DOCUMENT RESUME

ED 404 668 CS 215 766

AUTHOR	Rowley, Kurt; And Others
TITLE	The Influence of Learner Control and Instructional Styles on Student Writing in a Supportive Environment.
PUB DATE	28 Mar 97
NOTE	24p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, March 24-28, 1997).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Research/Technical (143)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Computer Assisted Instruction; Computer Software; High Schools; Instructional Effectiveness; *Learner Controlled Instruction; *Teaching Styles; *Writing Achievement; Writing Research
IDENTIFIERS	*R WISE Software

ABSTRACT

A study elaborated on the results of previous research on the effectiveness of the R-WISE (Reading and Writing in a Supportive Environment) software by examining the effects of the student factor of learner-control and the environmental factor of the teacher's preferred instructional style on student writing performance. R-WISE includes 3 specific exercises that teach key pre-writing, drafting, and revision skills identified as deficient in novice writers. Subjects were 1,276 public high school students from the classes of 32 teachers. Two data collection instruments were used: a writing sample used for pre- and posttesting, and an instructional styles inventory. Results indicated a small but statistically significant effect of both the level of learner control and the teacher's preferred instructional style on learning outcomes. Results also showed a small interaction between student and environmental factors. Findings support learner control research and suggest an increase in the adaptability of R-WISE to accommodate variable levels of learner-control, and preferred instructional styles of the teachers. (Contains 13 references; 3 tables and 5 figures of data; and 3 computer screens from the R-WISE software.) (Author/RS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 404 668

The Influence of Learner Control and Instructional Styles on Student Writing in a Supportive Environment

Kurt Rowley, Ph.D.
Command Technologies, Inc.

Todd Miller
MEI Technologies Corp.

Armstrong Lab / Intelligent Training Branch
Brooks AFB, Texas

Patricia Carlson, Ph.D.
Rose-Hulman Institute
Terre Haute, Indiana

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
- Minor changes have been made to improve reproduction quality

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
K. Rowley

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Paper to be presented at AERA, Division C, in Chicago, March 28, 1997

CS215766

BEST COPY AVAILABLE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SCREENS

4

BEST COPY AVAILABLE

ACKNOWLEDGMENTS

This paper describes a large-scale experiment conducted from September 1994 through May 1995 to test adaptive instructional software that teaches fundamental writing skills to high school students. The software and the research were designed by Dr. Patricia Carlson, Rose Hulman Institute, of Terre Haute, Indiana, who worked as a senior research associate of Armstrong Laboratory during the experiment. The software was developed by a dedicated team of English teachers and software engineers from Command Technologies, Inc. in San Antonio, Texas. The results of the experiment were evaluated, and this report written, by Dr. Kurt Rowley, Command Technologies, Inc., and Todd Miller, MEI Technologies Corp., in San Antonio, Texas. The experiment was conducted as part of the Fundamental Skills Training (FST) project, AL/HRTI, Brooks AFB, TX, Dr. Kurt Steuck, Program Manager. Funding for this FST research were provided by the U.S. Air Force's Armstrong Laboratory, Phillips Laboratory, Rome Laboratory, and Wright Laboratory. Support also was provided by the University of Texas at San Antonio, under a cooperative research agreement.

ABSTRACT

The R-WISE (Reading and Writing in a Supportive Environment) software is an artifact of ongoing research by the U. S. Air Force's Armstrong Laboratory into the application of adaptive training technologies to teaching fundamental writing skills. The design of R-WISE is based on findings of cognitive scientists relative to the nature of expert writing skills. R-WISE includes three specific exercises that teach key pre-writing, drafting, and revision skills identified as deficient in novice writers.

Studies performed over the two previous school years (1992-1994) measured the instructional efficacy of R-WISE under varying control conditions. The current year study (1994-1995) was an inquiry into the effects of the student factor of learner-control, and the environmental factor of the teacher's preferred instructional style, on student writing performance. The study included 1,276 students from the classes of 32 teachers. Results indicated a small but statistically significant effect of both the level of learner control, and the teacher's preferred instructional style, on learning outcomes. Results also showed a small interaction between student and environmental factors.

The findings support learner control research and suggest an increase in the adaptability of R-WISE to accommodate variable levels of learner-control, and preferred instructional styles of the teachers.

6

1.0 R-WISE BACKGROUND

The R-WISE (Reading and Writing in a Supportive Environment) software, version 3.0, is an artifact of the Air Force's Fundamental Skills Training (FST) research program developed at the Human Resource directorate's Intelligent Training Branch at Armstrong Laboratory in San Antonio. R-WISE was developed as part of a multi-year research program seeking to transfer advanced, adaptive training technologies similar to automated instructional systems developed for Air Force technical training, to public education. The R-WISE automated instruction under the FST program is directed at supporting the improvement of the fundamental skills of reading and writing among public high school students (Carlson & Crevoisier, 1994). The effectiveness of R-WISE as an automated composition training tool has been measured in three school-year experiments conducted in 1992-1995, and continuing in the 1995-1996 school year (Carlson & Miller, 1996; Carlson et. al, 1996).

2.0 A SUPPORTIVE WRITING ENVIRONMENT

The design of R-WISE has drawn on the work of cognitive psychologists who utilized think-aloud protocol analysis to help identify a number of common executive strategies employed by emergent and expert writers (Bereiter & Scardemalia, 1987; Flower & Hayes, 1980; 1981; Hayes & Flower, 1983). The principle skills they identified as key components of the writing process include the pre-writing skills of *goal-setting*, *planning*, and *organizing ideas*, followed by drafting skills such as *generating text* from the organized ideas, and finally the editing skills of *revising* and *improving the text*. These expert writing process skills allow a writer to approach writing as a systematic, 'knowledge-transforming' process in which composition is the result of an iterative, analytical development of ideas and text around goals set by the writer (Bereiter & Scardemalia, 1987). The design of R-WISE is a result of applying the expert writing process, as defined in this cognitive research on writing strategies, to the construction of an automated environment that supports 9th grade writing instruction.

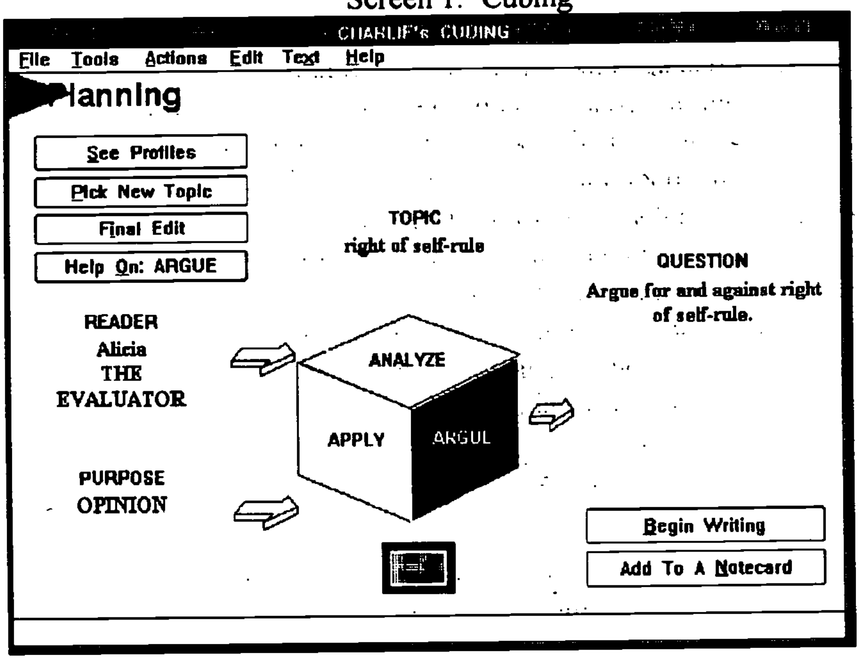
The R-WISE software was designed as a structured, computer-supported, writing environment in which students work through three exercises designed to reinforce critical thinking skills associated with the writing process. The three exercises are centered on the writing tasks identified in the cognitive analysis: finding ideas, translating those ideas into a first draft, and revising those ideas and text into an improved final form. Each tool operates in either guided or open mode, allowing students various levels of control and support as they progress through the exercises. The exercises provided by R-WISE are facilitated through software 'tools' named Cubing, Idea Board, and Revision.

2.1 Cubing

Cubing is an idea-generating and brainstorming tool. Its initial focus is on the pre-writing tasks of selecting a topic, target audience, and writing purpose. It next facilitates thinking about the selected topic through an exercise in thoughtful questioning related to the topic (see Screen 1). The exercise is based on six short writing tasks that are selected by the students from the visual prompt of a six-sided cube. After the exercise, Cubing allows the students to select ideas from their responses to the exercise questions, and compose a short writing product, by copying those ideas into a final editing workspace.

Several modes of tutorial-style help are available to the student during the Cubing exercise, including prescriptive advice, animated descriptions of the elements of the writing process, and lists of useful transitional phrases. The help information is tailored to the particular Cubing question the student is working on.

Screen 1. Cubing



The Cubing tool introduces students to the writing process in a structured exercise that, according to teacher feedback, promotes the development of critical thinking skills, helps students apply multiple analytical perspectives to a writing topic, and provides a written product that can be used in further activities in the classroom. Although Cubing focuses mostly on pre-writing activities, it also addresses basic elements of the drafting and revision/editing stages of the writing process.

2.2 Idea Board

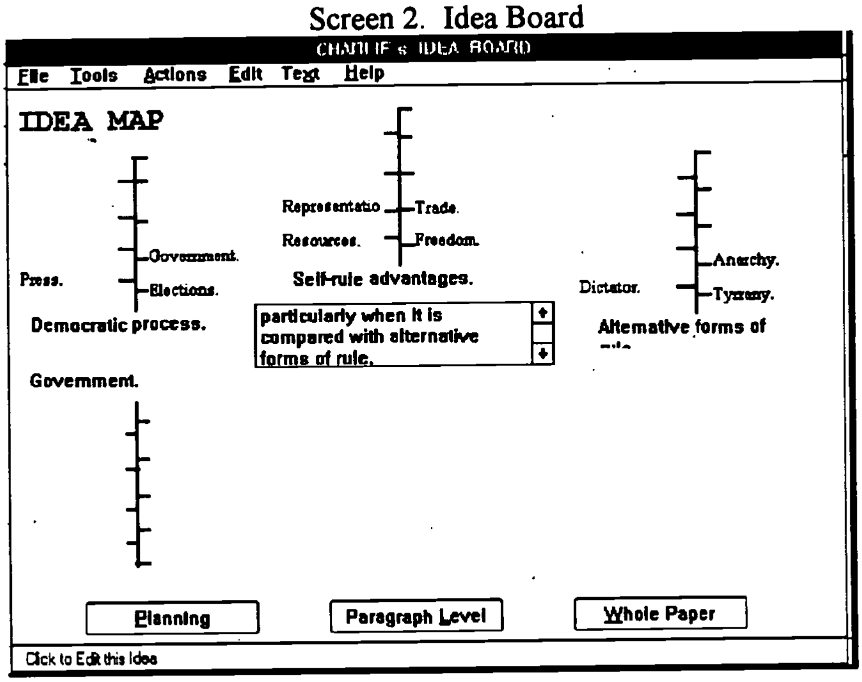
The Idea Board is a tool for planning, visually outlining, organizing, drafting, and re-sequencing, a short composition of up to ten paragraphs in length. The main purpose of Idea Board is to help the student writer focus on organizing and completing the drafting process for a composition.

BEST COPY AVAILABLE

Idea Board begins with the selection of planning options, including choosing a general goal, form, target audience, and identifying difficulties expected by the student during the writing assignment. The planning activities conclude with the writing of a thesis statement. Idea Board next focuses on the development and organization of a structure for composition, using a branching-tree type graphic organizer to help the students structurally map the concepts of their topic (see Screen 2). Finally, it presents organized workspaces that allow the students to write, then easily re-sequence, their sentences and paragraphs.

Tutorial-style help information is available in the paragraph-level workspaces during the drafting process, for assistance with the work of drafting and organizing sentences within paragraphs. This tutorial-style help is adaptive advice, adjusted relative to the stated goals of the student, and differentiated by the type of paragraph the student is drafting (main body, introductory, or concluding).

Screen 2. Idea Board



The primary function of the Idea Board is to introduce the students to a process for organizing and elaborating ideas for a first draft of a paper. Idea Board incorporates each of the stages of the writing process, including pre-writing (planning and graphical organizing), drafting (with help available to support the elaboration of student ideas), and revision of the written product (editing and reorganization). According to teacher feedback, the Idea Board is particularly effective at improving students' abilities to organize what they are writing.

2.3 Revision

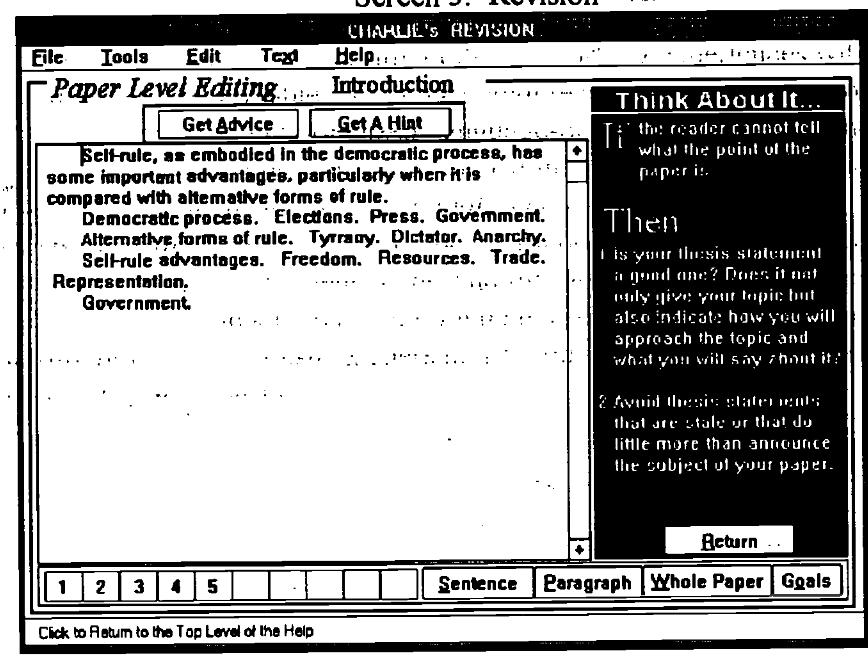
The Revision tool is an editing workspace that prompts the students to identify specific composition problems with a paper, and address those problems while revising their writing products. The revision tool allows the students to revise their own work, as

BEST COPY AVAILABLE

produced in the Idea Board. Revision also allows the students to revise other writings, as selected by the teacher.

The first step for the Revision tool is the identification of target reader characteristics, and writer characteristics. The Revision tool encourages the students to consider these characteristics during the revision process. All tutorial-style help available to the students in the revision workspace is tailored to the particular reader and writer characteristics selected. Addressing these reader and writer characteristics becomes a goal of the revision process.

Screen 3. Revision



The Revision workspace allows a student to review a paper and look for problems at the level of the overall paper (see Screen 3), or to step through the paper by paragraph, or even by sentence. At each of these levels, detailed questions related to revising the sentence, paragraph, or whole paper, help the student reflect on the text, and identify revisions to be made. When additional help is requested, thoughtful suggestions on how to improve the paper are given, based on the goals the student identified at the beginning of the revision process. All tutorial-style help is controlled by the student's use of a hypertext-style list that guides the revision process. Through the combination of the design of the workspace, and the available tutorial-style help, Revision helps the students through the overall processes of revising, providing tools that help the student consider many of the specific, detailed, rules of composition during the editing process.

2.4 Mode of Control

The three main tools of R-WISE, Cubing, Idea Board, and Revision, each operate in either guided or open mode. These two modes provide different levels of student control over the supportive writing environment. The two modes also provide two levels of student support. Guided mode (also called *lean*) restricts the operation of the software to a

BEST COPY AVAILABLE

sequence of linear operations, requiring the student to view several specific instructional help and information screens. The guided mode restricts the level of student control, and provides a set level of student support. Open mode (also called *rich*) provides additional instructional screens, and allows the student to manipulate the tools and access the instructional screens as needed, without restrictions. The open mode has fewer restrictions on student control, allowing the student to control the level of student support. Guided mode was designed to be used by novice R-WISE users, whereas open mode was designed for those who already had experience with the interface and were prepared to work independently.

3.0 PREVIOUS R-WISE RESEARCH

The prior years of the R-WISE study (1992-1994) focused primarily on the overall effectiveness of the R-WISE software on writing performance outcomes. The current year R-WISE study (1994-1995) was an inquiry into several design and implementation factors, including both environmental and student factors. The environmental factor studied was the teacher's preferred instructional style. The student factor studied was the effect of two levels of learner-control in the supportive writing environment. Three goals for the analysis of data were identified.

3.1 Findings of First Two Years of Studies

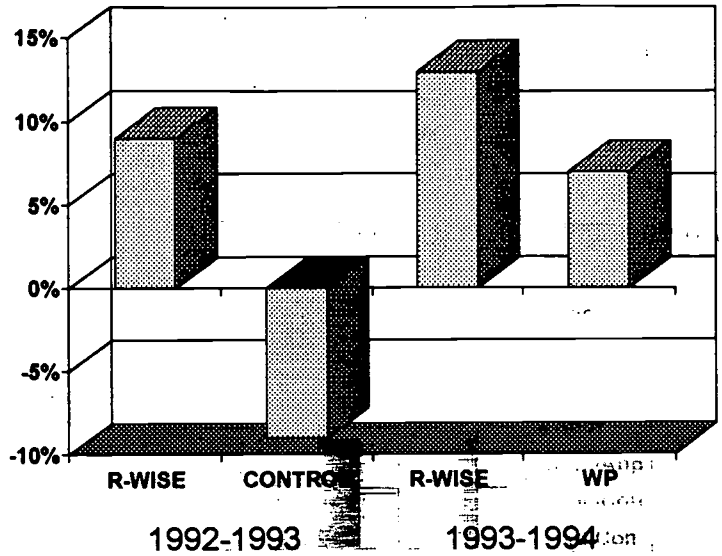
R-WISE research from 1992-1994 was designed to test the instructional efficacy of the R-WISE software in the setting of regular 9th grade English classes in computer labs. To accomplish this research goal, R-WISE underwent extensive field testing. The first version of the software was used in a formative test at two high schools (1992-93 school-year, N=852). Major revisions were made to the software and it was tested and evaluated the following school year in 8 high schools (1993-94: N=1,151).

The results of the research over these years have addressed research questions regarding the general efficacy of R-WISE. Findings for the first year of the study (1992-1993) were that students using R-WISE outperformed control-group students on overall measures of writing quality, including control groups of students using word processors and students writing essays by hand, with the largest net improvement in average score being 18% (Carlson & Miller, 1996). The students who used R-WISE also outperformed control-group students on analytical writing assessments in the first and second years of the study, indicating improved verbal reasoning skills among the R-WISE students.

In the second year of the study (1993-1994) a comparison of writing scores with student aptitudes was made, based on the Otis-Lennon School Ability Test (OLSAT) scores, with the result that higher aptitude students appeared to benefit the most from the use of R-WISE (Carlson & Miller, 1996). Figure 1 depicts the results of the R-WISE treatment group for the 1992-1994 studies, compared with the control group for the 1992-1993 study, and the word processor control group (WP) for the 1993-1994 study.

ERIC

Figure 1. Average Score Gain Per Year of Study



4.0 DESIGN OF THE THIRD YEAR STUDY

For the 1994-1995 study, the research was designed to elaborate on the results of the previous years of the study, by providing feedback related to the effectiveness of the software design factors of student control and the level of student support provided in the performance environment. These factors were explored through the comparison of the two operating modes of the software, guided and open. The factors were further explored by an assessment of the instructional styles of the teachers, for a comparison of learning outcomes for each mode by instructional style.

4.1 Evaluating Levels of Learner Control

The general issues of learner control have been discussed extensively in the general educational psychology literature, and the application of learner control to computer-based instruction is derived from that discussion. The general finding of research related to computer-based learner-control over sequence, content, and amount of system feedback is that students benefit from increased control over instructional systems when they have some prior knowledge of a subject. However, when students have little prior knowledge, or when the task to be performed is simple, there is usually little advantage to learner-control over computer-control (Steinberg, 1988; Morrison, Ross & O'Dell, 1995).

The main implication of existing learner-control research, with regard to the guided and open modes of R-WISE, is that it may be important to help the students acquire knowledge of the system and gain basic competence with the underlying skills, before providing a learner-controlled environment. This can allow the students to obtain maximum benefit from first a computer-guided mode of the software before using a learner-controlled version. Research designed to test student learning outcomes by

BEST COPY AVAILABLE

software mode can test the notion that learning with automated instructional systems is in some cases influenced by the level of learner-control available in an instructional system.

The 1994-95 R-WISE study was designed to first provide all students with basic competence in R-WISE using guided mode, then to perform a comparison of guided vs. open modes, providing a large-scale test of the general findings of learner-control research. To accomplish this, all students used the software in guided mode during the first semester, after which two groups were formed for the second semester, one continuing to use guided mode, and the other using open mode. These groupings allowed for an optimal learner-control mode test, given the general findings that students with increased ability and prior knowledge perform better under conditions of increased learner control. The use of guided mode by all students during the first semester provided those students who used open mode during the second with prior knowledge and ability in the use of the R-WISE software.

4.2 Evaluating the Effects of Instructional Styles

Instructional styles are usually related to learning styles, and teachers who are attentive to style issues will attempt to accommodate the differences between their own preferred styles of instructing, and the preferred learning styles of their students. For example, a teacher who prefers a given teaching style may work most effectively with students who prefer a compatible learning style. Instructional styles are based on learning styles, personality types, information processing styles, social interaction theory, and instructional theory (Claxton & Murrell, 1988). Although much of the argument for interaction between instructional styles, learning styles, and learning outcomes is based on rational insight or anecdotal evidence, there is some empirical evidence of effects of learning and instructional styles on learning outcomes, in some situations. For example, there is evidence of effects of variation in the teacher's accommodation of a student's preferred locus of control, sometimes considered a learning style variable, on learning outcomes (Klein & Keller, 1990).

The main idea behind the assessment of instructional styles for this study was to determine whether the instructional style of the teacher was a significant environmental factor in the effectiveness of the R-WISE computer-supported learning environment within the context of her classroom. The Canfield Teaching Styles Inventory (Canfield & Canfield, 1988) was used to measure the instructional styles of the teachers using R-WISE in their classrooms. In order to identify the influence of the instructional style variable on the teacher's use of R-WISE, the instructional styles of the R-WISE teachers were correlated with student performance on writing tasks before and after using the R-WISE computer-based learning environment in the classroom context.

4.3 Goals for Analysis of Data

There were three main goals for the analysis of the data for the 1994-1995 school year. The first was to measure the learning outcomes associated with R-WISE guided mode and R-WISE open mode. The purpose of this comparison of modes was to determine the effectiveness of learner-control of the workspace, in concert with the additional levels of support available in open mode. This addressed the design issue of how much autonomy to provide for the student in a tutored, supportive working environment.

ERIC

The second goal for the analysis was to correlate the teaching styles of teachers using R-WISE with the performance of their classes. The purpose of this assessment was to determine the effect that those teaching styles might have on learning outcomes in the R-WISE environment. This addresses the software design and implementation issue of supporting teachers with potentially diverse approaches and styles of teaching. This is particularly important if there is a relationship between the teacher's style of instruction and the success of the learner. If this relationship exists, then steps can be taken to accommodate the special needs of those teachers whose teaching styles interact negatively with the use of R-WISE.

The third goal for the analysis was to measure the level of interaction between the instructional styles of the teachers using R-WISE with their classes, and the guided or independent mode of learner control in the software. The purpose of this analysis was to determine whether there are some instructional styles that are more compatible with the two levels of student control available in R-WISE, and some instructional styles that are less compatible. A finding of interaction between the teacher's instructional style and the software design factor of level of learner control would suggest that the mode of the software may be adapted to the instructional style of the teacher. This could help optimize the positive effects of the R-WISE treatment on student performance.

5.0 METHODS

The design of the 1994-1995 data collection was based on the major conditions, guided mode and open mode of the R-WISE software. The first semester of the study was conducted in guided mode for all students, with 32 teachers and 1,277 students.

For the second semester, two treatment groups were used, with one group continuing to use R-WISE in guided mode, and the other group using R-WISE in open mode. The study initially included an additional 155 students in open mode for the second semester, but those subjects were dropped when the teachers did not meet the software mode restrictions of the study. A total of 21 of the 32 teachers had a class in each software mode during the second semester, which helped reduce the teacher bias on treatment conditions.

5.1 Instruments

Two data collection instruments were used in the study: a writing sample used for pre-, and post-testing, and an instructional styles inventory. The writing sample was generated by the students in response to prompts originally developed by the National Assessment of Educational Progress (NAEP) for a national longitudinal study of writing achievement. Trained external graders were used in the assessment of the writing samples. Each essay was scored by two judges, with a third judge available in the event that the two scores diverged by more than 2 points. Utilizing this process, the interrater reliability of assessment has averaged approximately .75 for all years of the study. This compares favorably with the interrater reliability of large-scale comparisons of writing assessments (McLean, 1992). The assessment rubric for the writing sample included a holistic score

(0-6 point scale) addressing the overall quality of the writing product as the principal dependent measure for the study.

The Canfield Instructional Styles Inventory (ISI) was administered to each of the teachers in the study. The ISI categorizes teaching styles along two basic dyads—social or independent, and conceptual or applied. These styles are descriptive of instructional approaches preferred by the teacher. The *social* style includes a preference for social interaction between students and between student and instructor, in the design and delivery of group discussions and teamwork-oriented instruction. The *independent* style teacher is the opposite of the social style. The independent teacher prefers to set up self-paced situations in which students develop and pursue individual goals. The *applied* style includes a focus on realistic, authentic situations and working experiences with a 'hands-on' approach to the extent possible. The *conceptual* teacher is the opposite of the applied style teacher. She prefers highly organized, language-oriented activities, such as reading and lecture. In addition to these four styles, the ISI includes a *neutral* style, and four mixed styles—*social/applied, social/conceptual, independent/applied*, and *independent/conceptual*. The four mixed type instructional styles combine some of the components of each of the constituent styles, and the *neutral* style includes no strong preferences, and may include a focus on tailoring an instructional approach to meet the needs of the situation. The English teachers in the study represented 7 of the 9 possible styles from the ISI (see Table 1).

Table 1. Numbers of Teachers by Instructional Style

Social/Applied $n_t = 1$	Social $n_t = 1$	Soc/Conceptual $n_t = 1$
Applied $n_t = 0$	Neutral $n_t = 5$	Conceptual $n_t = 10$
Ind/Applied $n_t = 0$	Independent $n_t = 2$	Ind/Conceptual $n_t = 5$

n_t is the number of teachers associated with each style.

<u>5.2 Samples</u>

Data were collected at 9 schools in Texas, New Mexico, and Ohio. All teachers and students were assigned to the guided mode treatment for the first semester. For the second semester, classes were divided into guided and open mode treatments. Student writing assessments were administered three times—pretest, midtest, and posttest. The NEAP prompts for each test were administered during a timed, 45-minute class period. The first set of prompts were administered at the beginning of the first semester. New prompts were administered at the end of the first semester for the mid-term measure.

All teachers in the study had at least one class in the guided mode treatment in the first or second semester. There were a total of 65 classes, with 797 students, in the guided treatment group. The open treatment group included 49 classes with 480 students. The final NEAP prompts were administered for the posttest at the end of the second semester.

The teachers reflected a diverse set of instructional styles, based on the ISI instrument. This included one in social/applied, one in social, one in social/conceptual, five in neutral, two in independent, five in independent/conceptual, and ten in conceptual. ISI scores were not available for the seven remaining teachers of the original group of 32, so the data from their classes was excluded from comparisons of instructional styles (see Table 1).

6.0 RESULTS

Two independent variables were considered in the current analyses: tutor *mode* (open vs. guided) and *teaching style* (social, independent, conceptual, neutral, social/conceptual, or independent/conceptual). The resulting 2 X 6 matrix was subjected to ANCOVA to test for differences between the student groups while controlling for linear dependencies between the dependent variable, a 0-6 point holistic score, and the covariates. The covariates employed were *midterm scores* and *time* spent in the computer lab. Midterm scores were included to control for the effects of non-random assignment of students to student groups to test conditions. Time was included because it became apparent during preliminary data analysis that some classes and/or teachers went to the lab more often than others. As a result, it was deemed necessary to statistically control for potential practice effects.

6.1 Covariate Trends

Midterm Scores. Average midterm scores were nearly identical for *open and guided mode* conditions (mean = 2.37 vs. 2.38, respectively). An independent sample t-test indicated that the small difference was not significant [t (1275) = -.10, p = .924].

Midterm score differences by instructional style, unlike those for open vs. guided mode, were quite robust. Mean scores ranged from 2.06 to 2.65 or by about 10% across teaching style. A one-way ANOVA indicated that these differences were significant [F(1,1057) = 8.095, p < .001]. Follow-up post-hoc analyses (Scheffe test, p < .05) revealed that the relatively poor performance by students of the six (out of 35 total) teachers with *social* and *independent / conceptual* styles accounted for most of the difference (see Figure 1).

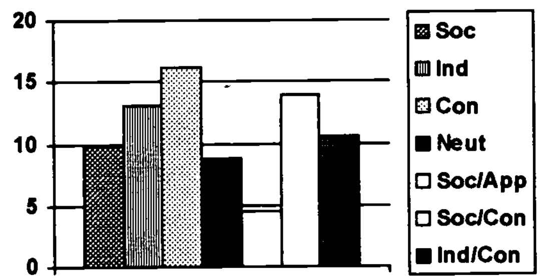
Time in Lab. Students using guided mode averaged about 13.6 hours while students in the open group averaged about 13.5 hours in the computer lab over the course of the school year. This difference was not significant [t(1222) = .40, p = .688].

Once again, differences by teaching style were more pronounced, ranging from approximately 8.8 to 16.5 hours over the course of the school year. As expected, these differences were significant [F(5, 1057) = 144.954, p > .001]. Post-hoc analysis

BEST COPY AVAILABLE

indicated pervasive differences in lab usage patterns by teachers with differing teaching styles. Although all teachers initially scheduled equal class time in the lab, those teachers with *conceptual* instructional styles chose to use the lab more than those with other styles, which may have been a factor contributing to the differences between student groups (see Figure 2).

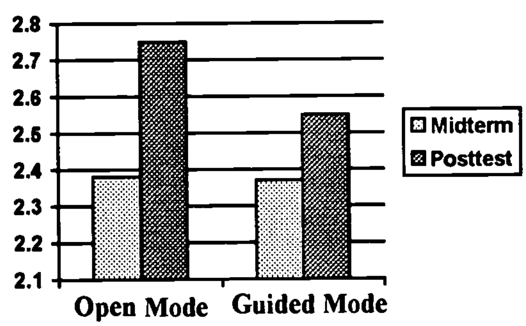
Figure 2. Time in Lab by Instructional Style



6.2 Mode Effect

As shown in Figure 3, students using guided-mode (n = 797) showed score increases of about 3% from midterm to post-test while students using the open-mode (n = 480) version of R-WISE showed increases of about 6% over the same period.

Figure 3. Mean Midterm and Post-Test Scores by Mode



The main effect of mode was significant $[F(1,1057) = 5.14, p = .024]$, accounting for approximately 1% of the observed score variance ($\eta^2 = .005$).

6.3 Instructional Style Effect

The *Canfield Teaching Styles Inventory* purports to measure 9 different teaching styles along 2 major dimensions. Table 2 shows each of these categories as well as the number of teachers and students from the study falling into each group. The *social/applied* group had to be dropped from the analyses because its inclusion would have introduced redundant effects into the ANOVA model (due to empty cells).

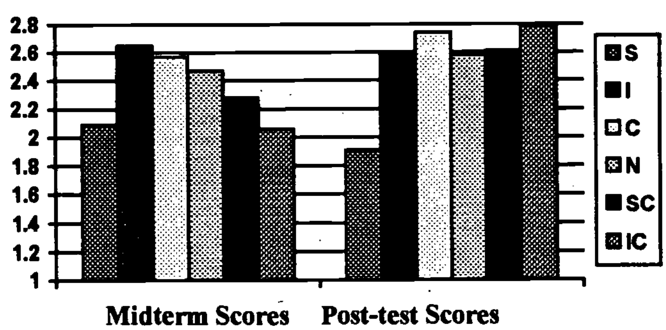
Table 2. Numbers of Teachers & Students by Instructional Style

Social/Applied $n_t = 1$ $n_s = 14$	Social $n_t = 1$ $n_s = 27$	Soc/Conceptual $n_t = 1$ $n_s = 144$
Applied $n_t = 0$ $n_s = 0$	Neutral $n_t = 5$ $n_s = 243$	Conceptual $n_t = 10$ $n_s = 581$
Ind/Applied $n_t = 0$ $n_s = 0$	Independent $n_t = 2$ $n_s = 113$	Ind/Conceptual $n_t = 5$ $n_s = 164$

n_t and n_s are the number of teachers and students associated with each style respectively.

Figure 4 shows mean midterm and post-test scores by the teachers' preferred instructional style. The main effect of instructional style was significant [$F(5,1057) = 8.13$, $p < .001$], accounting for approximately 4% of the observed score variance ($\eta^2 = .037$).

Figure 4. Mean Midterm and Post-Test Scores by Instructional Style



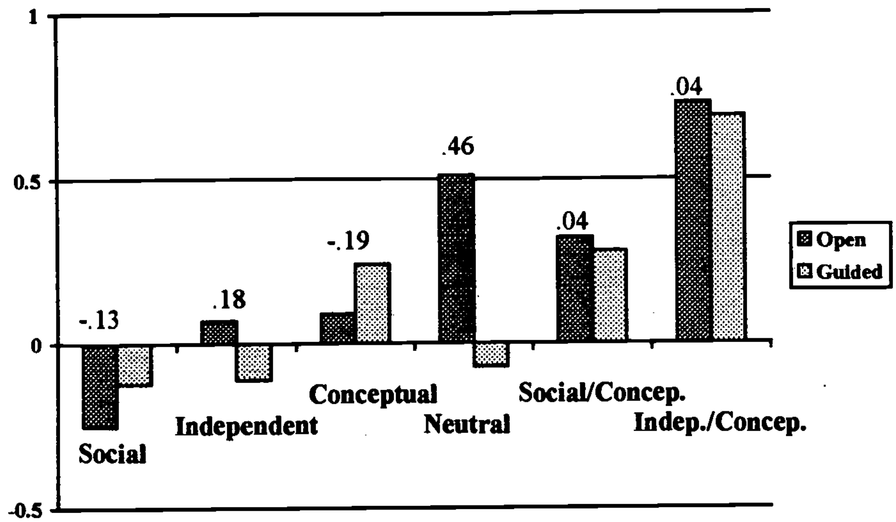
S=social, I=independent, C=conceptual, N=neutral,

SC=social/conceptual, IC=independent/conceptual

6.4 Instructional Style-Mode Interaction

As reported, both independent variables were significantly predictive of post-test performance. Therefore, the interaction of the two was examined. Figure 5 depicts the nature of this interaction.

Figure 5. Mid- to Post-Test Gain Scores by Mode and Teaching Style



The values shown in Figure 5 represent gain scores. That is, they were formed by subtracting post-test scores from midterm test scores for each of the 12 conditions. By subtracting guided-mode scores for a particular teaching style from open-mode scores for the same style, we obtained a measure of the relative differences between each of the teaching style-mode conditions. From the graph, it is evident that for four of the six instructional styles, students the open mode condition (as evidenced by the pervasive positive values), benefited more than their counterparts in guided mode. Further, those in the neutral and independent conditions under open mode, showed the largest score differences relative to their counterparts.

Table 3 presents the ANOVA results for tests of the mode-teaching style model. Of particular interest was the *mode X teaching style* interaction. As the table shows, this interaction was significant [$F(5, 1057) = 5.48$, $p < .001$]. The R^2 values associated with the model (unadjusted = .292, adjusted = .284) indicate that approximately 28% of the post-test score variance was explained by the independent variables and the covariates. The covariate regression accounted for about 25% of the observed variance. Midterm scores correlated about .90 ($R^2 = .81$) with the predicted dependent variable while time on tutor explained only about 3% of the score variance. Compared to the effect sizes associated with *mode* ($\eta^2 = .005$), *teaching style* ($\eta^2 = .037$), and the *mode* X *teaching style* interaction ($\eta^2 = .022$), midterm scores were a robust predictor of post-test performance. Interestingly, time on tutor was not especially predictive.

A post-hoc analysis indicated that the neutral instructional style under the open condition was largely responsible for the observed difference. In fact, the parameter associated with this condition was the only one which approached significance.

Table 3. ANOVA Table for Mode & Teaching Style Effects

Source of Variation	Sum of Squares	Degrees of Frdm	Mean Square	F Statistic	Significnce of F
Within + Residual	1198.59	1057	1.13	---	---
Regression	404.02	2	202.01	178.15	.000
Mode	5.83	1	5.83	5.14	.024
Teaching Style	46.09	5	9.22	8.13	.000
Mode X Style	27.39	5	5.48	4.83	.000
Model	495.28	13	38.10	33.60	.000
Total	1693.87	1070	1.58	33.60	.000

6.5 Summary

In summary, the English teachers in the study tended to fall into the categories of conceptual, independent/conceptual, and neutral categories. The results demonstrated that the differences in achievement between the students in the two mode conditions, although small, were statistically significant, as were the differences between the achievement of classes with teachers of differing instructional styles. The interaction between the social teachers and the open mode were also significant.

7.0 DISCUSSION AND CONCLUSIONS

The overall goal of the 1994-1995 R-WISE study was to provide some elaboration on the findings of the two previous years of the R-WISE research program, with regard to the design of the R-WISE software, and its implementation in the setting of high school English classes. In particular, two aspects of the use of R-WISE software were explored. This included an inquiry into the effects of varying the levels of learner control on student writing performance, as expressed in the guided and independent modes of the software, and an inquiry into the effect of the environmental variable of the teacher's preferred instructional style on student writing performance. These two aspects of the use of R-WISE were addressed through the research goals and the analysis of data. The analysis provided answers that addressed the three research goals of comparing the performance of guided and independent modes, measuring the effect of the teacher's preferred instructional style on the student's writing performance, and identifying the interaction between R-WISE mode and preferred instructional style. These goals were met positively

BEST COPY AVAILABLE

in the study, with moderate, but statistically significant findings for each of the tested conditions.

7.1 Addressing the Student Factor

The findings for the first research goal, the student factor of guided vs. independent mode, were consistent with general learner-control research findings. The level of prior knowledge that a student has of a domain has been demonstrated to be a critical factor in the effectiveness of learner-control in computer-based instructional systems. The fact that independent mode was more effective in the second semester suggests that the students' practice of the writing skills during the first semester using R-WISE using guided mode with a low level of learner-control provided sufficient prior knowledge of the situation for those using independent mode to benefit from the increased level of learner-control during the second semester. This finding can inform the design of R-WISE, and suggests a possible course for future development. Since the progression from computer-control (guided mode) toward learner-control (independent mode) within the R-WISE supportive learning environment has been demonstrated to be an effective approach to the student's acquisition of writing skills, future designs could intentionally accommodate the transition between computer-control and learner-control. This transition could be staged to correspond with an optimal balance between the two modes of control.

Further research could explore the issue of level of control in the context of a supportive writing environment in more detail, perhaps testing intermediary levels between computer-control and student-control, rather than focusing only on the guided and independent modes. For example, a version of R-WISE could be designed in which control would transition gradually from the computer to the student, as the student demonstrated competence in the skill performances supported by R-WISE.

7.2 Addressing the Environment Factor

The second research goal is to measure the effect of the environmental factor of the teacher's preferred instructional style on the student's writing performance. The results for the second research goal provide several interesting insights into interaction between the teacher's instructional style and her use of the R-WISE software in her class. Given the largely conceptual nature of language-related skills, the differences between the performance of students of teachers with conceptual and non-conceptual preferred instructional style was an interesting, but not entirely surprising result. The English composition content domain deals primarily with semantics and language, which are by definition a part of the conceptual instructional style. Most of the teachers belonged to the group that preferred an instructional style related to the conceptual style. These sixteen teachers spent more time in the lab, and appeared to interact more successfully with the R-WISE software under the conditions of the study. The students of the eight teachers who preferred a social, independent or neutral instructional style appeared to receive less benefit from the use of R-WISE, under the conditions of the study, than the students of teachers who prefer an instruction style related to the conceptual style. This suggests that teachers who prefer social, independent, and neutral instructional styles may not support, promote, or otherwise interact as positively with R-WISE in the classroom setting as those teachers who prefer a conceptual instructional style. Therefore, it will be useful in future research to inquire further into the approaches taken by some of these teachers in the classroom. In the event that significant differences in approach can be identified, it may be possible to consider ways to design the R-WISE software, or structure its implementation under the conditions of future studies, in order to accommodate the interaction of the teachers who prefer a social, independent, or neutral instructional style, in order to improve the performance of their students on the R-WISE software.

The significant effects of instructional style suggest that future versions of R-WISE might be able to accommodate some of the differences between styles. This could include, for example, increased support of some of the teachers in the computer labs, or incorporating higher levels of teacher control and interaction with the R-WISE software. However, due to the small number of teachers in some of the instructional style categories, these conclusions should also be validated with additional research, conducted with a broader base of teachers.

7.3 An Interaction of Factors

For the third research goal, the question of interaction between the student factor of mode of control, and the environment factor of the teacher's preferred instructional style, the results suggest that some teachers may be better suited to using R-WISE in a specific mode. This is an interesting elaboration of the finding of an interaction between the preferred instructional style of the teacher and the performance of students using the R-WISE software. Not only do some teachers appear to be better suited to using R-WISE with their classes, but some teachers also appear to be better able to use R-WISE successfully in a particular mode of control (guided or independent mode).

The interaction between the teacher's instructional style and the software mode, suggests that a teacher's preferred instructional style may be able to be accommodated by matching software modes, or other related design features, with her instructional preferences, thereby optimizing the effects of the R-WISE treatment on student writing performance. Again, although interaction between preferred teacher instructional style and student performance using the two modes of R-WISE is interesting, the interaction should be validated with additional research using a larger number of teachers. This would be useful due to the small number of teachers in some of the instructional style categories.

7.4 Conclusions

The results of the inquiry into the three R-WISE design factors studied—the effect of two levels of learner-control (guided and independent modes), the effect of the teacher's preferred instructional style, and the interaction between mode and instructional style—have demonstrated that all three design factors have some level of significant influence on the writing performance of students using R-WISE under the conditions of this study. This finding suggests that it may be reasonable to increase the adaptability of supportive software environments such as R-WISE, in order to accommodate both a variable level of learner-control, and variations in the preferred instructional styles of the teachers.

Future studies of R-WISE will explore the design factors of accommodating instructional preferences of teachers, and increasing the ability of R-WISE to adapt the level of student-control to the level of knowledge and skill of individual students in real time. As part of the plan to accomplish these objectives, a field-based study of the design of R-WISE has been initiated. This study is currently underway and will be reported in a future paper.

BEST COPY AVAILABLE

This new study is addressing environmental, teacher, and student design factors, in order to help narrow some of the details of how to address these and related issues in the future designs of R-WISE.

REFERENCES

Bereiter, C., & Scardemalia, M. (1987). The psychology of written composition. Hillsdale, NJ: Lawrence Erlbaum Associates.

Canfield, A., & Canfield, J. (1988). Canfield instructional styles inventory (ISI). Western Psychological Services.

Carlson, P. & Crevoisier, M. (1994). R-WISE: A learning environment to teach prose composition. Technical Report of the Human Resources Directorate, Technical Training Research Division, Brooks AFB, Texas.

Carlson, P., Hitzfelder, E., Hudson, T., & Redmon, D. (1996). Classrooms as test-beds for educational software design. T.H.E. Journal, 23(8), 75-78.

Carlson, P. & Miller, T. (1996). Beyond word processing: Using an interactive learning environment to teach writing. Technical Report AL/HR-TR-1996-0090 of the Human Resources Directorate, Technical Training Research Division, Brooks AFB, Texas.

Claxton, Charles S. & Murrell, Patricia H. (1988). Learning Styles. Syracuse, NY: ERIC Clearinghouse, Eric Digest 301 143.

Flower, L., & Hayes, J. R. (1980). The dynamics of composing: Making plans and juggling constraints. In L. Gregg, & E. Steinberg (Eds.), Cognitive processes in writing (31-50). Hillsdale, NJ: Lawrence Erlbaum Associates.

Flower, L., & Hayes, J. R. (1981). Plans that guide the composing process. In C. H. Frederiksen, & J. F. Dominic (Eds.), Writing: The nature, development, and teaching of written communication: Volume 2, Writing: Process, development and communication (109-123). Hillsdale, NJ: Lawrence Erlbaum Associates.

Hayes, J. R., & Flower, L. (1983). Uncovering cognitive processes in writing: An introduction to protocol analysis. In P. Mosenthal, L. Tamor, & S. Walmsley (Eds.), Research on writing: Principles and methods (206-220). New York: Longman.

Klein, J. D. & Keller, J. M. (1990). Influence of student ability, locus of control, and type of instructional control on performance and confidence. Journal of educational research, 83, 140-146.

McLean, J. (1992). The utility, reliability, and validity of holistic scoring for writing assessment samples. Symposium presented at the Annual Meeting of the Mid-South Educational Research Association, Knoxville, Tennessee, November 11-13.

Morrison, G. R., Ross, S. M., & O'Dell, J. K. (1995). Applications of research to the design of computer-based instruction. In Anglin, G. J. (Ed.), Instructional technology, past, present, and future (215-221). Englewood, CO: Libraries Unlimited, Inc.

Steinberg, E. R. (1988). Cognition and learner control: A literature review, 1977-1988. Journal of computer-based instruction, 16(4), 117-121.

BEST COPY AVAILABLE

CS 215 766
AERA CONFERENCE 1997

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

ERIC®

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: The Influence of Learner Control and Instructional Styles on Student Writing in a Supportive Environment	
Author(s): Kurt Rowley, Ph.D, Todd Miller, Patricia Carlson, Ph.D.	
Corporate Source:	Publication Date: March 28, 1997

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic/optical media, and sold through the ERIC Document Reproduction Service (EDRS) or other ERIC vendors. Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following two options and sign at the bottom of the page.

[X] **Check here For Level 1 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical) *and* paper copy.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Level 1

The sample sticker shown below will be affixed to all Level 2 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Level 2

[X] **Check here For Level 2 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical), but *not* in paper copy.

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but neither box is checked, documents will be processed at Level 1.

"I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic/optical media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries."

Sign here→ please

Signature: [signature]	Printed Name/Position/Title: Kurt Rowley, Research Associate	
Organization/Address: AL/HRTI 7909 Lindbergh Dr. Brooks AFB, TX 78235-5352	Telephone: 210 536 0587	FAX:
	E-Mail Address: RowleyK@cobra.brooks.AF.MIL	Date: 3/26/97

(over)