Department of English Memorandum

To: FEPC Members

From: Richard Hart

Date: 11/2/78

Here is some more information Hugh Burns has supplied in connection with his request.

Memorandum 10 September 1978

From: Hugh Burns (837-3464)

To: Dr. C. R. Kline, English Education, EDB 436D
Dr. G. H. Culp, Computer Science, HRC 3.364
Dr. J. L. Kinneavy, English, PAR 18
Dr. S. W. Wittig, Graduate School, MAI 101
Dr. W. J. Lamberg, English Education, EDB 436E

Subject: Dissertation Progress (Summer 1978)

As all of you know, I have had the opportunity and good fortune to show my dissertation proposal to several colleagues in rhetoric, computer science, and English education over the last four months. Dr. Kline suggested and I agreed that I ought to prepare a memorandum summarizing their comments and noting the direction the dissertation has taken as a consequence of their feedback. So here goes.

Patrick Suppes, Stanford University. I spoke with Professor Suppes in the late spring when he visited UT. He suggested that, since the state of the art in computer-assisted instruction had made considerable progress in the last ten years, I write and test specific CAI programs in a quasi-experimental format. Remember at that time I was considering a more comprehensive dissertation surveying how computers might be used to teach invention and arrangement. He discouraged that particular approach. Since that time, Professor Suppes has sent me nineteen reprints and three small bibliographies. He would have me emphasize quantifying student performance and attitude.

Comments: I have followed his advice to the letter, even though I am uncertain about the most appropriate way to

test and measure an attitudinal hypothesis. His reprints offer two fine models for designing CAI-related research, i. e. an experimental research study in Russian language teaching and a descriptive research study of elementary logic instruction at the university level.

Janice Lauer, University of Detroit. I spent two weeks in Detroit at Dr. Lauer's rhetoric seminar. She had the opportunity to read my proposal carefully, and then we talked about it during conference sessions. Her main advice was to simplify the CAI programs. Specifically, she recommended that I attempt to measure any differences among popular composition heuristics, and that I not combine heuristic models as I had originally planned. Second, she recommended that I avoid attempting to operationally define "competent academic writing." Third, she encouraged me to quantify student performance.

Comments: Dr. Lauer's first recommendation has both good and bad points. First, the good: English composition teachers have very little empirical data about invention heuristics; consequently, there is an urgent need for more empirical evidence that a specific heuristic procedure significantly increases both the quantity and the quality of a person's ideas. The bad point, however, is that there is a sacrifice in limiting the dissertation to only three popular heuristics. In my heart, I believe that the power of the invention process is in the manipulation of more

than one heuristic strategy. What I'll admit here, however, is that freshman composition students would have difficulty learning and internalizing one heuristic, let alone discovering the powerful combinations of multiple heuristics. Dr. Lauer made me consider my subject's abilities. The purpose of teaching invention in a few lessons should be to introduce students to one effective way for exploring a topic before stylistic concerns interfere with the process.

On the second point, I have dropped the phrase "competent academic writing" in the revised proposal. On her third point, I came back to UT and went ahead with the pilot study, attempting in part to measure quantity of ideas.

Ed Corbett, Ohio State University. I met Corbett in Denver at the 4C's and again at the Detroit seminar. He has not read the full proposal, but he has read the one-page abstract dated July 12, 1978. He has not heard of any similar research currently in progress. During our conversation at Detroit, he indicated that he would be most interested in the differences among the invention strategies. He agreed with Dr. Lauer that I should concentrate on single heuristic types and not confound the problem with heuristic combining. Not surprisingly, he was delighted to see that I planned to use Aristotle's topics. After the seminar, I sent him an updated abstract; he replied in part: "It is an interesting and a potentially fruitful project. The only thing that is left vague in your proposal is how you are going to analyze

and evaluate the results of your CAI in invention. But maybe you haven't yet set up your instrument for assessing 'differences.'"

Comment: Having the editor of College Composition and Communication say that he did not know of any similar research (testing heuristics via CAI) confirmed my findings. He is most interested in seeing if I find differences among the topics, the pentad, and the matrix.

Richard Young, Carnegie-Mellon University. I had a short conference followed by lunch with Dr. Young and Dr. Lauer in Detroit. He did not have time to read the proposal for he was there only a short while. After I summarized my proposal for him, he said it appeared to him that CAI-prompted invention would perhaps stimulate the retrieval of what the student already knew, but he did not know how such a method could prompt a student to make new, original discoveries. I explained the question pools, but he seemed less than convinced that students would answer such questions, especially when the questions were being asked by a computer. He was interested, like Corbett, in how I planned to articulate the differences between the invention strategies, indicating that my research review chapter should be devoted in part to the inherent differences in the heuristic types. He asked a question many people have been asking me lately, namely, "Why are you bothering to use a computer at all?" Finally, he encouraged me to make the dissertation a worthwhile

learning experience, saying "Take it for granted that your project will be imperfect, but make it useful for yourself; after all, all of us have much to learn about invention and cognition."

Comment: I wish I would have had more time with Dr. Young so that he could have reviewed the questions I derived from the tagmemic matrix. Nevertheless, the session was valuable. Although the pilot test illustrated that students in fact answer and often expand upon non-data conditioned questions, the question remains will they do likewise when the questions are put "on-line?" I believe such a question will be incorporated as the first hypothesis in the final study. It is an interesting question in itself and should not be that much more difficult to collect the raw data. His suggestion that I articulate each respective heuristic in chapter two echoes Dr. Kinneavy's advice. I hope to complete this particular chapter during the fall semester. As for the "why CAI?" question, I answered (1) control of the presentation of the heuristic procedures, (2) effective individual instruction since invention is basically an individual matter, (3) such CAI modules could supplement classroom instruction in English composition, and (4) educational computer applications are not going to diminish one iota in my lifetime.

Anna Marie Thames, Educulture. I met Dr. Thames after I presented my paper at the 4 C's in Denver. Her company, Educulture, has published "computer learning systems" in

basic math and basic English. Two programs I demonstrated during my presentation (on usage and on brevity) are slightly beyond their CAI programs on the "basics." She has received my dissertation materials, and I am waiting for a reply. I asked her in my last letter about their company's validation procedures. Gary Stivers, an editorial assistant, has responded that "Our CAI validation procedures have yet to be articulated clearly enough to be generalized upon."

Comment: I was flattered when Anna Marie approached me about my materials after my presentation. I am beginning to believe that my dissertation could have some moderate financial implications. Call me naive, but it was curious and bothersome to me that a commerical publisher has not clearly articulated the validation procedures of their materials.

David Willis, Ph. D. Candidate at Ohio State. David Willis is now researching and writing his dissertation on invention and sentence-combining under Corbett and O'Hare. He also participated in the Detroit seminar, and consequently we talked several times informally. David is adamantly opposed to quickie ways to teach invention, and he sees the CAI programs I intend to write as quickie ways to stimulate invention. His biggest doubt is that a heuristic, to be effective, must be internalized, and doing that requires time, "probably a half of semester or so." He believes that the

limited time my subjects have on the computer will probably rule out any chance of their benefiting much from the CAI. He told me that giving the posttest immediately afterwards may improve my chances for getting some significant results, but it also rules out my testing for the erosion or, more importantly, the internalization.

He also urged me not to neglect the descriptive aspects of my research, i. e. describing how the computer interacts with the student, commenting at some length about what the computer can and cannot do.

He recommends that I see if the cohesion chart <u>a la</u> Halliday and Hassan might help me actually count and distinguish the ideas which the students generate. That is above and beyond the proposition analysis.

Comment: I agree with David about internalizing heuristics; it does take time, but spending half of a semester manipulating the Burke pentad ratios may be a bit impractical. Testing for erosion is a possibility which might be incorporated into the design. What do you think? How could it be done? Finally, I'm taking a discourse analysis course with Dr. Carlota Smith, Linguistics, for which I plan to read <u>Cohesion in English</u>. Dave and I have stayed in touch since the seminar.

I agree with Dave. I think much more might be made of teaching of the heuristics

<u>Ellen Nold, Stanford University</u>. I met Dr. Nold in Denver briefly, and I sent her my proposal after I returned from Detroit. Dr. Nold's article, "Fear and Trembling: The

Humanist Approaches the Computer," was an important spur for my particular topic. When I told her that I was researching and hoping to write a dissertation about CAI-prompted invention, her exact words were, "Gees, somebody's finally doing it!" So it was no surprise when she responded with a three-page letter about my proposal (see attachment). Her letter cited five possible contaminants to my study: (1) subject's topic selection, (2) relative advantages of CAI, (3) interaction of heuristic taught and topic questions, (4) confusion between invention and arrangement in the test designs, and (5) contamination among groups.

Comment: Dr. Nold's advice is probably the most specific I have received this summer, especially if one considers the threats to the external and internal validity of what I'm about to do. I don't have all the answers here yet, but I'm working on them.

John Harwood, The Christopher Newport College of The College of William and Mary. Dr. Culp and Dr. Wittig met Dr. Harwood this summer while he was participating in Professor Sledd's NEH seminar, and they had him call me. Dr. Harwood and I share an interest in rhetoric and in possible CAI applications in rhetoric. We ended up sharing working bibliographies. He is specifically interested in the way adults learn and the way to measure learning outcomes. He sees the computer as one tool around which to build a model of language change in adult writers. My dissertation topic

meshes with his interest perfectly because the process by which adults generate ideas about topics has been imperfectly described. He encouraged me to include at least one appendix of a subject's complete interaction for each of the three heuristics.

Comment: Dr. Harwood's suggested reading list will be most helpful. For example, he suggested that I might incorporate some of the work in problem-solving which has been going on in mathematics education ever since George Polya published a "Short Dictionary of Heuristic" in How to Solve It (1945; renewed 1973). After talking with him for about eight hours on two separate occasions, I outlined the tentative appendices for the dissertation. Here they are:

A. Question Pools for the Heuristic Treatments
B. Listings
C. Sample Runs
D. Flowcharts of the Modules
E. Proposition Analysis Scoring Criteria
F. $H\emptyset_2$ Scoring Instructions
G. Likert Questionnaire on Attitude

What do you think? Are there too many here? About right? Any others?

L Borchardt - You can't make everybody happy.

Ralph Cain, University of Texas at Austin. I participated in Dr. Cain's research design seminar during the second summer session. After reading my dissertation proposal, he

allowed me to do the pilot study as part of his seminar. His comments about the proposal were: "Excellent rationale. Well done. I am still concerned about $H\emptyset_3$. The logic of the inferential model says only that a null hypothesis is rejected if the probability of observing what we observe occurs by chance less than .___. Failure to reject either means acceptance or it doesn't. What you are really doing is hypothesizing that there is a difference and that you will reject that hypothesis if $p<.35$. Right?" His written comments about the pilot study were: "Really more than a mini-study (only the sample was miniature.) An excellent pre-dissertation activity. Well-conceptualized, well-carried out, and well-reported." He also suggested in one of our conferences that my sample size (48) is fine as long as the CAI is used for control, but that an N of 48 would be suspect should I actually want to test and measure the interaction of heuristic and CAI/no CAI presentation.

Comment: My attitudinal hypothesis needs to be reworded; help. I've attached both the revised--no, refined--proposal and the pilot study. I've decided to keep the sample size at 48, emphasizing first the control and second that CAI-prompted invention is possible.

Summary. What a profitable summer! I am at that stage where I have to stop planning things and actually do them. In other words, I need to stop inventing and get busy arranging, programming, and writing. I am on schedule, however, according to my timetable at least. This semester, I hope to

complete the programming of the three CAI modules as soon as I can arrange for a computer account and a computer programmer. Also, I hope to have permission from the graduate research committee in C & I to conduct an experiment with human subjects. And finally, I hope to arrange with Dr. Kinneavy the four English 306 classes in the spring from which the subjects will be selected.

Get a request to PERC

Obviously, I would be most interested in your comments, especially comments about the pilot study. Therefore, in a week or two, after all of us are settled into the semester a bit more, I'll make arrangements to see you.

Cordially,

Hugh L. Burns
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Stimulating Invention in English Composition

This miniature-study was undertaken as a developmental pilot study for a dissertation now in the process of being researched at the University of Texas at Austin. The proposed title of the dissertation is "Stimulating Invention in English Composition through Computer-Assisted Instruction."

Problem

Background. One of the most difficult academic tasks for most human beings is the act of beginning to write a paper. The blank page has a tendency to stay blank, as if it were obeying some natural law similar to the law of inertia. Indeed, a blank page tends to stay blank for an inordinate length of time, particularly when placed in front of a college freshman composition student.

Today, however, in the English composition classroom, many teachers are returning to an earlier rhetorical model for teaching composition, a model which emphasizes the process of writing rather than the written product. Now while this classical rhetorical process breaks down into five stages, only the first three are crucially important for writing--invention, arrangement, and style. The following

study is most interested in exploring the issue of how to stimulate that first rhetorical art, invention, in English composition.

Sometimes called "prewriting," sometimes called "thinking a topic through," invention may be defined as the process of exploring a topic to discover ideas and then exploring the ideas in order to discover the most suitable arrangement for conveying those ideas to an audience. Of unique pedagogical interest is the entire issue of whether or not invention can be taught at all. Some argue that invention cannot be taught on the premise that, since so little is known about cognitive processes in general, how can one begin to teach effectively what ultimately must be one's own personal, quite private journey toward understanding. While everyone would agree that invention's domain is an undiscovered country within all of us, others argue that teaching invention effectively means guiding each student's individual search for ideas and arguments. In other words, while a teacher cannot predict what the students will discover, the teacher can prompt them to make discoveries. Richard Young (1976) describes "certain aspects of the process" which can be taught:

> The procedures themselves can be taught, as can their use in conscious thought; but one cannot teach direct control of the imaginative act or the unanticipated outcome. What can be taught is not, however, trivial; no one would question the importance of careful thought in the composing process. Furthermore, the use of heuristic procedures can coax imagination and memory;

> the intuitive act is not absolutely beyond the writer's control; it can be nourished and encouraged. (pp. 1-2)

Nourishing and encouraging intuitive acts as well as coaxing students' imaginations and memories are, needless to say, at the heart of this research report.

Purpose of the Research. Since specific invention strategies or heuristics have not been systematically taught in English composition settings, these strategies could not be systematically evaluated. The overall purpose of this research, therefore, is to evaluate three question-pools derived from three of the more popular heuristic procedures. Specifically, the three question-pools are based upon (1) Aristotle's enthymeme topics, (2) Kenneth Burke's dramatistic pentad, and (3) Young's, Becker's, and Pike's tagmemic matrix.

Questions to be Answered. In order to appropriately and systematically evaluate these question-pools, four questions must be answered.

1. A question of construct validity: will freshman composition students answer questions about their individual topics, even though every question is non-data conditioned?

2. A question of effectiveness: will these question-pools provide freshman composition students with more ideas about their respective topics than they discover on their own?

3. A question of comparative effectiveness: will there be differential effects among the three specific

heuristic treatments?

4. A question of attitude: will these students have a positive attitude toward these question pools after the invention treatment?

Hypotheses. Because teaching and invention share both scientific and artistic complexities, any set of hypotheses must at once be technically precise and intuitively useful. Under this rather broad and cautious rubric of scientific humanism, therefore, the following four hypotheses are presented:

H_1: Freshman composition students will answer seventy-five percent of the questions presented in the thirty minute treatment period.

H_2: Expressed in the null form, there is no difference in the performance (number of ideas generated) on a pretest and a posttest as measured by proposition analysis and a t-test for nonindependent or correlated samples. This hypothesis is to be tested at the .05 level of significance.

H_3: Expressed in the null form, there is no difference in the performance (number of ideas generated) on a pretest and posttest among the three groups as measured by analysis of variance (ANOVA). Again, this hypothesis will be tested at the .05 level of significance.

H_4: As measured by a Likert questionnaire, students will share an overall positive attitude toward the treatment without regard to the specific heuristic treatment they

received. This hypothesis will be supported if the ANOVA F-ratio is near 1.

Review of the Research

The aim here is to acknowledge briefly the literature from which the three question-pools are derived; consequently, pertinent research in cognition, creativity, heuristic thinking, and instructional design are not discussed.

Aristotle's Topics. The questions based upon Aristotle's enthymeme topics are adapted from his Rhetoric (1954), specifically Book II, Chapter 23: 1397a17-1400b35. At this point in the Rhetoric, Aristotle writes that it is time for his readers to "lay hold of certain facts about the whole subject, considered from a different and more general point of view" (p. 142). It is important to remember that when Aristotle speaks of invention, he is most concerned with enabling one to discover the most suitable arguments for persuading an audience. Young (1976) summarizes, "Arguments in support of the thesis can be discovered systematically by the use of topics, or heuristic probes: logical arguments can be developed by definition, comparison, contrast, antecedents, consequents, contradictions and so on" (p. 9). Corbett (1971) likewise argues that the classical rhetoricians defined the topics as "really an outgrowth of the study of how the human mind thinks" (p. 108). Finally, Kinneavy (1971) counters the argument that the topics "are not fertile

frameworks for exploration or persuasion in modern times" by stressing the validity of the basic notion of the topics, i.e. "an attempt to formulate the kinds of arguments which seem plausible to a given audience" (pp. 247-248).

Burke's Dramatistic Pentad. The questions based upon Kenneth Burke's dramatistic pentad are derived from A Grammar of Motives (1969). The five key terms of dramatism--Act, Scene, Agent, Agency, and Purpose--represent the specific perspectives all men share in the "attributing of motives" (p. xv). Specifically, Burke contends that "any complete statement about motives will offer some kind of answers to these five questions: what was done (act), when or where it was done (scene), who did it (agent), how he did it (agency), and why (purpose)" (p. xv). Interestingly, many people associate the dramatistic pentad with the journalistic pentad, i.e. who, what, when, where, and why. What ultimately recommends the dramatistic pentad is the manner in which the ten possible ratios can be manipulated in order to explore unknowns. For example, perhaps one can describe the scene and define the act, but a scene-act ratio enables one to explore a relationship between where something happened and what happened. Such ratios offer the writer exploratory probes he or she may not have considered before. Burke's rhetoric differs from classical rhetoric in that his major concern is not persuasion but "identification" (Burke, 1951; Corbett, 1971; Kinneavy, 1971; Young, 1976). Finally,

since some popular composition textbooks cite the pentad as an important invention heuristic (Irmscher, 1972; Winterowd, 1975), the pentad exists in most composition teachers' repertoires.

Tagmemic Matrix. The questions based upon the tagmemic matrix are derived from Rhetoric: Discovery and Change by Richard E. Young, Alton L. Becker, and Kenneth L. Pike (1970). The heuristic procedure itself combines four maxims for understanding a writer's position in relationship to the world, an audience, and a language system. The result of this combination is a nine-celled matrix: the rows representing the perspectives of particle, wave, and field; the columns representing the unit's "contrastive features, variant forms, and distributions in larger contexts" (Young, Becker & Pike, 1970, p. 126). Using the matrix, then, is a matter of developing some facility in shifting cells; Young, Becker, and Pike (1970) write:

> By following the instructions in each cell, you are led to shift perspectives systematically, focusing your attention first on one feature of the unit and then another. In doing so you fulfill the basic requirement of effective inquiry, which is to vary your assumptions. The purpose of the procedure is not to turn you into an intellectual machine that gathers information mechanically, but to guide and stimulate your intelligence, particularly your intuition, which is able to deal with enormous complexity in an original way. (p. 128)

Essentially, tagmemic invention emphasizes "psychological changes in the writer" and focuses on the "retrieval of relevant information already known, analysis of problematic

data, and discovery of ordering principles" (Young, 1976, p. 23).

Of the three heuristic procedures in this research report, the tagmemic matrix is the only one which has been evaluated to determine if "instruction in tagmemic invention does in fact bring about significant changes in the student's conceptual ability and ability to communicate" (Young, 1976, p. 24). Specifically, Lee Odell in an article in Research in the Teaching of English (1974) summarizes the findings of his dissertation, "Discovery Procedures for Contemporary Rhetoric: A Study of the Usefulness of the Tagmemic Heuristic Model in Teaching Composition." Odell's two significant findings were (1) students performed intellectual operations taken from tagmemic theory more times than in their pretest essays, and (2) students used more evidence than in their pretest essays after instruction in tagmemic invention. While Odell's design is short on internal validity (i.e. history, maturation processes, semester learning, and pretest learning), his study still makes a worthwhile contribution since it represents the first attempt to systematically evaluate the invention process in a freshman composition program using a preexperimental design.

Method

Subjects. Twelve students in one freshman English course in the second summer session at the University of

Texas at Austin volunteered to participate in a "prewriting session with an English tutor." Eleven students completed the experiment; one subject withdrew for personal reasons. The students were randomly assigned to one of the three experimental treatments, corresponding to either the Aristotle treatment (A group), the Burke treatment (B group), or the tagmemic treatment (C group). Since their composition instructor required a research paper, the students were told that the tutor, a doctoral candidate in English education, would help them explore their topic in a special prewriting session, part of a pilot test for a dissertation.

Design and Experimental Procedures. The design followed a three-group pretest-posttest design. The pretest was administered in a fifteen-minute session. The instructions were that the student list and number ideas about the topic of his or her research paper; the student was encouraged to write down all of those ideas as they would be helpful to the tutor later. The student's proposition count was doubled and reported as the pretest score. The treatment and the posttest were administered simultaneously--the treatment being one set of the heuristic questions (Appendix A) and the posttest being the list of answers or ideas. Time for the treatment/posttest was thirty minutes. No effort was made to teach the students a particular heuristic; they only realized that they were being asked to respond to a series of questions.

At the beginning of the treatment session, each student was given these scripted instructions:

> This afternoon, #name#, I am going to ask you a number of questions about your topic, #topic#. The questions are meant to be probing, but some may sound funny and not make much sense. However, if something, some idea, occurs to you, write it down, or if you prefer you can answer orally and write the idea down after you talk it out--whatever is the most comfortable for you. Any questions so far?
>
> Finally, you might think of me as a computer terminal for the next thirty minutes. As a matter of fact, I'll pretend I am a machine. Not a strange voice or anything like that, but you will have to tell me when you are ready to go on to the next question. Shall we try a couple of questions so you can get the idea. . . .

After a model question or two, the treatment began. During the treatment, a tally of the questions asked and the questions answered was kept. In order to check the tally, a cassette tape was also made of the treatment. Verbal positive reinforcement was given for every other idea. At the conclusion of the thirty minute session, the subject and the researcher talked about the session. Did the session seem valuable? What did the student think about the experience in general? What was the worst question? What was the best question? Why did you answer so many of the questions? This discussion was also taped. At the end of the session, the student was asked not to discuss the treatment with other members of their class who were also participating in the study.

A week after the final treatment session, a Likert-type questionnaire was distributed. The subjects had completed rough drafts of their research papers by this

time. Seven of the questionnaires were completed at that time; four questionnaires were left with the composition teacher for students who were absent, and they were returned three days later.

Findings

Test of Hypothesis One. The first hypothesis--that freshman composition students would answer seventy-five percent of the non-data conditioned questions presented--was supported. The students answered 228 of the 252 questions proffered, slightly over ninety percent. Specific results are presented in Table 1. Five subjects answered every question. Only one subject failed to answer seventy-five percent of the questions.

Test of Hypothesis Two. Since there was a significant difference in the performance (number of ideas generated) between the pretest and the posttest, the second hypothesis, as expressed in the null form, was rejected. A t-test for correlated samples was used to statistically analyze the data and gain a probability of .001 (Table 2).

Test of Hypothesis Three. Using ANOVA, the null hypothesis--that there was no significant difference between the three treatment groups--was retained (Table 3). Type of heuristic approach appeared not to matter, with respect to quantitative performance.

Test of Hypothesis Four. The implied prediction in this

attitudinal hypothesis was supported, for there was indeed no significant difference in the positive attitude toward each of the treatments. Although the specific probability was not calculated, the F-ratio was less than one (Table 4). Therefore, type of heuristic approach appeared not to make a significance difference in overall student attitude. See Appendix B for a more detailed analysis of the questionnaire.

Conclusion

Stimulating invention in English composition through non-data conditioned questions patterned after three popular heuristics appears to have some merit based on the findings in this study. Each treatment made the subject think in some detail about his or her topic, even though the questions were asked in a random order and confined within a thirty minute time limit. In short, the study has validated the questions which will now be programmed for computer-assisted instruction in invention. The proposed dissertation topic remains promising.

In addition to validating the questions, the study itself became an instrument of insight for other important considerations. Let me close by sharing five such observations.

1. The process of scoring ideas with propositional analysis alone is quite limiting. A summative scale for the counting of ideas may be more appropriate.

2. The scoring or counting of the ideas on the pretest and on the posttest should be done by committee. Either this proposition analysis instrument could be evaluated for its reliablity, or the mean score of each subject's test as evaluated by this knowledgeable panel could be reported.

3. Eventually, the treatment questions begin to look alike despite the differences in the heuristic perspectives. Such a phenomenon either speaks to the richness of the heuristic models or to the hypnotic effect of generating over 250 questions. I would hope that the first supposition is truer than the second.

4. After being asked a question, subjects often asked, "Do you mean. . . ?" The computer response was always an affirmative one, e.g. yes, fine, okay, right. Some of these sequences were most interesting, for the student had to do twice the work in creating an appropriate question and an appropriate answer. Here is one example:

> Researcher: What are the contradictions in the acts concerning #Easter 1916 Rising#?
>
> Subject: Do you mean like laws? Is that what you are talking about?
>
> Researcher: Okay.
>
> Subject: Let's see. The Acts in Ireland. Home Rule was one. Everything is an act; they pass acts all the time. And at this time, it got to where the acts did not mean anything. You know, there were so many people and so many acts to memorize, whatever, to know what you need to go by.
>
> Researcher: Very good. . . .

5. A tendency for some students to reject or act negatively toward ideas as they said them the first time was noted over and over again. I wonder what the implications of this behavior will be when they will be required to write down their ideas during the CAI treatments. Somewhere in the instructions must be the phrase "withhold evaluation of your ideas; let's just collect as many as we can now."

As it happened, these developmental insights as well as some others seemed as significant to me as the significant findings. Perhaps these are the good consequences of empirical exploration, particularly a quantitative exploration of rhetorical invention. Rephrasing Boris Pasternak (1960), who knows if the riddle's answered of what's in the mind; but educational research--like autumn silence--is always deep in detail. I have just begun raking up the details.

Table 1

Results for Hypothesis 1

Student	Questions Answered	Questions Asked	Percentage
A1	24	24	100%
A2	23	28	82%
A3	18	21	86%
A4	22	22	100%
B1	23	25	92%
B2	15	15	100%
B3	29	40	72%
B4*	--	--	--
C1	8	8	100%
C2	24	26	92%
C3	27	28	96%
C4	15	15	100%
Total:	228	252	90.5%

*Subject B4 withdrew from the study.

Table 2

Results for Hypothesis 2

Student	Pretest	Posttest	D	D^2
A1	26	48	+22	484
A2	10	34	+24	576
A3	10	19	+9	81
A4	20	31	+11	121
B1	16	33	+17	289
B2	12	42	+30	900
B3	14	19	+5	25
B4*	(15)	(31)	(+16)	(256)
C1	8	23	+15	225
C2	10	46	+36	1296
C3	24	34	+10	100
C4	14	23	+9	81
		Total:	+204	4434

$t=6.28$, $p<.001$

*B4's scores were determined as follows. Pretest score represents the mean of all the pretest scores of the other subjects. Posttest score represents the mean of the posttest scores for Group B.

Table 3

Measures and Summary for Hypothesis 3

Group A "Aristotle"		Group B "Burke pentad"		Group C "tagmemic matrix"	
$X_1(D)$	X_1^2	$X_2(D)$	X_2^2	$X_3(D)$	X_3^2
+22	484	+17	289	+15	225
+24	576	+30	900	+36	1296
+ 9	81	+ 5	25	+10	100
+11	121	(+16)*	(256)	+ 9	81
+66	1262	+68	1470	+70	1702
ΣX_1	ΣX_1^2	ΣX_2	ΣX_2^2	ΣX_3	ΣX_3^2
$\bar{X}_1=16.5$		$\bar{X}_2=17$		$\bar{X}_3=17.5$	
			$\bar{\bar{X}}=17$		

*B4's $X_2(D)$ score represents mean difference. See note, p. 16.

Summary of ANOVA of the Three Groups

Source of Variance	SS	df	MS	F	Level of Significance
Between groups	2.0	2	1.0	.0093	ns
Within groups	964.0	9	107.111		
Total	966.0	11			

Table 4

Measures and Summary for Hypothesis 4

Group A "Aristotle"		Group B "Burke pentad"		Group C "tagmemic matrix"	
X_1	X_1^2	X_2	X_2^2	X_3	X_3^2
+15	225	+11	121	+11	121
+ 6	36	+13	169	+11	121
+17	289	+14	196	+10	100
+13	169	(+13)*	(169)	+11	121
+51	719	+51	655	+43	463
ΣX_1	ΣX_1^2	ΣX_2	ΣX_2^2	ΣX_3	ΣX_3^2
$\bar{X}_1$=12.75		$\bar{X}_2$=12.75		$\bar{X}_3$=10.75	

$\bar{\bar{X}}$=12.08

B4's score represents group B's mean on the questionnaire.

Summary of ANOVA of the Three Groups

Source of Variance	SS	df	MS	F	Level of Significance
Between groups	10.67	2	5.335	.6467	ns
Within groups	74.25	9	8.25		
Total	84.92	11			

Appendix A

Each of the heuristic question pools, after a question is asked, branches to an exploration subroutine. This subroutine asks the student to describe, give another detail, take a guess, list one more idea, anything else, etc. In other words, the subroutine attempts to exhaust the invention potential of each question. At some point, the student asks to go on to the next question.

Five sample questions from Aristotle's topics are:

1. What is the opposite of T? (T=topic)
2. How does time affect T?
3. What has already been decided about T?
4. What still needs to be decided about T?
5. What are the good consequences of T?

Total questions: 65

Five sample questions from Burke's dramatistic pentad are:

1. What impresses people about the setting or scene of T?
2. How should people behave or act today considering T?
3. What do psychologists say about T?
4. How is T like mercury in a thermometer?
5. Does everyone agree that T has the same purpose?

Total questions: 133

Five sample questions from the tagmemic matrix treatment are:

1. What makes T, T?
2. How is T like a spiral?
3. How is T like a plant? What is the seed idea? The roots? The branches? The blossoms?
4. Your topic, T, exploded. Everything around it is flying around. You are ducking to get out of the way. Describe those things flying past you? List as many as you can imagine.
5. Take a mental photograph of your subject? What do you see? . . . Now enlarge that photograph, focus on a detail in the image. Describe what you see.

Total questions: 71

APPENDIX B -- Question mean in margin. Range: +2 to -2. Agreement charge down middle.

NAME: _____

ATTITUDE QUESTIONNAIRE TOWARD PREWRITING SESSION CODE: _____

Directions: Please read each of the following ten statements and then check the appropriate response as to whether you Strongly Agree, Agree, are UNdecided, Disagree, or Strongly Disagree with the statement.

Mean		Agreement Charge →	SA	A	UN	D	SD
0	1. Usually when I begin writing a paper, I don't have enough ideas to write about.	+	( )	( )	( )	( )	( )
+.9	2. After the prewriting session, I believe most freshman college students need help with prewriting.	+	( )	( )	( )	( )	( )
+1.8	3. The prewriting session helped me explore my topic.	+	( )	( )	( )	( )	( )
+.5	4. I would have responded differently if the questions had been displayed on a computer screen.	-	( )	( )	( )	( )	( )
+1.4	5. The prewriting session helped me organize my paper.	+	( )	( )	( )	( )	( )
+1.9	6. The prewriting session helped me discover two or three ideas which I had not thought about before.	+	( )	( )	( )	( )	( )
+.8	7. I have eliminated some of the ideas I had during the prewriting session in order to write the paper.	+	( )	( )	( )	( )	( )
+1.5	8. The prewriting session taught me to ask more of my own questions when I prewrite a paper.	+	( )	( )	( )	( )	( )
+1.4	9. The prewriting session made the writing easier.	+	( )	( )	( )	( )	( )
+1.7	10. If I had another paper to write, I would volunteer for another thirty-minute prewriting session.	+	( )	( )	( )	( )	( )

Comments: _____

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STIMULATING INVENTION IN ENGLISH COMPOSITION THROUGH COMPUTER-ASSISTED INSTRUCTION: A RESEARCH PROPOSAL

CHAPTER I: THE PROBLEM

Introduction

Invention is the process of exploring a topic to discover ideas and then exploring the ideas to discover the most suitable arrangement for conveying those ideas to an audience. Richard Young, in his bibliographical essay entitled "Invention: A Topographical Survey" (1976), describes the process this way:

> Every writer confronts the task of making sense of events in the world around him or within him--discovering ordering principles, evidence which justifies belief, information necessary for understanding--and of making what he wants to say understandable and believable to particular readers. He uses a method of invention when these processes are guided deliberately by heuristic procedures, that is, explicit plans for analyzing and searching which focus attention, guide reason, stimulate memory and encourage intuition. (p. 1)

Within recent years, many English composition teachers have returned to a fuller rhetorical model for teaching writing; consequently, they have searched for methods of stimulating invention, the first rhetorical art, in their composition courses. A method which has not been attempted, to my knowledge, is stimulating invention through computer-assisted instruction. The marriage of invention strategies and instruc-

tional computing could be a happy one indeed.

First, therefore, I propose to write and program three CAIs which systematically guide freshman composition students through an invention process. The three CAIs are based upon (1) Aristotle's topoi, (2) Burke's pentad, and (3) Young's, Becker's, and Pike's tagmemic matrix. Second, I propose to collect, analyze, and compare quantitative and qualitative data in order to describe respective achievement profiles and make appropriate generalizations to freshman composition students. Third, I propose to survey students' attitudes toward CAI-prompted invention.

Background of the Problem

Because invention is the most difficult rhetorical art to describe accurately, it is the most difficult rhetorical art to teach effectively. Consequently, invention, pre-writing, and "thinking about a topic" are ideas English composition teachers often use recklessly in their composition classrooms. Invention's domain is an "undiscover'd country" within each of us; therefore, teaching invention effectively means guiding each student's individual search for ideas. While we cannot predict what the students will discover, we can prompt them to make discoveries. We can provide systematic strategies or procedures. Again, Richard Young (1976) describes "certain aspects of the process" which can

be taught:

> The procedures themselves can be taught, as can their use in conscious thought; but one cannot teach direct control of the imaginative act or the unanticipated outcome. What can be taught is not, however, trivial; no one would question the importance of careful thought in the composing process. Furthermore, the use of heuristic procedures can coax imagination and memory; the intuitive act is not absolutely beyond the writer's control; it can be nourished and encouraged. (pp. 1-2)

Nourishing and encouraging intuitive acts as well as coaxing students' imaginations and memories are, needless to say, fundamental educational goals. They are most certainly activities which go far beyond the English composition classroom. Moreover, they are activities which not only enthrall rhetoricians and composition teachers, but also puzzle philosophers, psychologists, anthropologists, and artists as well.

The majority of the research effort for stimulating invention in composition courses by English educators has been simply to describe pet pedagogical heuristics. Four recent articles in College English illustrate this trend. John Schultz (1977) recounts oral invention procedures in an elaborate in-class "Story Workshop." John Balaban (1977) summarizes his particular set of stylistic directions for having students learn to write poetry. Gracia Grindal and Ellen Quandahl (1977) recount their adaptation of A. L. Becker's pattern of Topic-Restriction-Illustration or "T-R-I." Linda S. Flower and John R. Hayes (1977) combine problem-solving strategies such as arranging the brain-storming fragments in a hierarchical order via simple issue

trees. Such work illustrates the importance of the invention process to many composition teachers, but virtually none of these descriptive studies has appropriately tested and measured the data to determine the significance of the particular invention strategy across an appropriate sample. Why?

Let me suggest two reasons. First, the individual student interaction within the specific method is not available to the researchers. Despite their best intentions, researchers have been physically unable to record the various inductions, deductions, and intuitive leaps which a student makes while inventing. Second, evaluating the idea collecting process is a most difficult chore. What specific idea collecting processes should be evaluated? How should they be evaluated? Is it done by simply counting the number of ideas gathered? Is it done by calculating the propositions or topic-comment ratios? Is it done by calculating the mean time difference between the appearance of separate ideas? Or is significance better gauged by qualitative apparatus alone, such as participant observation, case study, evaluation by experienced judges, survey, or questionnaire? To my knowledge, few efforts to establish quantitative and qualitative criteria for testing and measuring various invention strategies have been made.

Both dilemmas--no transcript of individual interactions and no established quantitative or qualitative criteria for evaluating significance in invention--could be fruitfully

studied by having students initially explore a topic while engaged in an instructional computer module. Thus, CAI becomes a technological means for a rhetorical end, since each student's run could be stored and a transcript provided the researcher. An analysis of the transcripts would likely produce an appropriate and consistent list of criteria.

Questions to be Answered

1. To what extent, if any, are three of the more popular composition heuristics in a CAI format effective for stimulating quantity of ideas and quality of composition plan?

2. To what extent, if any, is any one heuristic more effective for stimulating quantity of ideas?

3. To what extent is any one heuristic more effective for stimulating the organizational quality of a composition plan?

4. What are students' attitudes toward these CAI invention modules?

Statement of Hypotheses

Two hypotheses will be tested at the .05 level of significance. They are:

$H\emptyset_1$: There is no difference with respect to the number of ideas generated among the four groups as measured by proposition analysis and a t-test for nonindependent samples.

$H\emptyset_2$: There is no difference in the quality of composition plans among the four groups as evaluated by a panel of experienced composition teachers and as statistically described with one-way analysis of variance (ANOVA).

A third hypothesis will be tested at the "greater than .35 level" of significance, i.e. the closer to an F-ratio of one the better. This hypothesis is:

$H\emptyset_3$: There is no difference among attitude scores of the three experimental groups as measured by a Likert-type questionnaire and ANOVA.

CHAPTER II: REVIEW OF RELATED LITERATURE

Overview

For the overall review of invention, Richard Young's "Invention: A Topographical Survey" in Teaching Composition: 10 Bibliographical Essays (1976) is excellent. Young has surveyed invention applications from Plato to Pike. The most valuable CAI sources to date have been Roger Levien's The Emerging Technology (1972), Anthony G. Oettinger's Run, Computer, Run: The Mythology of Educational Innovation (1969), and Ellen Nold's "Fear and Trembling: The Humanist Approaches the Computer" (1975).

Theoretical Premises of CAI Modules

The theoretical premises for each of the instructional modules have been distilled from the following literature. The CAI questions based upon Aristotle's topics are adapted

from the Rhetoric (1954), specifically II (23): 1397a7-1400b35. The CAI questions based upon Kenneth Burke's dramatistic pentad are adapted from The Grammar of Motives (1969). Finally, the CAI questions based upon the tagmemic matrix are derived from Rhetoric: Discovery and Change by Richard E. Young, Alton L. Becker, and Kenneth L. Pike (1970).

The literature regarding CAI in English education is relatively small compared to the massive amount of literature on invention and on composition in general. Nevertheless, CAI in English has to date had the greatest impact on reading, grammar, and spelling drills. While ample material is available on computers in education, this proposed dissertation will be among the first to program open-ended heuristic strategies. Patrick Suppes' course, "Introduction to Philosophy," at Stanford University is CAI-based. Such CAI modules allow each student to pursue various heuristic strategies in order to logically probe for individual "discoveries" in order to prove thirty philosophical theorems. Obviously, his CAI reprints will be most helpful.

Bibliographical Search

A two-year ERIC search matching nine descriptors uncovered seven recent items pertaining directly to CAI in English education. The two-year ERIC search lists 670 entries for "Computer Assisted Instruction, Computer

Oriented Instruction." A ten-year report bibliography from the Defense Documentation Center uncovered over 500 items on computer-assisted instruction. Appropriate materials have been ordered.

Arrangement of Literature Review

In an interdisciplinary study, a tension normally exists between the amount of literature reviewed in the respective areas. Such a tension exists here; however, I expect this chapter to be a balanced review of the instructional matters which relate both to invention strategies and to instructional computing.

CHAPTER III: METHODOLOGY

Description of Research Methodology

This investigation necessitates two distinct phases. The first is the development of the three CAI programs; the second is a quasi-experimental study which investigates relationships among four sample groups.

Research Design

What follows is the delineation of the structure and the strategy of the quasi-experimental study.

E_1:	T_1	X*	T_2	X*	T_3	(N=12)	
E_2:	T_1	X'	T_2	X'	T_3	(N=12)	
E_3:	T_1	X''	T_2	X''	T_3	(N=12)	
C:	T_1	·	T_2	·	T_3	(N=12)	Total N=48

Legend:
E = experimental group
C = control group
X* = CAI, topoi
X' = CAI, pentad
X'' = CAI, tagmemic matrix
· = no treatment
T_1 = pretest
T_2 = practice test
T_3 = posttest
N = number

Complete and ideal randomization of subjects to groups is impractical since the groups will be organized already into freshman composition courses. The experimental treatments will be assigned at random to the specific classes; therefore, the twelve volunteers in each class will then inherit one of the three experimental treatments or the control group. Moreover, since such a design allows students to take both a pretest (T_1) and a practice test (T_2), test interaction effects can and will be factored out statistically by analysis-of-covariance.

Those forty-eight freshman composition students at The University of Texas at Austin who participate in the experiment can be generalized to freshman composition students at most large, four-year universities. For some audiences, this sample may be cautiously generalized to most freshman composition students. Of course, each participant in the experimental groups will receive instructions about operating the computer terminal.

Pilot Studies

Two pilot studies will be conducted. The first study, scheduled for the summer of 1978, will establish the face and construct validity of the heuristic questions. Face validity will be determined question by question within each heuristic program; it is predicted that at least seventy-five percent of the non-data conditioned questions will be answered by the subjects. Construct validity, likewise, will be based on those student comments about readability and comprehensibility made during the treatment. The sessions will be taped. Even though this first pilot study will not be "on-line", an attempt will be made to test the first null hypothesis, i.e., there is no difference with respect to the number of ideas generated...as measured by proposition analysis and a t-test for nonindependent samples.

The second pilot study, scheduled for the fall of 1978, will analyze the respective computer-assisted instructions as computer-assisted instructions. Such matters as frame clarity, subroutine branching, clarity of program instructions, personalization, and computer graphics will be evaluated. Recommendations from interested faculty and selected freshman composition students will be sought. These findings will enable the researcher to "debug" the CAIs prior to the major experiment scheduled for the spring semester of 1979.

CHAPTER IV: FINDINGS (ANALYSIS AND EVALUATION)

CHAPTER V: SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Postscript

At this year's Conference on College Composition and Communication, I had the opportunity to speak on the panel entitled "Technology and Composition: Computer-Assisted Instruction." After the formal presentation, I asked my audience to complete a questionnaire on prewriting and instructional computing. The responses verified my suspicions that relatively little time is spent in composition courses on prewriting or invention strategies. In fact, not one respondent recalled any programmed materials or computer programs which attempted to teach the inventive process. A few respondents mentioned CAI modules in basic skills, mostly drill and practice programs. Some respondents were kind enough to send follow-up letters. For example, Michael G. Southwell of York College wrote:

> My own rather rudimentary feelings are that prewriting is not a subject matter which is susceptible to CAI treatment. At least as I teach it, prewriting is a time to try out all sorts of things, however crazy they may seem; to jumble out lots of ideas, with the expectation that some or most of them will eventually be discarded. My experience has been that the problem of most students is that they think they have nothing to say; for me, anyway, freewriting is a good way to show them that they have a lot to say, even more than they need. I can't see how this understanding could come from a CAI program. But maybe this is my blindness. Anyway, I'm eager to see what you're able to come up with.

Likewise, William J. Schultz, Chairman of the English Department at Muskingum College, wrote:

> . . .I can't resist mentioning the nagging humanist doubt that afflicted me during that meeting. Having recently taught Walden, I kept hearing a voice saying "Pay no attention to the enticing lights and siren screen; Ohio and Texas, it may be, have nothing important to communicate." But another voice kept answering "Even if the medium isn't the message, the medium makes the message inevitable. John Field and John Farmer are both truck drivers now, and who could have imagined, before someone invented CB, how much they have to say to one another." I mention this because I appreciate and applaud your humanizing intentions and I accept, though a bit reluctantly, your persuasive argument that computer instruction must and will be commonly used.

I suspect these two comments reflect both the curiosity and the reluctance many English educators feel today about the emergence of the computer in English instruction. Like Professor Southwell, I'm eager to see what I'll come up with. Like Professor Schultz, I applaud my intentions. But unlike Professor Schultz, I am absolutely convinced (albeit by my own persuasive argument) that computer-assisted instruction must and will be commonly used. Clearly, this proposed research must be done.

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