for example, provides a complex computer-assisted scheme matched to the child's developing cognitive abilities to teach children creative writing. Sharples is trying to use the computer for writing as it has been used in athletic coaching to break down individual movements, rehearse components, and polish performance through computer imaging and modeling (1985).

Von Blum and Cohen (1984) describe WANDAH as another ambitious attempt to integrate prewriting aids for planning, word processing for on-line composing, and text analysis aids. The authors suggest the integrated programs are consistent with the belief that "effective writing instruction must help remove 'writer's overload'."

Yet, Von Blum and Cohen acknowledge there are problems. First, learning the programs constitutes a new cognitive burden (1984). While students revise more, it is mostly surface level; larger entities such as paragraphs and pages seem more difficult to conceive than with pencil and paper,
and since printers produce clean drafts, writers appear less likely to see them as in progress and produce more "rambling papers" (1984).

Similarly, WRITER'S HELPER combines three groups of programs, prewriting, word processing and text analysis, to "give useful, if limited, information to students about their work" and to provide "new opportunities for teachers to discuss elements of style they normally can't interest students in" (Wresch 1984a). With the levels, options, and electronic gimmickry the computer is capable of, they do what workbooks cannot and "are fun" (1984a).

And finally, DRAFT, a set of composing programs in use at Carnegie-Mellon University, combines text editing abilities with programs to help with invention, arrangement, and style in order to accomplish four purposes: 1) guide writers while composing, 2) help teachers diagnose and correct problems 3) allow researchers to record evolving processes and products, and 4) provide text editing services (Neuwirth 1984). These combinations of programs are necessary because computer text editing programs provide only low-level editing functions while writers must produce plans for revisions which often involves all components of the composing process. "Unlike human editors...computer text editors cannot help writers decide what to say, how to organize their ideas, or how to improve their style" (1984).
Text Analysis Programs

Ross and Bridwell (1985) note that "one hope for both writers and teachers is that 'the computer' can make consistent and useful comments on 'style' and 'grammar' and can perhaps even correct 'errors'." Text analysis or "natural language processing" programs attempt to do this.

Smith (forthcoming) traces the history of the development of text analysis computer programs beginning with Page's efforts to identify programmable items of form and content. In 1971 Gorin developed a spelling checker. During the 1970's Kincaid developed a limited program entitled CRES to be used to improve manual and document production for the Navy, and Cherry, MacDonald, and others at Bell Laboratories created WRITER'S WORKBENCH. In 1981 Kiefer and Smith learned of the WORKBENCH and decided to experiment with its use in writing instruction at Colorado State University (Smith forthcoming). HOMER (part of WANDAH), was also first used in instruction at UCLA in 1981 (Cohen 1984).

The function of text analyzing programs is to provide "computer analysis of on-line, in progress texts as an aid for checking, revising, and editing" (Smith forthcoming). They do so through systems of pattern-matching; for example, a spell checker scans a text quickly, matches its words with the program's dictionary, and indicates words which may be
misspelled (Wallraff 1988). Other programs match preprogrammed items involving diction, etc.

Wresch (1988) classifies the uses of the "increasing number and variety of computer-based analysis software," each of which has a "different pedagogical orientation." His first category is the "error checkers" (WRITER'S WORKBENCH, WRITER'S HELPER, RIGHTWRITER, GHOSTWRITER, etc.) which identify potential problems in basic conventions. "Reformmaters" (e.g. WRITER'S WORKBENCH, QUILL, GHOSTWRITER and WRITER'S HELPER) highlight various aspects of sentences such as the first and last sentences of each paragraph for the writer's consideration. His next category, "audience awareness" programs (e.g. WRITER'S WORKBENCH and WRITER'S HELPER) include various readability indices, levels of diction, vagueness indices, etc. Next are student "conferencing utilities" which allow students and teachers (or others) to communicate electronically, then "grading utilities" (e.g. QUILL and RSVP) which supply long preprogrammed explanations of errors (e.g. sentence fragments) when they are identified by human readers who send the commands, and lastly, "automatic graders" (e.g. WRITER'S WORKBENCH) which supply quantifiable information such as number of words per sentence, paragraph, and essay (1988).

An additional program, CRITIQUE (formerly EPISTLE), deserves mention. Under development by Heidorn's research-
ers at IBM, who insist it is pure research into "natural-language" processing and therefore not yet a product, CRITIQUE's potential lies in its ability, though limited, to parse sentences for grammatical structure (Wallraff 1988).

WRITER'S WORKBENCH contains the most comprehensive collection of text analysis packages (Kiefer 1985) and is considered the "pre-eminent example of this new methodology" (Smith forthcoming). When Kiefer and Smith first adapted WRITER'S WORKBENCH for instructional use with students, they hopefully wondered...

Wouldn't the objectivity of a computer encourage students to adopt a more critical stance toward their writing? Wouldn't students learn more by considering surface weaknesses in their own work rather than in the manufactured exercises of texts and handouts? Wouldn't a computer's objective analysis of patterns in diction and style result in more informed and more thorough stylistic revision? And finally, wouldn't computer assistance make possible better writing in disciplines across the campus? (1984).

Kiefer and Smith (1983) conducted a study involving WRITER'S WORKBENCH. Posttest data indicated that on editing skills covered in class or the text both groups scored about the same. However, on those revision areas introduced only by WRITER'S WORKBENCH, the experimental group understandably was able to identify more errors. The holistic scoring of pre and post essays revealed there was no significant difference in improvement in writing between the groups.
Finally, students using the computer programs reported enjoying doing so and felt they were beneficial (1983).

Kiefer and Smith speculated that the use of the text analysis programs helped students improve their course-assigned essays before the instructors saw them, that computer-assisted instruction in editing skills was superior to drill and response grammar exercise because students were directed to errors in their own writing (although these claims were not supported by the data), and that the "eye-catching technology" of text analysis programs such as WRITER'S WORKBENCH intrigued and motivated students. However, they concluded that nothing could be said for the effect of WRITER'S WORKBENCH on student writing (1983). They also write "the greatest value of WORKBENCH lies in its ability to raise questions to help with revision and reconsideration -- not merely to point out error" (1984).

These researchers have continued to write optimistically about the potential of WORKBENCH to help students improve their writing.

Such programs...offer a potent weapon against insensitivity to diction and style and against further decline in editing skills (Smith, Kiefer, and Gingrich 1984).

Teachers spend less time editing surface errors, they report, and more on content and logic. The typed copies of essays are easier to read, students get immediate feedback on problems in their own writing and word processing
replaces drudgery and fear with enjoyment. Students learn that revision and editing are a matter of choices and that typing is the first, not the final, step to improving their essays. The computer is a more objective evaluator and provides tireless, consistent analyses. Moreover, the computer introduces a sort of "magic" into writing, and "students -- with only a few exceptions -- feel that computer assistance adds significantly to their enjoyment and learning" (1984).

Kiefer (1985) admits that "not all these programs encourage revision" but rather highlight surface level concerns. However, she states,

others...help students see their words as others will see them. With increased objectivity, writers read more critically and revise more thoroughly (1985).

Even though all students do not always use the programs to revise, their potential to help students improve their papers is "clear" (1985).

These optimistic assessments touched off criticism and controversy. Issues were raised that are yet to be resolved (Smith forthcoming). Thus, while Reid (1987) found significant improvement in holistically scored essays by English as a Second Language students who used WRITER'S WORKBENCH, she cautions that the programs provide students "quantitative, not qualitative measures," and teachers must emphasize the limitations of the programs and encourage
students to approach the advice critically. Used properly, though, WRITER'S WORKBENCH provides "another audience" and offers "information...too time consuming for the teacher to collect" (1987).

One of the central criticisms leveled at text analysis programs, and WRITER'S WORKBENCH specifically, is that they focus on product and reflect "an error-based, rule-bound pedagogy" whereas the "orthodox position in composition training and research" is process oriented (Smith forthcoming). Thus, Sirc (1985) likens computer-assisted writing programs to Nautilus exercise machines. Text analysis programs are like "robotic police" that by producing product-based aid must lead to a product-based curriculum which is a "debilitating" and "sterile model" of the writing process" (1985).

Hult (1988) speculates that word processing and text analysis programs may inhibit revision strategies because word processing makes deleting and rewording so easy students interrupt the generating process to concentrate on surface problems, and text analysis reinforces this attention to words rather than the complete composition. Thus, computers may encourage the notion that revision is essentially the tidying up of texts and that first drafts are "essentially finished products" (1988).
Kiefer (1987), on the other hand, suggests text analysis programs are somewhat benign in that she suspects that without the knowledgeable intercession of instructors "most students would ignore ... most computerized revision aids." In her view, "clearly we need to keep asking the questions and looking for support for our continued use of word processing and revision programs" (1987). Smith (forthcoming) argues that text analysis may be used or misused as "end-of-process" learning depending on the instructor.

Another common criticism is that since computerized text analysis programs cannot understand texts, they cannot consider evaluative issues such as audience and purpose (Smith forthcoming). As Wresch (1987) puts it, "how can a machine that can't see help a writer re-see?" Thus Oliver (1984a), one of the more eloquent critics, writes:

Contemporary theory in composition and rhetoric stresses that no sentence or larger unit of written discourse can be validly appraised in isolation from its intended meaning, purpose, and audience. But when analyzing written language, the computer...altogether ignores meaning and rhetorical context, its evaluation and recommendations based solely on the text's surface features. Nor can the uncomprehending machine consider coherence, logic, complexity of ideas, ambiguity, or word choice when it attempts to assess readability or stylistic merit.

To this criticism Smith (In Press) replies that text analysis merely identifies features that assist users to make more informed judgments about the texts they are
writing. They cannot replace human readers, but they do provide their service "rapidly, dispassionately, and tirelessly, day or night" (In Press).

Another complaint is that students especially inexperienced and basic writers lack the knowledge and judgement necessary to skillfully use the programs (Smith In Press). Thus, Southwell (1984b) writes that text analysis programs "have the potential for being helpful" because student writers generally have a weaker sense of the range of possibilities open to them for expressing a given idea than do skilled writers, they are not very likely to notice if they fall into simple or cliched ways of expressing their ideas, or to repeat the same ways again and again. Specific advice about stylistic revisions can therefore benefit them. The problem is that the quality of that advice is dependent on what has been built into the program...and on the program's ability to analyze accurately what is actually in the text. Neither of these can be relied on completely (1984b).

Students then have difficulty interpreting these programs' advice, and weaker students with gross rhetorical and encoding problems cannot appreciate such subtle stylistic suggestions (1984b).

Ross and Bridwell (1985) critically note that within the 6–8 pages of commentary WORKBENCH provides, the comments range in "heinousness" from the "mildly questionable" to the "unpardonable." Readability formulas, they contend, scold writers for lengthly sentences whereas these should be "allowed to grow before they are pruned."
Bridwell-Bowles (1987) adds these programs indicate "errors" where they do not exist up to 30% of the time.

Wresch (1987) worries that WORKBENCH provides an "overwhelming" amount of information which is not useful to every student; for weaker students it is "less important that a sentence contain an active verb than that it contain some sort of verb somewhere." On the other hand, for students who write correctly but with limited styles, the programs can help them explore alternatives (1987). Oliver (1984b) cautions the programs were originally developed for professional writers and editors, but "beginning writers... might be all too ready to defer to the machine's inaccurate pronouncements on the style, diction, and readability of their compositions."

Little (1987), however, finds WRITER'S WORKBENCH analyses provide "valuable, though limited, feedback" when students are warned in class not to accept the results uncritically. In fact, students begin to argue about their analyses, the teacher becomes an intermediary resource, and students have a heightened sense of audience awareness and the choices revision represents (1987). Smith (forthcoming) feels textbooks exhibit similar conflicts, and that teachers must match students with programs according to complexity.

A related problem is that the advice provided by text analyzers such as WRITER'S WORKBENCH may not match the
evaluative criteria of human readers. Reid and Findlay (1986) sought to determine the degree to which the specific programs comprising WRITER'S WORKBENCH measured quality in student writing by correlating 27 stylistic measurements in these programs with the results of holistic scoring. They found that only 9 of the 27 WORKBENCH stylistic measures correlated with essay quality assigned by holistic readers. They conclude that there is a danger that the limits and ranges on program measurements in WRITER'S WORKBENCH may mislead students, and therefore, these measurements must be used with caution in leading students to improved essays (1986).

Another criticism is that these programs are not capable of even rudimentary grammatical analysis (Southwell 1984b). Thus, Oliver (1985) states that since computers cannot read, "as an editor of grammar and usage errors...the machine is an unqualified failure."

Hull and Smith (1985), however, describe efforts to make computers "amenable" to teaching students to edit. Their project attempts to combine pattern-matching and a parser to create "a program that analyzes the texts of inexperienced writers...driven by a taxonomy of the kinds of errors these writers actually make" (1985). The desire is to model the activity of editing and teach the close
analytic reading skills necessary to perform this function (1985).

Their approach makes certain assumptions which they proffer as maxims for effective computer assistance. Unlike present text analyzing programs, they contend computers must provide practice at editing and relieve machine dependency by teaching students how to correct text. Further, programs must distinguish clearly between matters of style and correctness, that is, between changes that must be made and those that might be made. Effective programs must not flag correct usages and must have sophisticated detection and diagnostic capacities. Feedback must be useful, and the programs should reflect the best pedagogies of the finest teachers (1985).

Style analyzers simply are not designed to deal with ungrammatical text and often confuse students (Hull et. al. 1987). CRITIQUE may be an improvement in that it parses grammar, but students need programs which provide a taxonomy of errors they most frequently commit (1987). Gould (1980) adds that the usefulness of grammar verification "relates to the general issue of strategies in composing" since writers may consider this a risky "diversion" that interrupts writing. Bridwell-Bowles (1987) concludes that spelling checkers are probably helpful, but since the present technology cannot detect common errors such as sentence
fragments and run-on sentences, the primary positive advantage of text analysis aids seems to be that students enjoy them.

Another criticism is that research studies have not demonstrated these programs improve student writing. Schwartz (1984b), for example, agrees that many of the above criticisms may be valid, but that more experimentation and research is needed. Oliver (1985) criticizes the empirical studies done at Bell Laboratories and CSU essentially for forming conclusions unsupported by the data and argues that only case studies which record and analyze students' revisions and probe for adverse side effects are feasible. Questions of writing and learning styles, motivation, and writing skills and habits must be explored (1985).

Another investigator (Logan 1988) agrees that ethnographic research be used because composition research should reassert its intrinsic humanistic nature by focusing on the individual writer as a human being and not as a specimen or quantity. She reports one such study of four students using word processing and WRITER'S WORKBENCH which found students' basic attitudes about using the computer varied widely with profound implications for its introduction and use. Students persisted in views ranging from seeing the computer as "a tool," for example, to merely "a
given" necessitated by modern society, to "the enemy" (1988).

Schwartz and Vockell (1987) examined the impact of style and spell check analyses on freshman writing. In this study, both the experimental and control groups used word processing programs, but the experimental group had use of a spell checker and stylistic analyzer (RIGHTWRITER). Pre and post writing samples revealed that both groups improved their writing, but the group using the spell and style checker did not show significantly greater improvement. The authors conclude such programs "raised consciousness" and may have potential, but teachers must teach students how to make revisions once the programs identify problems (1987).

Ober and Kocar (1986) studied the influence of punctuation, style, and spell check programs on the writing of 124 students. All students used word processing, but 68 students also had use of the text analysis programs. They found this group's writing did not show significantly higher scores on mechanics, tone, or style, although these were integral parts of the program's analyses. Until research can demonstrate results, they conclude, such programs should be a supplement not a substitute for instruction (1986).

Daiute (1984) discusses the uses and evaluations of a word processing and text analysis program named CATCH used in a project with children at Harvard. Daiute found that
some students received higher holistic scores on posttest writing but these did not reflect overall quality, that the computer stimulated revising activity on first drafts, but while students made more changes, these were not as extensive as when they recopied (1984).

Smith (In Press) grants that empirical studies have not kept pace with the explosion of "transforming technologies and methodologies for writing instruction." He predicts the future "lies with fast, accurate, and efficient parsers." Advances in hardware and artificial intelligence will allow text analyzers to run on personal computers and writing with word processors will automatically involve text analyzers (In Press).

Thiesmeyer (1987) concludes that the research neither supports nor contradicts the use of computers in composition. Having reviewed the dominant examples of the computer software available for composition, Ross and Bridwell (1985) conclude they are "heavy on the superficial" and "light on real help with solving complicated rhetorical problems." The authors, however, believe that using computers makes writing easier and therefore leads to a "more integrated teaching environment" and better prepares students for "the futures they will face" (1985). Like Smith, these researchers conclude that only breakthroughs in artificial intel-
lignence can endow the computer with the attributes necessary for genuine writing assistance (1985).

However, these and other commentators suggest how distant such input from artificial intelligence is. First, Ross and Bridwell (1985) suggest that advanced parsers such as CRITIQUE "barrage" writers with complicated data rather than errors about which they want to know, whereas:

the sort of computer programs a writer or teacher might want should have specific, practical and realizable goals — they should do something, and what they do should be desirable from the perspective of both people (Ross 1985).

Simply put, "the problem is twofold: limitations in linguistic theory and the inability of computers to read for meaning" (Ross and Bridwell 1985) hinder present programs. That is, computers cannot check grammar because it is based on syntax and semantic content, and "no commercial computer program can even tell a sentence fragment from a complete sentence" (Schwartz 1987).

Having reviewed the major text analysis systems presently available, Wallraff (1988) points out that none of them can accept as input all the kinds of English that a person could be expected to accept or understand...Nor can any of them generate...a wide range of reliably grammatical, idiomatic English.

Thiesmeyer (1987) explains that the so-called "expert systems" can only "decide" based upon what is programmed into them. But the brain and language are so complex that
linguistics and cognitive science are not sufficiently
developed to provide the data needed for programs, and even
if they were, there are no computers powerful enough to cope
with computability problems of this magnitude. Therefore,
solutions from artificial intelligence are not immediately
nor even distantly forthcoming (1987).

Wallraff (1988) quotes Winograd, one of the preeminent
researchers in artificial intelligence, who says simply,
"it's not in sight." Editing involves interpreting and
decision-making, and as Winograd says, "That's not something
that computers are good at" (Wallraff 1988). Thus, she
concludes:

Before it becomes possible for computers to use
the kind of English that we use, we will need to
get to know our language, and our mental proces-
ses, much better than we know them now. And as we
learn how to delegate to machines those human
tasks that turn out not to be beyond their grasp
after all, we can hardly fail to gain new respect
for the ultimate complexity of language and
thought...but we are still far from fathoming
language and thought themselves (Wallraff 1988).

Thiesmeyer (1987) similarly concludes that for the foreseeable future "teachers and students of writing must remain...
dependent...on their own marvelous and mysterious linguistic
abilities..." and "programmed intelligences...will play a
supporting role at best."

Summary

This review of the literature establishes that writing
instruction is important, that it has not been done well,
and that improvement is vital. There has been considerable optimism that a combination of basic composition research and computer-assisted instruction may offer dramatic contributions in this effort.

The literature describes composition research as a relatively new, multi-disciplinary investigation into the complex cognitive processes involved in writing and their effects on written texts. Among the results of this research is the discovery that writing involves a large number of simultaneous, interactive, recursive, and demanding cognitive activities and that the learning of these is not fully understood. The literature also demonstrates that neither writing processes nor written products are solely cognitive but are also influenced by writers' attitudes and emotions. Therefore, the literature stresses the need for further research, and that this research be multi-methodological, and include both cognitive and affective measures.

Moreover, composition research has raised issues which have transferred into the assessment of the computer as a writing and writing instructional aid. Among these is the conflict between reductionist and constructivist theories of writing and the debate over the relative importance of developing writing processes as opposed to evaluating and correcting errors in texts. Indeed, excessive concentration on error and editing has been shown to inhibit content and
fluidity. Text analysis programs such as WRITER'S WORKBENCH in particular have been the focus of much of this controversy which is as yet unresolved.

Much of the literature regarding computers and composition is typified by speculation and debate whether the computer constitutes a threat and/or a benefit to writing and writing instruction. While much of this literature describes a variety of present programs purporting to aid various stages of the writing process, most observers agree that constructive research has been scant and that the results of this research have been inconclusive at best. There is also consensus that present methods of software development and review are inadequate, that present software programs do not realize the computer's potential and that they may be pedagogically unsound. Also there is general agreement that there is a role for the computer in composition, that better software is necessary, and that more research is needed to both measure the effects of present programs and guide the development of future software and its applications. Here again, multiple methods, both cognitive and affective, are viewed as essential.

Finally, the literature suggests that, barring any unforeseen inspirational revelations, the present and projected state of cognitive and linguistic knowledge combined with the computability limitations of even the most
sophisticated of anticipated computers precludes significant revolutionary contributions from artificial intelligence in the area of reading, evaluating, editing, or generating a normal variety of syntactic English text. It appears, then, that program improvement must come without recourse to major assistance from artificial intelligence.
CHAPTER II REFERENCE LIST


Daly, John A. 1985a. Writing apprehension. In When a writer can't write, ed. Mike Rose, 43-82. New York: Guilford Press.


CHAPTER III

METHOD

This chapter presents a description of the methods and procedures employed for the collection and analysis of data. Included are descriptions of the design of the study, the population and samples studied, the instruments used, and the procedures for collection and treatment of data.

The Design of the Study

This study is made up of approximately 275 students enrolled in English Composition 150 at Colorado State University (CSU) during the Fall term, 1987. These students are subdivided into an experimental group and a control group.

Because policies adhered to by the Department of English at CSU dictated that random selection of participants could not be accomplished, this study is an example of Campbell and Stanley's Quasi-experimental Design 10: Nonequivalent Control Group Design (1963). These authors point out that this design can suffer from threats to internal validity through selection - maturation interaction and regression. However, steps were taken to mitigate against this possibility: 1) the students were not self-selected, 2) entire classrooms were used to diminish
the "guinea pig" effect, and 3) demographic and pre-test
data were drawn to demonstrate the degree of comparability
of the groups. Because they recognize the "intransigency of
the environment" and "the experimenter's lack of complete
control," Campbell and Stanley (1963) observe that this is
"one of the most widespread experimental designs in educa-
tional research" and consider it stronger than others and
definitely "well worth using."

The Population

The population of this study is comprised of ap-
proximately 2,000 students enrolled in English Composition
150 (Co. 150) at Colorado State University during the Fall,
1987 term. A sample of approximately 275 students was drawn
from this population by asking Co. 150 instructors to
volunteer their sections to participate. Eight instructors
committed eleven sections (each representing approximately
25 students) to be involved in this study.

This sample of 275 students was then subdivided into an
experimental group of approximately 200 students who would
use WRITER'S WORKBENCH and a control group of 75 students
who would not. This was accomplished by asking the par-
ticipating instructors to choose whether or not they wished
their students to use the program; three instructors agreed
not to have their students use WRITER'S WORKBENCH. In
accordance with the policies of the Human Subjects Research
Board at CSU, each student was given the freedom to refuse to participate with each administration of the instruments but none chose to do so. However, some students were absent during the multiple administrations of the various instruments which decreases the number of complete sets of data.

An additional point about the groups needs to be discussed. A stratified random sample of 75 posttest essays was drawn from the larger experimental group and matched with those of the control group which was comparable in size. However, pretest essays could be found in the English Department's files for only 61 of the experimental group and 55 of the control group. Even so, matched essays were scored for 116 students which represents approximately 42% of the total sample.

In the cases above, however, there is no reason to believe that the sample or subgroups of the sample differ significantly from the population as a whole. On the other hand, potential interviewees were initially selected by the investigator from the experimental group based on extreme scores on the Writing Apprehension Test (see Appendix C). The purpose of the interviews was to provide individuals' insights into the WORKBENCH programs; when added to the descriptive statistics of the questionnaire, the interviews would allow additional interpretation. Choosing inter-
viewees by extreme apprehension scores insured the input of both high and low apprehensives.

The students selected were invited to participate by private correspondence via instructors; once they "volunteered," interview appointments were scheduled by telephone. Thirteen appointments were scheduled. The interviews were held on campus and were private. Participants were guaranteed anonymity, and each signed a research consent form. Each interview consumed between 45 and 60 minutes. The interviewees' responses were written down by the investigator and were also audio recorded.

The thirteen interviewees represent five of the eight sections comprising the experimental group. It should be noted, however, that these interviewees represent extremes of writing apprehension, and being volunteers, they may represent extremes in their attitudes, as well.

Instruments

Based upon an extensive review of the literature (e.g. Davis, Scriven, and Thomas 1981; Fagan, Jensen, and Cooper 1985; Godshalk, Swineford, and Coffman 1966; Rose 1985a; White 1985; and Witte and Faigley 1983), it was decided to utilize a variety of instruments and procedures in order to provide multiple measurements of the possible effects of the WRITER'S WORKBENCH treatment.
First a demographic data sheet was administered early in the term to gather certain information from all the participants in the study (see Appendix C). Information such as age, sex, ethnicity, SAT verbal scores, average grade in high school composition courses, number of prior university courses taken, etc. was gathered primarily to ascertain the degree of comparability between the experimental and control groups.

Data for the first of the primary measures, gains in writing performance, was gathered in a pretest/posttest format. This was accomplished by having each participating student write a "summary and response" essay (see Appendix B) during the final examination period of one hour's duration. As described above, a stratified random sample of these final essays was selected from the experimental group to be compared against the final essays written by the control group. These essays were then matched with the same type of essay written by the same students of both groups under identical time constraints prior to the semester during the English Department's placement procedures. These 232 essays were then mixed and subjected to a blind judgment by an independent panel of four trained graders according to established holistic scoring methodology as described by White (1985) and others to provide comparative measures of writing improvement. The graders were profes-
sional writing instructors who had performed holistic scoring previously at CSU, and who were trained to score for uniform criteria according to established practice at the university. Inter-reader reliability using these procedures (see "Analyses of Data" section of this chapter for a complete description) is considered to be .90 (Reid and Findlay 1986).

The second measurement, that determining any significant changes in writing apprehension among and between the experimental and control groups over the course of the semester, was accomplished by a pretest and posttest administration of the Daly-Miller Writing Apprehension Test (see Appendix C) to each group early and again late in the term. The title of the test, however, was changed to "Writing Attitude Survey" to help conceal the apprehension variable from participants. Developed in 1974 and published in Research in the Teaching of English in 1975, this instrument was designed to help discover the "role, the effects, and the treatment" of writing apprehension (Daly and Miller 1975b). The instrument has been used widely with children, college students, and adults. It was used by the National Assessment of Educational Progress (Daly 1985a), and it has established predictive validity (Daly 1975a). The Writing Apprehension Test (WAT) also appears sufficiently reliable: using a split half technique, Daly and
Miller (1975b) obtained a reliability coefficient of .940. Test-retest reliability over a week obtained a coefficient of reliability of .923, and later studies found test-retest coefficients greater than .80 (1975b). Daly (1985a) reviews several correlational studies which successfully utilized the WAT, and he provides evidence of convergent validity, as well.

In addition, a 40 item Freshman English Questionnaire was developed specifically for this study (see Appendix D). Administered only to the experimental group using WRITER'S WORKBENCH, its purposes were to provide primarily descriptive data in an effort to determine: 1) students' attitudes about using a computer for writing, 2) how WRITER'S WORKBENCH is used within the students' writing processes, 3) students' perceptions of the usefulness of WRITER'S WORKBENCH as a component of Co 150, and 4) students' perceptions of the usefulness of the individual major programs offered by WRITER'S WORKBENCH to them as student writers. This instrument was judged by four professional writing instructors who are familiar with WRITER'S WORKBENCH and are widely regarded as authorities on computer-assisted writing instruction to establish face and content validity.

And finally, an in-depth personal interview was conducted with 13 students selected on the basis of their WAT scores to further clarify student attitudes about
WRITER'S WORKBENCH. An Interview Protocol (see Appendix E) was developed and submitted to the same face and content validity process described above.

The Treatment

Both the experimental and control groups received the standard one semester English Composition 150 course. All instructors are selected and supervised by the Director of Freshman English, are expected to use a common text and to achieve common goals, and are provided in-service training to insure they do so.

In addition, however, the experimental group used the WRITER'S WORKBENCH programs in the English Department's Computer Writing Lab as an intrinsic component of the Co. 150 course. Located near the English Department office, this lab contains two 3B2/400 AT&T Unix-based minicomputers, approximately 40 terminals, and five Data Products and NEC printers.

Since point-by-point text analysis consumes a great deal of computer lab time, students at CSU write their essays first, schedule computer lab time each week to enter them, run WRITER'S WORKBENCH and take away a 6 - 8 page print-out of computer generated criticism which they analyze before revising and returning to the lab to produce a final draft. The teacher then evaluates this draft, and students
may return to the lab and revise further on the computer. (Smith, Kiefer, and Gingrich 1984).

Procedures for the Collection of Data

Initial approval to conduct this research was received from Dr. Rosemary Whittaker, Chair of the English Department, Dr. Jean Wyrick, Director of Freshman English, and Dr. Thomas Knight, Dean of Arts, Humanities and Social Sciences at CSU. Additionally, permission of the human research committees of both CSU and The University of North Texas was secured.

As stated earlier, a sufficient number of students to make up the experimental and control groups was obtained by requesting Co. 150 instructors to volunteer their course sections. Permission to use the Daly-Miller Writing Apprehension Test was sought and received from Professor John A. Daly, College of Communication, University of Texas at Austin.

All instruments, with the exception of the interview, were administered to the students by the volunteer instructors during class time following detailed instructions regarding required procedures and time constraints. Coded sets of instruments were given to each instructor by section and returned directly to the investigator. The demographic survey and pretest of the WAT were administered the first full week of the Fall term, the Freshman English Question-
naire during the week preceding Thanksgiving break, and the posttest WAT the last week in the term. The researcher identified students to be interviewed based upon writing apprehension scores and conducted these private individual interviews during the first two weeks of December. All instruments (with the exception of the holistically scored essays) were hand-scored by the researcher.

Under the guidance of Professor Stephen Reid, the CSU English Department's Director of Placement, pretest summary-response essay samples were collected from the department's placement test files, and a similar posttest essay topic was selected from previous placement test topics and administered by instructors during the final exam period under time constraints duplicating the placement test. An independent panel of four trained holistic essay scorers, all professional writing instructors, was selected from the English Department's list of placement test scorers and employed to judge the students' essays.

Analyses of Data

To investigate the research questions of this study several types of data were collected from all or subsets of the approximately 275 participants. The following paragraphs describe how these data are compiled and analyzed for each research question.
First, a demographic profile of both the experimental and control groups was constructed for comparative purposes. These data are derived from administering the demographic questionnaire. Descriptive in nature, these data are presented with frequencies, percentages, and/or means after being submitted to Chi Square or other statistical tests of significance. These data portray the comparability of the groups.

The first research question seeks to determine the comparative effects of instruction on gains in writing performance on summary-response essays written before and after instruction by sub-sets of students from the experimental and control groups as indicated by an independent panel of trained writing judges using holistic scoring techniques. A panel of four judges spent 36.5 work hours during one day holistically scoring a total of 232 essays (116 pretest/posttest sets) according to established holistic scoring precepts and standard practices at CSU. These readers were unaware of the purposes or design of the study. The pretest and posttest essays were mixed and presented randomly to the readers who identified essay scores only by the last four digits of the authors' social security numbers.

Prior to beginning to score, the readers were coached concerning common evaluative criteria using the scoring
guidelines previously developed and tested for each essay by CSU placement personnel (see Appendix F). This coaching was repeated periodically throughout the day to insure inter-reader reliability. Each essay was independently read by two judges each of whom awarded the essay a single digit score ranging between 1 and 9. (The evaluative criteria at CSU are high, and scores of 7, 8 and 9 are rare and indicate superior performance warranting advanced placement.) These lists of independent scores were periodically collected by the researcher. Independent scores awarded by two readers within one point of agreement were averaged and became that essay's score. Essays with score differences greater than one point were read by a third judge independently, and the three scores then averaged by the researcher to derive the essay's final score.

Following a previously designed code unrevealed to the judges, the researcher then compiled matching pretest and posttest scores for the experimental (N = 61) and control (N = 55) groups. Then, analysis of covariance was used as a test of statistical significance to determine if significant differences exist between the pre and posttest holistic writing scores awarded by the panel of essay raters both within and between the experimental and control groups.

The second and third research questions concern whether one semester of English Composition significantly reduces
writing apprehension and whether there are significantly
different reductions between the experimental and control
groups as measured by a pre-post administration of the Daly-
Miller Writing Apprehension Test. This 26 item Likert-style
instrument produces a score on a continuum between 26 and
130 with 78 being the median and representing uncertainty or
ambivalence. Participants respond by circling a number
between 1 and 5. The score is computed by either adding or
subtracting the participant's numerical response to each
item (depending on the item's predetermined positive or
negative value) to or from 78. A low score represents
a high degree of apprehension; a high score indicates a lack
of apprehension.*

Here again, matched pre and post apprehension scores
were computed and compiled for all individuals (excepting
absentees) in both the experimental and control groups. And
analysis of covariance was used as a test of statistical
significance to determine if significant differences exist
between the pre and posttest scores on the Writing Apprehen-
sion Test both within and between the experimental and
control groups.

*NOTE: There are two established ways of scoring the WAT.
This study utilizes the published formula. With the other,
a low score would indicate lack of apprehension and a high
score a higher degree of apprehension. The methods merely
reverse the direction of the score from the median of 78;
the distance from the median is not affected.
The fourth research question asks if there are any significant relationships between gains in writing performance and levels of writing apprehension. Pearson product moment correlations between 1) the degree of change in holistic scores and the posttest WAT scores and 2) the posttest holistic score and the posttest WAT score were computed to discover any relationships. Each of the correlation coefficients were computed for both the experimental and control groups.

The fifth and sixth research questions concern students' attitudes about using WRITER'S WORKBENCH, how they utilize it within their individual writing processes, and whether or not it improves their writing. These issues are addressed by the items on the Freshman English Questionnaire administered once to only the experimental group. Since the data are descriptive in nature, item by item frequencies and percentages are reported.

Finally, appropriate responses of the 13 individuals to the items on the Personal Interview Protocol are reported. When added to the data above, these responses provide details for additional interpretive insight.

Data derived from the interviews will be presented in narrative form as they relate to the other items investigated. All other data will be presented in narrative and tabulated form where the latter contributes to clarity.
Summary

This chapter presents the methodology employed in conducting this study. The design of the study follows Campbell and Stanley's Quasi-experimental Design 10: Nonequivalent Control Group Design. The procedures for selecting the approximately 275 participating students from the population are described, as is the method used to divide them into the experimental and control groups. The treatments are described, and then each of the instruments used in the study is discussed: 1) the pretest/posttest of summary-response essays subjected to blind judgement by a panel of trained holistic scorers, 2) the pretest/posttest of the Daly-Miller Writing Apprehension Test, 3) the Freshman English Questionnaire administered to the experimental group only, and 4) the Interview Protocol used to conduct in-depth interviews. Data regarding the content, structure, and reliability and validity are provided, as are the methods used in their administration. Finally, the procedures used to collect, process, and analyze the data are presented as they relate to the research questions.
CHAPTER III REFERENCE LIST


Daly, John A. 1985a. Writing apprehension. In When a writer can't write, ed. Mike Rose, 43-82. New York: Guilford Press.


CHAPTER IV

PRESENTATION AND ANALYSES OF THE DATA

Introduction

The purpose of this chapter is to present analyses of the data derived from the various measures described in Chapter III. Included are analyses of: pre and posttest holistic essay scores; pre and posttest scores on the Daly-Miller Writing Apprehension Test; and the data derived from the self-report questionnaire and personal interviews concerning students' attitudes about computers and WRITER'S WORKBENCH, students' writing processes, and how students utilize the various WORKBENCH programs.

This presentation of data analyses is arranged according to the research questions stated in Chapter I. The result of each analysis is presented in both narrative and tabular form. In addition, statistical data were derived which go beyond the stated research questions, and these data are presented, as well.

The following measures comprised the study. Participants in both the experimental and control groups completed a demographic survey (see Chapter III) to establish their comparability. To measure writing performance gains, both groups of students wrote a posttest summary-response essay during the final examination period. These
posttest essays were then matched with similar summary-
response essays written during the English Department's
placement examination process (see Chapter III). The pool
of essays was then mixed and submitted to a blind judgement
by a panel of four independent, experienced readers using
established holistic scoring techniques.

Similarly, both groups of students completed the Daly-
Miller Apprehension Test (see Chapter III) early and again
late in the term which provided pre and posttest measures of
writing apprehension. This 26 item instrument provides
scores ranging between 26 - 130; a low score represents
higher apprehension and higher scores represent lesser
apprehension.

In addition, the participants in the experimental group
completed the 40 item Freshman English Questionnaire
designed to determine certain aspects of the students'
attitudes toward computers and WRITER'S WORKBENCH, as well
as the writing processes they invoke, how they utilize the
WORKBENCH programs, and the relative utility of the various
programs as perceived by the user. And finally, 13 members
of the experimental group who were selected based on extreme
apprehension scores participated in an in-depth personal
interview with the investigator to further discover their
writing processes and how they use and feel about WRITER'S
WORKBENCH. These are also described in Chapter III.
Demographic Survey

The demographic survey established that the experimental and control groups were comparable on seven of the eight measures. Data regarding sex, number of handicapped, citizenship, age, high school composition grades, and ethnicity were submitted to Chi Square as a test of statistical significance.

Table 1 displays the data regarding sex, proportion of handicapped, and citizenship among the two groups. It

<table>
<thead>
<tr>
<th></th>
<th>Experimental</th>
<th>Control</th>
<th>Total</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>100</td>
<td>54.1</td>
<td>34</td>
<td>51.5</td>
</tr>
<tr>
<td>Female</td>
<td>85</td>
<td>45.9</td>
<td>32</td>
<td>48.5</td>
</tr>
<tr>
<td>Handicap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>.5</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>No</td>
<td>182</td>
<td>99.5</td>
<td>65</td>
<td>98.5</td>
</tr>
<tr>
<td>Citizen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>183</td>
<td>99.5</td>
<td>65</td>
<td>98.5</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>.5</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Note: N = number, % = percentage, DF = degrees of freedom, and Sig. = significance.

demonstrates there were no significant differences between the two groups in terms of sex (p = .7226), number of handicapped (p = .4498), or citizenship (p = .4471).
Table 2 presents the frequencies and percentages of age groupings. As can be seen, there was no significant difference between the groups in age ($p = .5085$). In fact, over 89% of both groups reported they were between 17 and 20 years of age, the traditional range for university freshmen.

Table 3 shows the frequencies and percentages of the high school composition grades reported by members of the two groups. It demonstrates there was no significant difference between the groups in terms of the average grade they reported receiving in high school composition classes ($p = .1771$).
Table 3.—High School Composition Grade by Group

<table>
<thead>
<tr>
<th></th>
<th>Reported Grades</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
</tr>
<tr>
<td>Experimental</td>
<td>50</td>
<td>103</td>
<td>30</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>Number</td>
<td>27.0</td>
<td>55.7</td>
<td>16.2</td>
<td>1.1</td>
<td>--</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>12</td>
<td>46</td>
<td>7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Number</td>
<td>18.5</td>
<td>70.8</td>
<td>10.8</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistics

<table>
<thead>
<tr>
<th>Total N</th>
<th>Chi Square</th>
<th>DF</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>4.92852</td>
<td>3</td>
<td>.1771</td>
</tr>
</tbody>
</table>

Table 4 presents the data regarding the ethnicity of the two groups. As can be seen, there was a significant difference in the ethnic makeup of the two groups (p=.0264).

Table 4.—Ethnicity by Group

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black</th>
<th>Asian American</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>170</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Number</td>
<td>92.4</td>
<td>1.1</td>
<td>2.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>53</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Number</td>
<td>81.5</td>
<td>7.7</td>
<td>4.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistics

<table>
<thead>
<tr>
<th>Total N</th>
<th>Chi Square</th>
<th>DF</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>249</td>
<td>9.22506</td>
<td>3</td>
<td>.0264</td>
</tr>
</tbody>
</table>
Even though the experimental group had a total of 14 minority students, they constituted only 7.6% of the group's larger number of participants ($N = 184$), while the control group's 12 minority members accounted for 18.5% of the smaller group ($N = 65$). This is a statistically significant difference, yet it can also be said that the groups are remarkably homogeneous.

The groups were also asked to supply two additional pieces of information: the number of college credits, if any, they had completed prior to the study and their Verbal SAT scores. These data were subjected to a two-tailed T Test as a measure of statistical significance.

Table 5 displays the data regarding credits taken prior to the study. It demonstrates there was no significant difference ($p = .774$) between the two groups on the number of prior credits taken before the study. The mean for each group was between 3 and 4 courses.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean Credits</th>
<th>Stan. Dev.</th>
<th>T Value</th>
<th>DF</th>
<th>2-Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>172</td>
<td>10.7791</td>
<td>13.946</td>
<td>.29</td>
<td>230</td>
<td>.774</td>
</tr>
<tr>
<td>Control</td>
<td>60</td>
<td>10.2000</td>
<td>11.761</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6 contains the data regarding scores reported on the SAT Verbal. It demonstrates there was also no sig-
ificant difference (p = .239) between groups on this measure. It should be noted, however, that only 94 par-
ticipants reported a score, suggesting that many students could not remember their scores, did not wish to report them, or did not take the SAT.

Together these eight measures indicate that the experimental and control groups were comparable. The groups were also found to be comparable on pretest measures, but these statistics will be presented in the appropriate sections below.

Writing Performance

The first research question sought to determine the comparative effects of instruction on gains in writing performance on summary-response essays written before and after instruction by students from the experimental and control groups as indicated by an independent panel of
trained writing judges using holistic scoring techniques. The procedures followed were described in Chapter III. The primary statistical test of significance employed was analysis of covariance; however, other statistical tests were also applied, and the results of these analyses will be presented, as well.

Table 7 presents the results of using a two-tailed T test of significance on the pretest and posttest holistic scores of the groups. The pretest portion of the table

Table 7.—Two-tailed T Test of Pretest/Posttest Holistic Writing Scores by Group

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean Score</th>
<th>Stan. Dev.</th>
<th>T Value</th>
<th>DF</th>
<th>2-Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>61</td>
<td>3.9541</td>
<td>.819</td>
<td>.21</td>
<td>114</td>
<td>.836</td>
</tr>
<tr>
<td>Control</td>
<td>55</td>
<td>3.9873</td>
<td>.909</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>61</td>
<td>4.3689</td>
<td>1.014</td>
<td>-.13</td>
<td>114</td>
<td>.899</td>
</tr>
<tr>
<td>Control</td>
<td>55</td>
<td>4.3909</td>
<td>.827</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

indicates there was no significant difference between the experimental and control groups (p = .836) on holistic scores awarded to pretest essays. Thus, the two groups were comparable in writing performance prior to the respective treatments. The posttest data in Table 7 shows that writing performance had improved within each group during the course of the semester. However, there was no significant difference between the two groups (p = .899) in terms of
writing performance on the posttest essay. In other words, while both groups improved as a result of their respective treatments, the rate of improvement was not significantly greater for either group.

Table 8 presents the results of subjecting the pretest and posttest holistic scores of both groups to a paired T test as a test of statistical significance. This table demonstrates that the gains in writing performance between the pretest and posttest essays for both the experimental and control groups were statistically significant (p = .006 and p = .005).

Table 9 presents the results of subjecting the holistic scores to an analysis of covariance using the pretest scores
as the covariant as a test of statistical significance.

This statistical test also demonstrates that the difference between the two groups' writing performance gains was not statistically significant \( (p = .942) \).

Table 10 presents the results of subjecting the holistic scores to a repeated measures analysis of variance.

It also indicates there was no significant difference between the groups \( (p = .956) \) on gains in writing performance.
Therefore, based on the results of these statistical tests, it can be said that: 1) the two groups were comparable in writing performance before the treatments, 2) both groups demonstrated significant growth in writing performance as a result of the respective treatments, but 3) neither the WRITER'S WORKBENCH treatment nor the course treatment alone produced significantly greater gains in writing performance as measured by holistic scoring.

Writing Apprehension

The second and third research questions dealt with measures of apprehension of writing. Tables 11 - 14 present the results of submitting comparative data to various statistical tests of significance. First, however, an overview of the entire sample. Appendix 7 contains frequency tables and histograms of all the students' scores on the Daly-Miller Writing Apprehension Test, both the pretest (WAT 1) and posttest (WAT 2). Pretest scores ranged from 43 (most apprehensive) to 122 (least apprehensive). A score of 78 represents uncertainty or ambivalence. Of the total group (N = 269), 35.9% scored 77 or below indicating apprehension, and 62.1% scored 79 or above and were less apprehensive. Scores on the posttest (N = 251)* ranged

*NOTE: Absentees accounted for a lower number of posttest scores; the number of matched pre/posttest scores is lower (N = 227) for the same reason.
between 36 and 126, but only 25.9% scored 77 or below while 72% scored 79 or above.

The second research question asked whether completion of one semester of English Composition results in a significant reduction of writing apprehension as measured by a pre and post instructional administration of the Writing Apprehension Test. Table 11 addresses this question by presenting the results of submitting the pretest and posttest Writing Apprehension Test (WAT) scores for both groups to a paired T-Test as a measure of statistical significance. As can be seen, there is a significant difference in the levels of writing apprehension of both the experimental (p = .005) and the control (p = .001) groups between the pre and post administration of the WAT. That is, both groups' scores reflect a significant, if small, decrease in apprehension following their respective treatments.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean Score</th>
<th>Stan. Dev.</th>
<th>T Value</th>
<th>DF</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest WAT</td>
<td>169</td>
<td>84.8639</td>
<td>16.239</td>
<td>-2.87</td>
<td>168</td>
<td>.005</td>
</tr>
<tr>
<td>Posttest WAT</td>
<td>169</td>
<td>87.5030</td>
<td>16.907</td>
<td>-2.87</td>
<td>168</td>
<td>.005</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest WAT</td>
<td>58</td>
<td>82.7759</td>
<td>12.718</td>
<td>-3.84</td>
<td>57</td>
<td>.001</td>
</tr>
<tr>
<td>Posttest WAT</td>
<td>58</td>
<td>88.0690</td>
<td>13.523</td>
<td>-3.84</td>
<td>57</td>
<td>.001</td>
</tr>
</tbody>
</table>

NOTE: Higher mean scores indicate decrease in apprehension.
The third research question, however, concerned whether there are significant differences in the reduction of writing apprehension as measured by the same instrument between the experimental group and the control group over the course of the same one semester of instruction. Here, again, a variety of statistical tests was employed.

Table 12 presents the results of submitting the pretest and posttest WAT scores of both the groups to a two-tailed T-Test of statistical significance. First, the pretest portion of this table demonstrates that there was no significant difference in the pretest WAT scores between the experimental and control groups (p = .415). In other words, the two groups were comparable on this measure of writing apprehension prior to instruction. Second, the posttest portion of this table demonstrates that while both groups increased their WAT mean scores on the posttest,
there was no significant difference \((p = .973)\) in the posttest WAT scores between the experimental and control groups. In other words, neither treatment produced a significantly greater reduction in apprehension of writing.

The WAT scores were also subjected to analysis of covariance using the pretest WAT scores as the covariant as a test of statistical significance. Table 13 presents the results of this analysis. Again, there was no significant difference between the experimental and control groups on decreases in writing apprehension following the respective treatments \((p = .201)\).

As can be seen in Table 14, subjecting these WAT scores to a repeated measures analysis of variance reveals similar results. There was no significant difference between the groups \((p = .134)\) on decreases in writing apprehension.

---

Table 13.--Analysis of Covariance of Pretest/Posttest WAT Scores \((N = 227)\)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>(F)</th>
<th>Significance of (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Group</td>
<td>224</td>
<td>121.91205</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Regression</td>
<td>1</td>
<td>31139.67433</td>
<td>255.42738</td>
<td>--</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>200.50918</td>
<td>1.64470</td>
<td>.201</td>
</tr>
</tbody>
</table>
Table 14.---Repeated Measures Analysis of Variance of Pretest/Posttest WAT Scores (N = 227)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>1</td>
<td>50.01599</td>
<td>.11624</td>
<td>.733</td>
</tr>
<tr>
<td>Within Group</td>
<td>225</td>
<td>430.27302</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>1248.91850</td>
<td>18.53545</td>
<td>.001</td>
</tr>
<tr>
<td>Time by Group</td>
<td>1</td>
<td>152.08175</td>
<td>2.25708</td>
<td>.134</td>
</tr>
<tr>
<td>Residual</td>
<td>225</td>
<td>67.38000</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Therefore, based on the results of these statistical tests, it can be said regarding research questions 2 and 3 that: 1) the two groups were comparable on this measure of writing apprehension prior to the treatments, 2) both groups' posttest WAT scores reflect a significant decrease, though small, in writing apprehension following the treatments, but 3) neither the WRITER'S WORKBENCH treatment nor the course treatment alone produced significantly greater declines in apprehension as measured by the WAT.

Relationship Between Writing Performance and Writing Apprehension

The fourth research question sought any significant relationships between gains in writing performance and levels of writing apprehension. This question was approached by computing Pearson product moment correlation coefficients between: 1) the degree of change in holistic scores and the posttest WAT scores and 2) the posttest
holistic score and the posttest WAT score. Each of these correlation coefficients were computed for the experimental and the control group.

Table 15 displays these four correlation coefficients. None of these coefficients is strong, and only one is significant. Within the control group there is a weak positive correlation between the post holistic score and the post WAT score (r = .3238) which is significant (p = .010). Nevertheless, these data do not indicate a clear relationship between writing performance and writing apprehension.

<table>
<thead>
<tr>
<th>Correlation Between:</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Holistic Score/WAT 2</td>
<td>r = - .1308</td>
<td>r = .1141</td>
</tr>
<tr>
<td>Post Holistic Score/WAT 2</td>
<td>r = - .0284</td>
<td>r = .3238</td>
</tr>
</tbody>
</table>

The Freshman English Questionnaire and Personal Interviews

In addition to the measures discussed above, a 40 item self-report Freshman English Questionnaire was administered to the experimental group who used WRITER'S WORKBENCH. Personal interviews were also conducted with 13 of these students in order to provide deeper insight into attitudes.
about WRITER'S WORKBENCH thereby complementing the question-naire.

As stated in Chapter III, the students to be inter-viewed were selected based on their extreme scores, high and low, on the Writing Apprehension Test. This provides information that helps determine whether high and low apprehensive students differ in their attitudes about WRITER'S WORKBENCH. The pretest apprehensives' scores ranged from 43 - 62; students with scores in this range represented 10.8% of the total sample (see Appendix G). Scores of the 6 lower apprehensives interviewed ranged between 107 - 122; this range represented 6.4% of the total scores.

During the interviews these 13 students disclosed basic dispositions toward WRITER'S WORKBENCH (WWB), either generally positive or negative. Table 16 presents the general characteristics of the students interviewed.

Table 16.—Number and Sex of High and Low Apprehensive Interviewees by Basic Disposition to WWB

<table>
<thead>
<tr>
<th>Disposition Toward WWB</th>
<th>High Apprehensive</th>
<th>Low Apprehensive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Positive</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>Negative</td>
<td>--</td>
<td>5</td>
</tr>
</tbody>
</table>
Overall, 6 of the 13 interviewees felt essentially positive about WORKBENCH while 7 were mostly negative. Interestingly, however, 5 of the 7 more negative students were highly apprehensive, and all 7 were female.

The questionnaire was designed to elicit student responses concerning their attitudes about computers and WRITER'S WORKBENCH, any role the WORKBENCH plays in improving their writing, the writing processes they employ, and the role the WORKBENCH plays within these processes. On 38 items students were asked to respond to a positively or negatively phrased statement about these issues by choosing one of five responses: 1) strongly agree, 2) agree, 3) uncertain, 4) disagree or 5) strongly disagree. The last two questions were open-ended asking students what they most and least liked about WRITER'S WORKBENCH.

Because of absences and withdrawals, only 169 of the original participants in the experimental group completed the questionnaire. The number of responses to individual items occasionally varies slightly, however, since some students did not respond to some items.

The data derived from this instrument are used primarily to answer research questions 5 and 6. Often, the same information is sought from more than one item on the questionnaire, and often items are variously stated, either positively or negatively, to compare responses. Also, items
eliciting similar information are distributed throughout the instrument. Therefore, the data are presented in tables in which the questions appear in the order necessary for discussion rather than in numerical order. All 38 items will be presented, however. Items 39 and 40 are discussed in narrative form. Each table presents the question in abbreviated form, the number of responses under each category, and subtotals of agreement and disagreement responses and percentages. Since the purpose of the interviews was to provide interpretive insight into the descriptive data generated by the questionnaire, highlights of the subjects' responses are reported in narrative form as they pertain to the research questions and the questionnaire.

Attitudes About WRITER'S WORKBENCH
And Writing Improvement

The fifth research question concerned the students' attitudes about using WRITER'S WORKBENCH and whether it contributes to improvements in their writing. Tables 17 - 21 present data from the questionnaire that are pertinent to this question.

For example, Table 17 presents students' responses concerning their previous experiences with and attitudes about computers. It appears the majority of students had prior experience using a computer for writing, but a
sizeable minority had not. Also, limited typing ability does not seem to present an obstacle to computer use for a

Table 17.—Questionnaire Responses: Attitudes About Computers

<table>
<thead>
<tr>
<th>Question</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Had prior experience writing with computer.</td>
<td>60</td>
<td>40</td>
<td>2</td>
<td>34</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>(59.2%)</td>
<td>(1.2%)</td>
<td></td>
<td>(39.6%)</td>
<td></td>
</tr>
<tr>
<td>5. Typing ability hinders computer use.</td>
<td>5</td>
<td>17</td>
<td>8</td>
<td>86</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td></td>
<td></td>
<td>139</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13.0%)</td>
<td>(4.7%)</td>
<td></td>
<td>(82.3%)</td>
<td></td>
</tr>
<tr>
<td>9. Prefer computer because of word processing.</td>
<td>87</td>
<td>59</td>
<td>11</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>146</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(88.5%)</td>
<td>(6.7%)</td>
<td></td>
<td>(4.8%)</td>
<td></td>
</tr>
<tr>
<td>10. Prefer composition without computer.</td>
<td>19</td>
<td>22</td>
<td>25</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(24.7%)</td>
<td>(15.1%)</td>
<td></td>
<td>(60.2%)</td>
<td></td>
</tr>
<tr>
<td>12. Enjoy computer in composition.</td>
<td>26</td>
<td>63</td>
<td>40</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td></td>
<td></td>
<td>39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(53.0%)</td>
<td>(23.8%)</td>
<td></td>
<td>(23.2%)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Questions are stated in abbreviated form; see Appendix 4 for complete version. SA = Strongly Agree, A = Agree, U = Uncertain, D = Disagree, and SD = Strongly Disagree. The first line presents frequencies of each response; the second line is the subtotal of general agreement and disagreement; the third line presents the percentage of general agreement, uncertainty, and general disagreement in parentheses. N = 169; individual items may vary slightly.

large majority. Significantly, however, 89% felt the primary advantage of computer use was that word processing lessened the chore of revising. Fewer students report they enjoy
using the computer for writing, and a sizeable minority may prefer composition without the computer requirement.

The interviews provide insight helpful in interpreting these data. For example, while only two of the 13 students interviewed had had no previous experience with a computer, the experience of the others ranged widely from occasional use in a ninth grade math class to actual programming. Most had not used the computer for writing.

Excepting scheduling conflicts caused by the computer lab, 9 of the 13 students said they enjoyed using the computer but primarily because of the advantages of word processing. Only two mentioned WORKBENCH, and one, a poor typist, liked SPELL because it flagged her typos.

All four of the students who were hostile to using the computer were high apprehensive students. One said he did not like to write regardless of the technology. Another, "Kay," said she was never able to learn the word processing commands and was "petrified" of the computer throughout the term. Also, she never learned what the WORKBENCH printout meant and was frustrated that her teacher downgraded her essays because she did not make changes based on its recommendations.

Table 18 presents students' general attitudes about using WRITER'S WORKBENCH. A majority of the students report
no initial nervousness using WORKBENCH, and 88% agree that they became comfortable with the computerized WORKBENCH. As already discussed, this was not the case for the students who were interviewed. Four did not like the computer nor WORKBENCH, and several others tended to ignore the printout analyses provided by WORKBENCH altogether.

Table 18.—Questionnaire Responses: Attitudes About Using WWB.

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Initially nervous using WWB.</td>
<td>12</td>
<td>52</td>
<td>11</td>
<td>66</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td></td>
<td></td>
<td>94</td>
<td>(37.9%)</td>
</tr>
<tr>
<td>4. Immediately comfortable using WWB.</td>
<td>26</td>
<td>72</td>
<td>31</td>
<td>35</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>98</td>
<td></td>
<td></td>
<td>40</td>
<td>(58.0%)</td>
</tr>
<tr>
<td>6. Still uneasy using WWB.</td>
<td>2</td>
<td>12</td>
<td>12</td>
<td>98</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td></td>
<td></td>
<td>143</td>
<td>(8.3%)</td>
</tr>
<tr>
<td>8. Now comfortable using WWB.</td>
<td>52</td>
<td>97</td>
<td>11</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>149</td>
<td></td>
<td></td>
<td>9</td>
<td>(88.2%)</td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

Table 19 presents students' attitudes about the clarity of the WORKBENCH printout. The majority agree the analyses are clear and easily understood and report no difficulties understanding the printouts. There are sizeable minorities, however, who are uncertain or who dissent from this opinion, but only 12% feel the analyses confuse them, and fewer say they are too difficult to be of use.
Table 19.—Questionnaire Responses: Attitudes About WWB Clarity

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>28. WWB analyses clear and easily understood.</td>
<td>14</td>
<td>81</td>
<td>33</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>95 (56.2%)</td>
<td>35</td>
<td>41</td>
<td>(24.3%)</td>
</tr>
<tr>
<td>30. Would rather have computer point out problems than the instructor.</td>
<td>10</td>
<td>47</td>
<td>33</td>
<td>52</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>57 (34.1%)</td>
<td>52</td>
<td>77</td>
<td>(46.1%)</td>
</tr>
<tr>
<td>31. Often have difficulty understanding WWB.</td>
<td>4</td>
<td>33</td>
<td>33</td>
<td>81</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>37 (22.2%)</td>
<td>81</td>
<td>97</td>
<td>(58.1%)</td>
</tr>
<tr>
<td>35. WWB analyses too difficult to use.</td>
<td>0</td>
<td>14</td>
<td>24</td>
<td>104</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>14 (8.3%)</td>
<td>104</td>
<td>130</td>
<td>(77.4%)</td>
</tr>
<tr>
<td>37. WWB confuses me more.</td>
<td>1</td>
<td>19</td>
<td>27</td>
<td>94</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>20 (11.8%)</td>
<td>94</td>
<td>122</td>
<td>(72.2%)</td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

Again, however, the students interviewed were not so positive. Only 3 of the 6 low apprehensive students felt the analyses were clear and helpful; 1 said they were not, and 2 students virtually ignored them. The 7 high apprehensive students were even more dissatisfied; only 2 felt the printouts were clear.

Table 20 presents students’ attitudes about the effects of WORKBENCH on anxiety. While the majority do not feel WORKBENCH increases anxiety, only 43% feel it decreases
Table 20.—Questionnaire Responses: Attitudes About WWB and Anxiety

<table>
<thead>
<tr>
<th>Question</th>
<th>'SA'</th>
<th>'A'</th>
<th>'U'</th>
<th>'D'</th>
<th>'SD'</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. WWB increases my anxiety about writing.</td>
<td>5</td>
<td>23</td>
<td>34</td>
<td>71</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(16.6%)</td>
<td>(20.1%)</td>
<td>(63.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. WWB decreases my anxiety about writing.</td>
<td>13</td>
<td>58</td>
<td>56</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(42.5%)</td>
<td>(33.5%)</td>
<td>(24.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. SPELL is a relief.</td>
<td>40</td>
<td>74</td>
<td>30</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(67.9%)</td>
<td>(17.9%)</td>
<td>(14.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. DICTION/SUGGEST are a relief.</td>
<td>6</td>
<td>71</td>
<td>53</td>
<td>31</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(45.8%)</td>
<td>(31.5%)</td>
<td>(22.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. WWB relieves fear my writing contains too many errors.</td>
<td>8</td>
<td>68</td>
<td>40</td>
<td>39</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>(45.2%)</td>
<td>(23.8%)</td>
<td>(30.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Feel frustrated when computer points out so many problems.</td>
<td>17</td>
<td>45</td>
<td>25</td>
<td>72</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(36.7%)</td>
<td>(14.8%)</td>
<td>(48.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

anxiety. Most students do not feel WORKBENCH relieves their fear that their writing contains too many errors, and 52% are either frustrated by the printouts or unsure. The SPELL feature provides relief to the greatest number of students (68%).

The personal interviews suggest that neither the computer nor WORKBENCH alter students' basic attitudes about writing. All 6 low apprehensive students said they had entered feeling positive about writing and continued to feel
good about it. All 7 high apprehensive students reported entering with a negative attitude about writing but were emphatic that the computer had not modified this predisposition. In fact, many felt it had reinforced and strengthened these negative attitudes. "Kay," for example, felt the computer added "one more step," rushing her and leaving less time to write (she reported spending 11 - 12 hours per essay). She felt the computer "ripped apart" her work and "hurts my feelings." Another student said her problems usually had to do with content, and since the computer cannot read for content, it offered no assistance. Another student said she liked to write but not for classes because she was always told she did not write well. She felt the computer just presented "everything I do wrong," but since it cannot read, it "can't be right."

Most of the low apprehensive students were not frustrated by WORKBENCH, but 1 student felt irritation and another thought the analyses were "mechanical" and resented being told his writing represented a low grade level. On the other hand, 3 of the apprehensive writers found the printouts frustrating (one felt her writing was "never good enough" for WORKBENCH), and the other 4 said they ignored them.

Table 21 presents students' attitudes regarding the role WRITER'S WORKBENCH plays in improving their writing.
Table 21.—Questionnaire Responses: Attitudes About WWB and Writing Improvement

<table>
<thead>
<tr>
<th>Question</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. WWB frees me to be more creative in the planning of my papers since I can address problems later.</td>
<td>23</td>
<td>85</td>
<td>22</td>
<td>29</td>
<td>10</td>
<td>(63.9%) (13.0%) (23.1%)</td>
</tr>
<tr>
<td>24. PROSE/STYLE helps me develop sentence variety.</td>
<td>3</td>
<td>43</td>
<td>57</td>
<td>58</td>
<td>5</td>
<td>(27.7%) (34.3%) (37.9%)</td>
</tr>
<tr>
<td>33. Usually happier with my essays after I have used WWB.</td>
<td>22</td>
<td>79</td>
<td>39</td>
<td>23</td>
<td>5</td>
<td>(60.1%) (23.2%) (16.7%)</td>
</tr>
<tr>
<td>38. WWB is not worth time and effort.</td>
<td>11</td>
<td>12</td>
<td>27</td>
<td>72</td>
<td>45</td>
<td>(13.8%) (16.2%) (70.0%)</td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

The majority agree that WORKBENCH helps them be more creative in the planning of their essays by deferring questions of grammar and mechanics until later. Similarly, most feel happier with their essays after using the WORKBENCH analyses, and only 14% report it is not worth the effort. But more specifically, the PROSE/STYLE analyses do not seem to help many develop sentence variety.

Here again, the interviews suggest apprehension may play a role in perceptions of WORKBENCH. Five of the 6 low apprehension students interviewed thought WORKBENCH had helped improve their writing. Only three of the seven high
apprehension students, however, felt it helped, and then only slightly. Of the various WORKBENCH programs, the interviewees most frequently cited SPELL and VAGUENESS as helpful. However, two low apprehensive students reported barely looking at the programs, and many high apprehensive students such as "Kay", who did not even know how to run SPELL, virtually ignored the printouts.

Students' Writing Processes: How They use WRITER'S WORKBENCH

Research question number six concerned what writing processes students follow and how they use WRITER'S WORKBENCH. Tables 22 - 24 present data pertinent to this question.

Table 22 presents information about students' writing processes and how the computer meshes into these. First, most students conduct some form of pre-writing activity before writing their essays. And presumably because of the design of the lab component, most students use the computer to transcribe previously written texts. Only 24% compose their essays at the computer. However, once their essays are entered into the computer, only 25% report making changes before running WORKBENCH; 66% appear to review the analyses before making revisions.
Table 22.—Questionnaire Responses: Students' Writing Processes

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Do pre-writing before writing essay.</td>
<td>42</td>
<td>91</td>
<td>12</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>133</td>
<td>(78.7%)</td>
<td>24</td>
<td>(14.3%)</td>
<td></td>
</tr>
<tr>
<td>14. Usually write one or more drafts before entering into computer.</td>
<td>39</td>
<td>73</td>
<td>12</td>
<td>33</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>112</td>
<td>(66.3%)</td>
<td>45</td>
<td>(26.6%)</td>
<td></td>
</tr>
<tr>
<td>15. Usually revise essay drafts before entering into the computer.</td>
<td>23</td>
<td>54</td>
<td>16</td>
<td>60</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>(46.1%)</td>
<td>74</td>
<td>(44.3%)</td>
<td></td>
</tr>
<tr>
<td>16. Usually compose papers at computer.</td>
<td>15</td>
<td>25</td>
<td>14</td>
<td>59</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>(23.7%)</td>
<td>115</td>
<td>(68.0%)</td>
<td></td>
</tr>
<tr>
<td>17. Run a &quot;d print&quot; to revise computer print-out of essay before running WWB.</td>
<td>14</td>
<td>29</td>
<td>14</td>
<td>67</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>(25.4%)</td>
<td>112</td>
<td>(66.2%)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

The interviews generated considerable detailed information about the 13 students' writing processes; only highlights relevant to research question 6 are presented here. First, the students seldom, if ever, composed their essays at the computer. The average time spent per essay ranged between 2 - 3 hours and 10 - 15 hours, but more high apprehensive students reported spending longer time spans writing than did low apprehensives. Significantly, the low apprehensive students clearly delineated pre-writing and organizing stages, but the high apprehensive students tended
to just think about the subject, then write drafts from beginning to end. They then spent considerable time repeatedly revising and rewriting these drafts. These are the students who reported spending as much as 10 - 15 hours per essay. Thus, the high apprehensive students reported spending a higher proportion of their time reviewing, revising and editing -- between 25 and 45% of all composing time.

"Kay" provides an extreme example. She reported spending fifteen minutes thinking about her topic, then writing a complete draft. This she took to the lab and entered into the computer, revising extensively while typing. She then ran WRITER'S WORKBENCH and took these results home. Pressed by deadlines, she revised with careful attention to the percentages of long and short, simple and compound sentences. She then rewrote the entire essay by hand, often repeatedly, until it "sounds good." Next, because of fear of the computer, she spent much time typing her final draft on a typewriter which took as much as nine hours.

Twelve of the 13 students usually ran WORKBENCH analyses, although many indicated they did so only because they were required. These students reported spending as little as 30 minutes and as long as 8 hours in the computer
lab, but most spent between 1 - 2 hours including the time used to enter their essays.

Table 23 presents data regarding how students use WORKBENCH as an aid for revision. Most students are not confident of their ability to find and correct errors without WORKBENCH assistance, but only a minority say WORKBENCH is responsible for most of their revisions. Also, nearly 44% are either uncertain or seldom rely on WORKBENCH to identify problems in their writing.

Table 23.—Questionnaire Responses: WWB as A Revision Aid

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.</td>
<td>Can usually correct my own writing without WWB.</td>
<td>12</td>
<td>50</td>
<td>38</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>62</td>
<td></td>
<td>55</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(36.7%)</td>
<td></td>
<td>(22.5%)</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Have difficulty finding my own errors.</td>
<td>16</td>
<td>58</td>
<td>24</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>74</td>
<td></td>
<td>71</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(43.8%)</td>
<td>(14.2%)</td>
<td></td>
<td>(42.0%)</td>
</tr>
<tr>
<td>23.</td>
<td>Most of my revisions are suggested by WWB.</td>
<td>8</td>
<td>59</td>
<td>28</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67</td>
<td></td>
<td>73</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(39.9%)</td>
<td>(16.7%)</td>
<td></td>
<td>(43.4%)</td>
</tr>
<tr>
<td>27.</td>
<td>Seldom rely on WWB to identify problems.</td>
<td>8</td>
<td>40</td>
<td>26</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48</td>
<td></td>
<td>95</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(28.4%)</td>
<td>(15.4%)</td>
<td></td>
<td>(56.3%)</td>
</tr>
<tr>
<td>36.</td>
<td>Pay little attention to WWB.</td>
<td>14</td>
<td>27</td>
<td>15</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41</td>
<td></td>
<td>113</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(24.3%)</td>
<td>(8.9%)</td>
<td></td>
<td>(66.9%)</td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.
Table 24 provides further information about how students use WORKBENCH for revision. It appears far more

Table 24.—Questionnaire Responses: WWB and Global or Surface Level Revisions.

<table>
<thead>
<tr>
<th>Question</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>26. Often rewrite paragraphs based on</strong></td>
<td>0</td>
<td>28</td>
<td>46</td>
<td>81</td>
<td>14</td>
</tr>
<tr>
<td><strong>ORGANIZATION.</strong></td>
<td>28</td>
<td>(16.6%)</td>
<td>(27.2%)</td>
<td>(56.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>29. Often revise introductions and conclu-</strong></td>
<td>0</td>
<td>36</td>
<td>48</td>
<td>76</td>
<td>7</td>
</tr>
<tr>
<td><strong>sions based on DEVELOPMENT.</strong></td>
<td>36</td>
<td>(21.6%)</td>
<td>(28.7%)</td>
<td>(49.7%)</td>
<td></td>
</tr>
<tr>
<td><strong>32. VAGUENESS makes my essays more specific.</strong></td>
<td>28</td>
<td>63</td>
<td>38</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>91</td>
<td>(54.8%)</td>
<td>(22.9%)</td>
<td>(22.3%)</td>
<td></td>
</tr>
<tr>
<td><strong>34. PASSIVE helps identify ineffective passive voice.</strong></td>
<td>14</td>
<td>65</td>
<td>42</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>79</td>
<td>(46.7%)</td>
<td>(24.9%)</td>
<td>(28.5%)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: See note to Table 17.

students look to WORKBENCH for help with surface level revisions provided by programs such as VAGUENESS than for issues of essay or paragraph development.

The students interviewed reveal how differently students use WORKBENCH. Among the low apprehensive students, for example, one student spent only 10 - 15 minutes with WORKBENCH; she felt her writing did not benefit from the analyses but that they were probably helpful to poorer students. Another student, however, ran three drafts and
spent three hours "analytically" revising each WORKBENCH analysis of his essay. Among the high apprehensive students, two ignored the printouts altogether, and "Kay" was not sure what to do with them. One student, however, spent 4 - 8 hours in the lab because he was not sure "why the computer says what it says." His solution was to type in several versions of different sentences "to see what works." The 3 other students, by contrast, merely glanced over the printouts before turning them in with their essays.

Additional Student Comments

During the interview, students were asked if their teachers helped them to understand and use WORKBENCH. Nine of thirteen answered yes, the others said no. For "Kay", who answered no, this presented a problem from which she never recovered.*

In two final items on the questionnaire, students were asked what they liked least and most about WRITER'S

*NOTE: The English Department at CSU uses neither formal nor informal guidelines governing teachers' use of WORKBENCH for Composition 150. While the computer is a required component for most sections, teachers are free to use it as they please. Thus one teacher may expect students to have made all revisions suggested by the analyses and grades this in his evaluation, while others may view the programs as a service available to students and not a part of their grading procedures.
WORKBENCH. The critical remarks will be discussed first. Students did not choose to limit themselves to commenting specifically on the WRITER'S WORKBENCH programs. Rather, they seem to perceive WORKBENCH as only a part of their total computer lab experience. Thus, the largest category of critical remarks were concerned with a variety of complaints about problems associated with scheduling time in the computer lab (87), or problems such as hardware inadequacies and personnel associated with the lab itself (30).

Some students criticisms were general. For example, a number felt the WORKBENCH printouts were long, confusing or difficult to read and interpret (24), that they offered little help (8), or bad suggestions (3), or that they were frustrating (1), eroded confidence (3), or should show how to correct errors (2). These types of general criticisms constituted a total of 41 remarks.

Another general category of criticism had to do with the inability of the computer to understand the context of what is written (7). Some others felt this was cause to be "wary" of the advice given (2), that WRITER'S WORKBENCH implies there is a "correct" style (2), that it makes writing "plastic" and "mechanical" (2), or that it erodes creativity (1). Two found it irrelevant, and 2 thought it should "be more like an instructor." These types of criticisms totaled 18.
There were 40 negative comments about 11 specific WORKBENCH programs. Eight disliked either the average sentence length or grade level reports, 7 disliked VAGUENESS, 5 were unhappy with ORGANIZATION, and 4 were critical of NOMINALIZATION. Also, 10 felt SPELL was inferior to other spell checkers, and five found the word processing capacity inadequate.

Like the critical remarks, large numbers of the positive comments were general and not specifically about WRITER'S WORKBENCH. For example, the feature receiving the highest total remarks of praise was word processing. Sixty-four students felt this was the greatest assistance because it saved retyping, and they made comments such as "I'll never go back to a typewriter." The feature receiving the second largest number of positive remarks (57) was SPELL. These two features accounted for 121 positive comments.

Another large category of positive remarks had to do with WORKBENCH's ability to provide revision assistance, however. Many (30) appreciated its ability to serve "like a revision coach" as one student put it, so "you are not alone" as another said during this stage. Others (13) thought it improved their writing; others appreciated the help revising before the instructor saw their papers (5); and others praised WORKBENCH for accuracy (1), consistency and lack of bias (4), and clarity (1). Thus, 54 students
commented positively on the general revision assistance they received from WRITER'S WORKBENCH.

Finally, there were 83 positive comments about specific programs that students felt were most helpful. These were: VAGUENESS (26), FINDBE (12), STYLE (10), PASSIVE VOICE (9), DICTION (7), and a variety of others in lesser numbers.

Two Additional Research Questions

Out of curiosity, two additional research questions were explored. The first questioned if there were any significant relationships between students' attitudes about computers and their attitudes about WRITER'S WORKBENCH. Ten items were selected from the questionnaire which measured relative degrees of comfort or anxiety about computers or the computer-driven aspects of WRITER'S WORKBENCH. These were items 1 - 8, 10, and 12 and were labeled A items. Similarly, ten items which measured degrees of relief derived from or overall satisfaction with the use of WRITER'S WORKBENCH were selected. These were items 18, 19, 22, 25, 28, 31, 33, 35, 37, and 38 and are labeled C items. The values of negatively stated items were reversed (e.g. 5 became 1, and 4 became 2). Thus, scores and means could be computed for both "A" items and "C" items; "A" scores reflected attitudes about computers, and "C" scores reflected attitudes about WRITER'S WORKBENCH.
Since each item was scored from 1 to 5 or from strongly agree to strongly disagree, the higher the score on both "A" and "C" the higher the relative disagreement or discomfort. The mean scores for "A" items was 2.4027 and for "C" items, 2.5403.

These scores were then correlated for 169 individuals using the Pearson product moment formula. This produced a positive correlation \( r = .5261 \) significant at the .001 level. This suggests there is a correlation, then, between attitudes about computers and overall attitudes about using WRITER'S WORKBENCH.

The second added question asks if a significant relationship exists between levels of writing apprehension and students' attitudes about using WRITER'S WORKBENCH. This question could be approached by comparing "C" scores -- attitudes about WORKBENCH -- and the results of the second administration of the Writing Apprehension Test (WAT 2). These scores were then correlated for 160 participants using the Pearson product moment formula. This produced a weak negative correlation \( r = -.3445 \) significant at the .001 level.

We must recall that WAT scores range between 26 and 130; the lower the score the higher the level of apprehension. Again "C" scores range from 1 -- strongly agree, to 5 -- strongly disagree. Thus, the lower the "C" score the
higher the satisfaction with WORKBENCH. Therefore, this negative correlation suggests, though not strongly, that students with higher apprehension may be less comfortable or satisfied with using WRITER'S WORKBENCH.

Summary of Data Findings

The following data findings are summarized according to the research questions asked.

1. While there was a significant difference in improved writing performance among both groups as a result of the treatments, there was no significant difference in writing performance gains between the group using WRITER'S WORKBENCH and the control group who did not (p = .942).

2. There was a significant, though small, decrease in writing apprehension among both groups as a result of the treatments.

3. There was no significant difference in the degree of decrease in writing apprehension between the group using WORKBENCH and the control group (p = .201).

4. The data did not indicate a clear relationship between writing performance and writing apprehension.

5. A majority of students (53%) enjoyed using the computer for composition; a substantial minority either did not or was uncertain.
6. More students (89%) prefer writing on the computer because they feel word processing makes revising easier than for any other reason.

7. The majority of students (56%) reported no initial uneasiness using WORKBENCH, and 88% said they became comfortable using the programs.

8. The majority (56%) considered the WORKBENCH programs clear; a sizeable minority did not or was uncertain.

9. A minority felt WORKBENCH lessened anxiety; SPELL was cited by the most students as the greatest relief.

10. WORKBENCH relieved fear about errors for 45%; the majority of students (60%) were happier with their essays after using WORKBENCH analyses.

11. A majority (60%) would prefer composition with a computer; 40% would not or are uncertain.

12. Of the students interviewed, highly apprehensive students were less satisfied and more frustrated by WORKBENCH than less apprehensive students.

13. The majority of students (79%) reported using prewriting in their writing processes; 64% reported WORKBENCH helps delay issues of correctness at this stage.

14. The majority (66%) write drafts before entering their essays into the computer.
15. A minority (37%) was confident of detecting errors in their own writing; also a minority (40%) said WORKBENCH accounts for most of their revisions.

16. Substantial numbers of students appreciate WORKBENCH revision assistance; far more students cited programs such as SPELL, VAGUENESS, FINDBE, and PASSIVE as helpful than they did ORGANIZATION or DEVELOPMENT.

17. A substantial minority (28%) reported seldom relying on WORKBENCH to point out errors and 15% more were uncertain.

18. Of the students interviewed, highly apprehensive students employed different writing processes and used WORKBENCH less often and less skillfully.

19. There was a correlation ($r = .5261$) between attitudes about computers and attitudes about WORKBENCH significant at the .001 level.

20. There was a weak negative correlation ($r = -.3445$) significant at the .001 level between writing apprehension and attitudes about WORKBENCH.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The purposes of this study are to determine the effects of the computer-assisted text analysis program, WRITER'S WORKBENCH, on comparative gains in writing performance, on comparative outcomes in writing apprehension, and to explore relationships between these measures. In addition, the study sought to determine and describe students' attitudes about using WRITER'S WORKBENCH, its usefulness as a writing aid, students' writing processes, and how they use WORKBENCH. The data analyses are divided into holistic score results, writing apprehension test results, the results of the questionnaire and personal interviews, and combinations of these measures.

Summary of Data Findings

Following are the data findings which are summarized in the order of the research questions investigated.

1. While there was a significant difference in improved writing performance among both groups as a result of the treatments, there was no significant difference in writing performance gains between the group using WRITER'S WORKBENCH and the control group who did not (p = .942).
2. There was a significant, though small, decrease in writing apprehension among both groups as a result of the treatments.

3. There was no significant difference in the degree of decrease in writing apprehension between the group using WORKBENCH and the control group (p = .201).

4. The data did not indicate a clear relationship between writing performance and writing apprehension.

5. A majority of students (53%) enjoyed using the computer for composition; a substantial minority either did not or was uncertain.

6. More students (89%) prefer writing on the computer because they feel word processing makes revising easier than for any other reason.

7. The majority of students (56%) reported no initial uneasiness using WORKBENCH, and 88% said they became comfortable using the programs.

8. The majority (56%) considered the WORKBENCH programs clear; a sizeable minority did not or was uncertain.

9. A minority felt WORKBENCH lessened anxiety; SPELL was cited by the most students as the greatest relief.

10. WORKBENCH relieved fear about errors for 45%; the majority of students (60%) were happier with their essays after using WORKBENCH analyses.
11. A majority (60%) would prefer composition with a computer; 40% would not or are uncertain.

12. Of the students interviewed, highly apprehensive students were less satisfied and more frustrated by WORKBENCH than less apprehensive students.

13. The majority of students (79%) reported using prewriting in their writing processes; 64% reported WORKBENCH helps delay issues of correctness at this stage.

14. The majority (66%) write drafts before entering their essays into the computer.

15. A minority (37%) was confident of detecting errors in their own writing; also a minority (40%) said WORKBENCH accounts for most of their revisions.

16. Substantial numbers of students appreciate WORKBENCH revision assistance; far more students cited programs such as SPELL, VAGUENESS, FINDBE, and PASSIVE as helpful than they did ORGANIZATION or DEVELOPMENT.

17. A substantial minority (28%) reported seldom relying on WORKBENCH to point out errors and 15% more were uncertain.

18. Of the students interviewed, highly apprehensive students employed different writing processes and used WORKBENCH less often and less skillfully.
19. There was a correlation ($r = .5261$) between attitudes about computers and attitudes about WORKBENCH significant at the .001 level.

20. There was a weak negative correlation ($r = -.3445$) significant at the .001 level between writing apprehension and attitudes about WORKBENCH.

Conclusions

The following conclusions, which are based upon the findings of the study, appear to be warranted.

1. Composition courses such as the one at CSU can bring about significant improvement in students' writing as measured by holistic scoring over the course of one semester. However, the use of WRITER'S WORKBENCH as a required supplemental laboratory does not appear to provide significantly greater gains in writing improvement as measured by holistic scoring than does the composition course alone.

2. Composition courses such as the one at CSU can bring about significant, though small, decreases in students' apprehension of writing as measured by the Daly-Miller Writing Apprehension Test over the course of one semester.

3. The use of WRITER'S WORKBENCH, however, as a required supplemental laboratory component does not appear to result in significantly greater reductions in writing
apprehension as measured by the same instrument than the composition course alone.

4. There does not appear to be a clear relationship between writing performance and writing apprehension; that is, good, average, and poor student writers may be apprehensive of writing.

5. Rather narrow majorities of students reported they enjoyed using the computer for composition, that the WORKBENCH programs are clear and understandable, that their essays benefit from WORKBENCH, and that they prefer composition with a computer. However, the fact that in each case substantial minorities either did not agree or were uncertain suggests that attention be directed to these students' attitudes and needs also.

6. The fact that by far the reason most students prefer writing on the computer is the advantages provided by word processing and secondarily the services of a spell checker merits attention. This is especially important considering that the majority of students do not compose their essays at the computer (perhaps because of laboratory time constraints), but use it primarily to transcribe and edit their texts. This, for example, may be why only a minority report WORKBENCH accounts for most of their revisions even though they admit they are not confident of detecting errors in their writing.
7. While many students appreciate the assistance WORKBENCH provides with revision, most seem to value a few of its programs far more than other programs and these tend to be programs detecting surface level difficulties. Also, a fairly substantial number of students seldom rely on WORKBENCH to indicate needed revisions.

8. The fact that WORKBENCH does not create initial uneasiness and that most students report becoming comfortable with its use is gratifying. However, only a minority feel the programs lessen their anxiety or relieve fear that their writing contains too many errors. And a substantial minority seems not to rely on WORKBENCH for revision. Also, the results of the interviews often contradict the results of the questionnaire. For example, of the students interviewed, some seemed to over react in their effort to satisfy the computer, some ignored the printouts altogether (an effective way to eliminate uneasiness), and apprehensive students especially seemed frustrated by and ill at ease with the computer and WORKBENCH.

9. That a large majority utilizes prewriting and feels WORKBENCH helps them defer concerns of correctness to later stages in the writing process is significant and encouraging. Much of composition research suggests undue concern with error at the planning stage can inhibit content and fluidity.
10. That students' attitudes about computers more often than not affects their attitudes about WORKBENCH and that more apprehensive students may be less comfortable with and less satisfied by WORKBENCH suggests these programs may not be effective for all students.

Implications

The following general implications are derived from the findings and conclusions of this study.

1. The fact that WRITER'S WORKBENCH did not appear to lead to improvement in student writing has several implications. First, the programs may not, indeed, improve students' writing. Second, however, there is the suggestion in the literature in Chapter II that the WORKBENCH recommendations may not correlate with the evaluative criteria of human readers, and therefore, either the recommendations may be misleading or holistic scoring may not detect improvements that have come about. Relatedly, the literature also emphasizes that revision and editing skills are judgemental; holistic scoring may not be the proper instrumentation to measure these cognitions. Also, timed in-class writings are primarily first draft products, and therefore, they may not display improved revision capabilities derived by use of WORKBENCH. In addition, there are also pedagogical implications of how WORKBENCH is introduced to and used by both teachers and students. For example, the fact that WORKBENCH
was designed to be an editing tool and not a teaching tool has implications for its use in instruction. And finally, it is possible that the critical reading and judgemental abilities involved in revision and editing may take longer than one semester to develop.

2. The fact that the composition course resulted in a small decrease in apprehension but that the use of WORKBENCH did not enhance this decrease also has several possible implications. The first is that writing apprehension may be a somewhat tenacious predisposition toward writing derived from past experiences. The second is that if this attitude is to be altered, the change agent appears to be the influence of a sensitive human instructor rather than the computer. Regarding these machines, the question may not be whether computers or programs like WORKBENCH reduce writing apprehension, but rather what effects do they have on already apprehensive writers?

3. Since apprehensive writers represent the full spectrum of writing abilities, perhaps writing and computer apprehension as well as performance should be considered in course placement and instructional strategy decisions.

4. The fact that very substantial minorities are either uncertain of the value or do not attest to valuing the computer or various features of WORKBENCH and many ignore it altogether warrants attention and concern.
Perhaps the computer and/or programs like WORKBENCH should be an option rather than a requirement for students; this would relieve crowding in laboratories and allow students who are disposed to profit from their use greater access to the computer and programs. Also, large numbers of students indicated scheduling difficulties in the centralized computer lab. Perhaps decentralized lab configurations would provide for greater access and more thoughtful and constructive program use.

5. While there are fewer students who seem to value the instructional or editing assistance provided by WORKBENCH than there are students who value the advantages of word processing, the emphasis placed on using the complete WORKBENCH does not allow students exposure to the potential values of composing and developing essays on the computer. Perhaps a broader perspective to the uses of the computer in composing as reflected in Chapter II would prove beneficial.

6. Since students seem to value some programs within WORKBENCH far more than others, perhaps the number of programs should be pared down or the user allowed to select among programs; perhaps different programs could be highlighted for different essays. Selected concentration on a few programs might result in more significant improvements. Also, as the literature in Chapter II suggests, the immediate utility of text analysis and WORKBENCH to students
would be enhanced if the kinds of gross errors students most often commit could be detected and if the programs developed the critical reading skills involved in error detection.

7. Students may react to the computer and WORKBENCH in radically different ways. If they are to insure their students are comfortable with and productively using the computer and the text analysis programs, teachers must provide adequate instruction in how to use all the features of the computer and be aware that students learn these at varying rates depending on their previous experience with and attitudes about computers and writing. Furthermore, it would seem advisable that teachers or lab personnel periodically monitor how students are using the various programs and to what effect. It appears that teachers should also be aware of which students are highly apprehensive of writing and computers.

8. Relatedly, it would seem that departmental leadership in developing guidelines governing how instructors may most profitably integrate the use of WORKBENCH into their course structures would be beneficial in producing consistency. This could also create a forum for eliminating difficulties and creating new strategies.

9. The correlations between students' attitudes about computers and writing and their attitudes about WORKBENCH may mean that the former should be ascertained before
computer treatments are prescribed. Perhaps the process of introducing these students to the computer and WORKBENCH should be tailored to help these students better adjust.

Recommendations for Future Research

Based on the findings of this study and their implications, the following recommendations for future research are suggested.

1. Further research should be conducted regarding the correlation between the specific recommendations provided by WORKBENCH and the evaluative criteria employed by human readers to determine the usefulness and quality of the advice these text analysis programs offer. Perhaps, for example, gross errors such as fragments and run-on sentences play a larger role in holistic scores than the more subtle problems addressed by WORKBENCH?

2. Future study should also be directed toward evaluating the usefulness of text analysis to individual students. Students should be observed using the computer and various WORKBENCH programs. Areas to be examined could include what decisions are motivated by WORKBENCH recommendations? How do students cope with the program's inherent margin of error? On what criteria are decisions and judgments made? Do these decisions lead to specific improvements in the students' writing, and if so, how often, and why; if not, why not? Does WORKBENCH foster attention
to surface level error correction at the expense of concern for content or organization? Does it draw students' attention away from the gross errors they commit? Does it enhance audience awareness; if so, how? Do these programs foster machine dependency? Do improvements appear in first draft written products or only at subsequent stages? What time period does it take for editing skills to develop? A variety of methodologies such as case and ethnographic studies, keystroke analysis, verbal protocols, or others focusing on the processes writers employ and their products seem more capable of measuring these types of effects and accounting for individual differences than large empirical studies. Longitudinal studies may also prove beneficial.

3. Comparative studies should also be conducted to determine the effects of text analysis programs and WORKBENCH on the attitudes of both apprehensive and non-apprehensive writers toward writing and the use of computers for writing. Perhaps these programs intensify fear and frustration? Perhaps computer anxiety combined with apprehension of writing present an even more powerful impediment to learning? Perhaps attention from an empathetic instructor is more successful in creating attitudes more conducive to writing development? Here, too, case studies may focus attention on individual writing processes and problems.
4. Studies should be conducted to examine the effects on students' attitudes of requiring the use of the computer and text analysis as compared to those of students who voluntarily opt to use them.

5. Further study should be conducted to determine the relative effects of other potential uses of computers for writing such as word processing and invention programs as compared to text analysis on quality of student writing.

6. Studies should be undertaken to determine the relative merit of various WORKBENCH programs to the improvement of student writing. Studies could also focus on determining which programs are most closely associated with the errors students most often make and which most detract from writing quality. Would concentration on a few programs at a time be more effective than using all programs for every essay? Another approach would be to measure the degree to which these programs develop the critical reading skills involved in editing and revision and whether these transfer to instances when the computer is not used.

7. The area of how instructors use text analysis, WORKBENCH, and computers needs to be examined. What are the most effective uses? Which are most detrimental? Do teachers modify computer use for different students to accommodate attitudinal and experimental differences? Should they?
APPENDIX A

WRITER'S WORKBENCH PROGRAMS IN USE AT
COLORADO STATE UNIVERSITY
APPENDIX A

WRITER'S WORKBENCH PROGRAMS IN USE AT COLORADO STATE UNIVERSITY

UNIX WRITER'S WORKBENCH software is available from AT&T technologies. The WORKBENCH programs in use at Colorado State University are as follows:

ORGANIZATION prints the first and last sentence of each paragraph to give the writer an abstract or outline of an essay. Students can use the output as a check for focus, unity, and coherence.

DEVELOPMENT counts words in each paragraph and compares those figures with averages drawn from sample papers for the course; if the figures are significantly lower than the averages, the program reminds students that paragraphs can be any length but suggests writers check for adequate detail.

FINDBE capitalizes and underlines all forms of "to be" appearing in students' texts. Students check for weak expletive and passive constructions and revise for active verb choice as necessary.

DICTION highlights (i.e., capitalizes and encloses in brackets) any of about 500 wordy, overused, misused, sexist, and inflated words and phrases.

SUGGEST follows the text with possible substitutions for words and phrases highlighted by DICTION. SUGGEST cautions students to choose wisely because the program cannot evaluate the context for substitution.

VAGUENESS INDEX flags any of 140 vague or general words. If the text has more than 5 percent of these words, the printout lists them and recommends revisions; if the text has less than 5 percent, students see only the percentage.

SPELL lists typographical and spelling errors.

CHECK lists commonly confused homophones and word pairs when the writer has used one of the words in the text. The program includes a brief distinction between the two words or a reference to the glossary (a handout all students receive the first day of class) for longer explanations.
PUNCTUATION checks for missing parentheses and for patterns of punctuation -- periods followed by capital letters, commas and periods inside quotation marks, semicolons and colons outside quotation marks, periods inside parentheses for complete sentences, and so on. It lists both the sentence as punctuated in the student's paper and a suggested change.

GRAMMAR identifies most split infinitives and misuses of "a" and "an".

PROSE compares values for ten stylistic criteria in a student's paper with standards derived from the best papers written for that course. When the student's value falls outside a range of plus or minus one standard deviation from the mean, the program suggests improvements.

PASSIVE prints out all passive sentences appearing in a student's text with a reminder to use only effective passive constructions and to change ineffective passives to active voice.

NOMINALIZATION prints out all sentences with nominalized words (nouns ending in -ance, -ence, -ion, or -ment) when the percentage of nominalizations exceeds 3 percent of the total number of words.

STYLE summarizes information about sentence length, type, and sentence opening and word class counts.

ABSTRACT compares words in a text to a dictionary of 314 abstract words (determined through psycholinguistic research). If students use more than 2.3 percent of these words in a text, the program prints a message reminding students to check for adequate concrete detail.

Excerpted from Kiefer & Smith 1984.
APPENDIX B

SUMMARY-RESPONSE POSTTEST ESSAY
First letter of last name  

ENGLISH COMPOSITION PLACEMENT EXAM  
Summer/Fall 1986  

Please print  
Name: ___________________________  
Last ______________  First __________  Middle Initial __________  

Social Security/CSU Student Number: _____ _____ - _____ - _____  

Non-Native Speakers Only:  
If your native language is not English, please complete the following:  
Native Language: __________  TOEFL score: ________  

EXAMINATION RESULTS:  Students taking this examination during Preview may check results at the English Office (359 Eddy) after August 1. Students taking this examination August 28 or 29 should check their results on September 2, either at the English Office (359 Eddy) or at the north lobby of Moby Gym. All students taking this exam will be assessed a $7.00 fee. Students who earn credit for CO150 will be registered automatically for CO150T. There will be no overload tuition charge for CO150T. Students placed on CO101 will be enrolled fall or spring semester.  

DO NOT WRITE BELOW THIS LINE  

SCORER 1: number ______ score ______  
SCORER 2: number ______ score ______  
SCORER 3: number ______ score ______  

PLACEMENT: _____ CO101  _____ CO150  _____ CO150T  _____ ESL
INSTRUCTIONS: Read the following passage. In an organized and detailed essay, summarize its main ideas and then explain why you agree or disagree with what the article says. Support your agreement/dissagreement with specific examples from your experience or reading and/or with an analysis of the essay's argument.

HEALTH QUACKERY IN AMERICA

"Step right up, folks, and get your bottle of Black Jack's Potion! It'll cure the arthritis, it'll fix your gout, it'll calm your fevers. You'll feel better, instantly! Money back guarantee! Look at Jack here. Jack was once lame, had water on the brain, cataracts in his left eye, was deaf, and had to walk with a cane. Now, after only three bottles of Black Jack's, he's regained his youthful vitality! It's a miracle!"

We have no trouble recognizing—and ridiculing—these stock characters from films about the Old West. The huckster and bunco artist selling his wares; the country yokels blowing good money on a worthless product. The snake oil of yesteryear is gone, but in today's slick magazines and on TV advertisements and talkshows, the pitch is still the same. Advertisers hype health fad schemes using "scientific" language and the latest "research" on health, fitness, and longevity to generate sales beyond the dreams of the itinerant salesmen of the West. P.T. Barnum was right: "There's a sucker born every minute."

"Buy the new MACRO AEROBIC Fitness Master XL-280! Insures total cardiovascular fitness! Superior to jogging, biking, aerobics, swimming or weight lifting!"

"Help with the fight against STRESS! StressB, a Mega B-Complex Formula fortified with calcium and vitamin C reduces STRESS that can ROB YOUR BODY of vitamins without your actually knowing it!"

"Summer's almost here, girls. Are YOU ready for the competition at the beach? Get the best-selling book of the summer, Thin Thighs in 30 Days!"

Gullible consumers believe they're getting healthy when they pay for a workout with Jane Fonda or Victoria Principal. They believe "studies" which show that daily doses of vitamin C, calcium, Herbalife, ginsing, rose-hips, and Oil of Evening Primrose will prevent heart disease, diabetes, anemia, colon cancer, and infertility. In fact, consumers are just as simple-minded and naive as Westerners were a century ago. Selling the slim and trim image is a billion dollar industry today, and Americans are willing, eager suckers. We believe, therefore we buy. Vanity overwhelms our reason and empties our wallets.

Why have we become a nation of vitamin junkies, marathon joggers and diet fanatics? Simple. Human nature does not change. Our vanity lures us to the scams, and when we do not experience immediate and miraculous results, pride drives us to fanatic excesses. Inevitably, the result of our diets and exercises is not good health, but a destructive and obsessive fanaticism.
The pattern is predictable. The diet and exercise syndrome begins with the advertiser’s big lie: fat is sinful. Never mind that in other cultures, men and women are satisfied with their natural weight, unharrassed by slogans ridiculing their “Hazardous Waist.” Now the newest clothing styles, designed to sell high fashion, dictate that men and women be thin and fit. We are lured by diets to torture our natural body shape into a mannekin’s mold: the Scarsdale diet, the I Love NY Diet, the grapefruit diet, the protein diet, the carbohydrate diet, even the “yellow” diet. Similarly, we are told that jogging, aerobics, or weight-lifting can burn over 100 calories per hour. So we pay outrageous prices for fashionable machines with weights, pulleys, levers and springs to punish our bodies. The body has no choice: the mind decides on a diet of carrots for three months or on a jogging schedule of 50 miles a week, and the body pays the price.

When our diet and exercise regimen does not immediately transform us into Jane Fonda or Arnold Schwarzenegger, however, we push harder. Then the problems escalate. Torn muscles, knee surgery or heart attacks. Bulimia. Anorexia. Severe complications and even death from diet pills, liquid protein supplements or steroids. Each is a logical, inevitable result of a mind persuaded by ads and fashion to abhor its own body. The parallels between the Lenten fast (the mind punishing the body for its sins) and the diet and exercise schemes of this decade are not coincidental. Our latent puritan obsessions and innate gullibility lure us to spend millions on liquid diets and toxic doses of vitamins far more dangerous than Black Jack’s Potion.

At the heart of this syndrome is the worship of youth. Fashion models are girls who look to be no older than 14. Sports heroes are men and women who must “retire” at age 30. In the last decade, movie stars have all become young, lean and lithesome. Tom Cruise and Matthew Broderick have replaced the bulky maturity of John Wayne. Instead of the full-bodied, statuesque look of Marilyn Monroe, we have the child-like frames of Ally Sheedy and Meryl Streep. The philosophy behind the diet and exercise boom is simple and simple-minded: "If we look like children, we will never grow old."

We are just now beginning to acknowledge the terrible results of our naivete and gullibility. The more money we spend on these health schemes, the more we actually endanger our health. Jim Fixx, a celebrated author and promoter of “healthful” running, died while jogging. Singer Karen Carpenter died of complications from bulimia. The signs are all around us. In America today, a health fad sucker dies every minute.

—Dudley Erskine Devlin
First 3 letters of last name: __ __  Social Security #: __ __ __ __ __ __ __
APPENDIX C

DEMOGRAPHIC SURVEY AND
DALY-MILLER WRITING
APPREHENSION TEST
ENGLISH COMPOSITION SURVEY

We are trying to gather information that hopefully will help us to help students improve their writing. Please take a few moments to fill in the information on this page; then turn the page, read the instructions on the next page and answer those questions.

Your participation is voluntary. Your responses will be strictly confidential, your instructor will not know how you answer, and there will be no affect on your grade since all data will be pooled.

Thank you for your help!

Course Title: ___________________________ Section Number:_______

Your Social Security Number:______________

Please check: Male _____ Female _____

Age: 17 - 20 years ____
     21 - 25 years ____
     26 - 30 years ____
     31 - 35 years ____
     36+ years _____

Number of total university courses before this term: _______

What was your score on the SAT verbal? _______

Average grade in high school composition: A __, B __, C __, D __, F __

Handicapped: Yes ____, No _____

U. S. Citizen: Yes ____, No _____

Ethnic Origin/Descent (check one):
   ______ White, Non-Hispanic    ______ Black American    ______ Hispanic
   ______ Native American Indian ______ Asian American ______ Other
WRITING ATTITUDE SURVEY

Below is a series of statements about writing. There are no right or wrong answers to these statements. Please indicate the degree to which each statement applies to you by circling the number that shows whether you strongly agree, agree, are uncertain, disagree, or strongly disagree with the statement. While some of these statements may be repetitive, please respond to all of them; take your time and try to be as honest as possible. Thank you for your cooperation in this matter.

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APPENDIX D

FRESHMAN ENGLISH QUESTIONNAIRE
Please help us determine how well WRITER'S WORKBENCH meets your needs as a composition student by voluntarily completing this questionnaire. Of course, your responses will be kept confidential.

Below is a series of statements about writing and about using WRITER'S WORKBENCH. There are no right or wrong answers to these statements. Please indicate the degree to which each statement applies to you by circling the number that shows whether you strongly agree, agree, are uncertain, disagree or strongly disagree with the statement. Please respond to all statements and be as honest as possible.

NOTE: The last two statements ask you to write a short opinion about WRITER'S WORKBENCH.

Thank you for your cooperation.

Course Title: ___________________________  Section No. ____________

Your Social Security No. ___________________________

I expect my final grade in Co 150 will be: A__, B__, C__, D__, F__

1. At first, I was nervous about using the computerized WRITER'S WORKBENCH programs as an aid to improving my essays.

2. I had had experience with using a computer for writing before this course.

3. Using WRITER'S WORKBENCH as an aid to improving my essays increases my anxiety about writing.

4. I was immediately comfortable with using the computerized WRITER'S WORKBENCH programs as an aid to improving my essays.
5. My limited typing ability makes using the computer difficult.  
   | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1           | 2     | 3     | 4     | 5          |

6. Using the computerized WRITER'S WORKBENCH programs still makes me uneasy.  
   | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1           | 2     | 3     | 4     | 5          |

7. Using WRITER'S WORKBENCH as an aid to improving my essays decreases my anxiety about writing.  
   | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1           | 2     | 3     | 4     | 5          |

8. I am now comfortable using the computerized WRITER'S WORKBENCH programs.  
   | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1           | 2     | 3     | 4     | 5          |

9. I prefer to use the computer because word processing makes revising easier.  
   | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
   | 1           | 2     | 3     | 4     | 5          |

10. I would prefer a composition course that did not require me to use a computer.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

11. Knowing that WRITER'S WORKBENCH will help me catch certain weaknesses — e.g., spelling, diction, vagueness, etc. — frees me to be more creative in the planning of my papers since I can address these problems later.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

12. I enjoy using the computer as part of my composition course.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

13. I do some form of pre-writing — free-writing, listing, outlining or others — before I write my essays.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

14. I usually write out one or more drafts of my essays before I enter them into the computer.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

15. I usually review and revise these essay drafts before I enter them into the computer.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

16. I usually compose my papers at the computer.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

17. I run a "d print" to review and revise the computer printout of my essay before I run the WRITER'S WORKBENCH.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

18. I can usually find and correct errors in my own writing without assistance from WRITER'S WORKBENCH.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |

19. Knowing SPELL will flag most of my incorrect spellings is a relief to me.  
    | Strongly Agree | Agree | Uncertain | Disagree | Strongly Disagree |
    | 1           | 2     | 3     | 4     | 5          |
20. I have difficulty finding errors in my own writing.

21. Knowing DICTION and SUGGEST will flag my potential word choice and diction problems is a relief to me.

22. WRITER'S WORKBENCH relieves my fear that my writing contains too many errors.

23. Most of the revisions I make on my essays are suggested by WRITER'S WORKBENCH.

24. The PROSE/STYLE analyses have helped me develop more effective sentence variety.

25. I often feel frustrated when the computer points out so many problems in my writing.

26. I often rewrite some paragraphs based on information provided by ORGANIZATION.

27. I seldom rely on the WRITER'S WORKBENCH programs to identify potential problems in my essays.

28. The WRITER'S WORKBENCH analyses are clear and easily understood.

29. I often revise my introductions and conclusions based on information provided by DEVELOPMENT.

30. I would rather have the computer point out problems than the instructor.

31. I often have difficulties understanding the WRITER'S WORKBENCH analyses of my essays.

32. the VAGUENESS program has helped me make my essays more specific.

33. I am usually happier with my essays after I have used the WRITER'S WORKBENCH analyses to revise them.

34. The listing of possible passive sentences helps me identify my ineffective use of passive voice.
35. The WORKBENCH analyses are too difficult to read to be of much use.

36. I run the WORKBENCH programs but usually pay little attention to them.

37. Much of what WRITER'S WORKBENCH provides me just confuses me more.

38. Using WRITER'S WORKBENCH is not worth the time and effort I put into it.

39. What do you most like about WRITER'S WORKBENCH?

40. What do you least like about WRITER'S WORKBENCH?
APPENDIX E

PERSONAL INTERVIEW PROTOCOL
INTERVIEW PROTOCOL

Explain the purpose of the interview:

To provide more detailed and personal information about the effects of using WRITER'S WORKBENCH on students' attitudes about writing, on their writing processes, and on improvement in their writing.

Also insure confidentiality and anonymity. Put the respondent at ease and ask for complete honesty.

1. Had you ever used a computer prior to your CO 150 course?

   If so, how much and for what purpose: writing, word processing, typing, other?

2. Have you enjoyed using the computer as part of your CO 150 course?

   Why or why not?

3. Do you feel using a computer as part of Co. 150 has changed your attitude about writing?

   In what way?
4. How have you used the computer for Co. 150?

WRITER'S WORKBENCH?

Composing and word processing?

5. Generally, when given a writing assignment, what steps do you follow in completing it?

About how much time do you spend per essay?

6. Based on the above, what proportion of time do you spend on such processes as:

- Prewriting (generating ideas, planning, etc.) %
- Organizing %
- Writing Drafts %
- Reviewing/Revising %
- Editing %

7. At what point do you use the computer?

For how long?
8. Which of the following WRITER'S WORKBENCH programs do you use regularly?

_____ SPELL  _____ ORGANIZATION

_____ DICTION  _____ DEVELOPMENT

_____ SUGGEST  _____ VAGUENESS

_____ PROSE  _____ PASSIVE VOICE

_____ STYLE  _____ OTHERS

9. How would you rate the usefulness of each of the above programs to you in improving your essays?

10. Can you describe how you use the WRITER'S WORKBENCH analyses?

How many drafts do you run?

How much time do you spend?

11. Is the information these programs provide you clear and easy to utilize in revising your essays?

If not, why not?
12. Are you ever frustrated by the WRITER'S WORKBENCH analyses?

How often?

Which programs or features?

Why?

13. Does your teacher help you to understand and use WRITER'S WORKBENCH?

How?

14. Are there features about WRITER'S WORKBENCH you don't like?

Which ones? Why?

15. Has WRITER'S WORKBENCH helped you improve your essays?

How?
Could you show me an example of a paper before and after WRITER'S WORKBENCH and how you feel it was or was not improved?

16. Has using WRITER'S WORKBENCH made you feel any more or less confident in your writing?

17. Do you feel using WRITER'S WORKBENCH is a positive addition to your Co. 150 class?

Why or why not?

18. Is there anything else you would like to say about WRITER'S WORKBENCH or your writing?
APPENDIX F

HOLISTIC SCORING CRITERIA FOR ESSAYS
Q C0150 Placement Exam
Summer 1986 Grading Guide

9 - 8 The upper range responses satisfy the following criteria:

a. Summary -- The summary should identify Devlin's main idea that Americans, driven by vanity, are gullible consumers of health quackery which, when it fails, leads to fanatic self-destructiveness.

b. Focus of agreement and/or disagreement -- Agr/disagr may be complete or partial, but the writer must make clear what he/she is agreeing/disagreeing with. Specifically, upper range papers must deal with Devlin's main ideas -- not just with health, diets, or exercise.

c. Support for agreement and/or disagreement -- Support should provide an analysis of Devlin's argument and/or relevant and concrete examples from the writer's experience/general knowledge.

d. Style and coherence -- These papers demonstrate clear style, overall organization, and consecutiveness of thought. They contain few repeated errors in usage, grammar, or mechanics.

7 This grade should be used for papers which fulfill the basic requirements for the 9-8 grade but are thinner.

6 - 5 Middle range papers omit or are deficient in one of these four criteria:

a. Summary -- Summary absent or contains only sketchy reference to the article.

or

b. Focus of agreement/disagreement -- What the writer is agreeing/disagreeing with is not clear or is not related to Devlin's main ideas.

or

c. Support -- Writer only counter-asserts; writer's examples are highly generalized or not distinguishable from examples given in the article.

or

d. Style and coherence -- These papers are loosely organized or contain noticeable errors in usage, grammar, or mechanics.

4 This grade should be used for papers which fulfill the basic requirement for the 6-5 grade but are slightly weaker. Also, a student who writes his/her own parallel essay in a competent style should receive a 4.

3 - 2 Lower range papers are deficient in two or more of the criteria. Typically, these papers weakly paraphrase Devlin's essay OR they have serious organization/coherence problems. Papers with serious, repeated errors in usage, grammar, or mechanics must be placed in the lower range.

1 This grade should be given to a paper which has almost no redeeming qualities.

NOTE: An essay written in fluent, stylistic prose may be scored one point higher than the guide would normally permit.

Please give 1's, 9's, LD and ESL papers to the table leader.
APPENDIX G

FREQUENCIES OF PRE AND POSTTEST

DALY-MILLER WRITING

APPREHENSION TEST

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REFERENCE LIST

Books


Daly, John A. 1985a. Writing apprehension. In When a writer can't write, ed. Mike Rose, 43-82. New York: Guilford Press.


Articles


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