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ABSTRACT

A study is reported that examined the relative effectiveness of four computer-assisted-instruction (CAI) manners of presentation and response for teaching irregular verbs to English/Spanish bilingual students in South Texas. Each of 4 types of CAI presentation gave the same 46 selected irregular verbs in context to fifth-graders in 4 subject groups for seven 55-minute periods. The manner of presentation included the following: visual only, visual plus emphasis (enhanced, highlighted text), visual plus kinesthetic (multiple choice format), and visual plus emphasis plus kinesthetic. Findings suggest that the visual plus kinesthetic or the visual plus emphasis approaches are the most effective. The results illustrate simple, easily programmable ways for language teachers at all levels to improve and enhance teacher-prepared computer software in a low-cost manner. Contains 5 references. (Author/LB)

IMPROVING TEACHER-PREPARED COMPUTER SOFTWARE FOR BETTER LANGUAGE TEACHING/LEARNING

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ABSTRACT

Report of a study conducted to examine the relative effectiveness of four C.A.I. manners of presentation/response for teaching irregular verbs to South Texas English/Spanish Bilingual students. Each of four manners of presentation presented the same forty-six selected irregular verbs in contexts to four subject groups for seven periods of fifty-five minutes each. Rank ordering of the results will be presented.

The results of this study illustrate easy-to-program simply ways to improve and enhance teacher-prepared computer software and to ensure that those dealing with the low-budget concerns of language teachers at all levels can get the most benefit out of their programming efforts.

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Computers have been increasing more apparent in the West since the 1940s. From the mid-1970s on — since the appearance of the microcomputers — the American educational complex has accepted the new computer technology and has integrated it more and more into the educational scene. Along the way, however, certain rather basic questions have remained unanswered, and, in some cases, unframed. For example, the most effective C.A.I. manner of presentation for teaching verbal materials to certain grade levels has remained undetermined as also has the most effective C.A.I. presentations for teaching mathematic materials. Considerations on most effective time spans for student-computer interaction, for alternating student-computer interaction with student-teacher interaction, and for alternating student-computer interaction time-on-task with student assimilation and accommodation "sinking-in" time have remained as questions needing answers. While C.A.I. has provided the support necessary for the wings of some fledgling students, for others it has simply provided an expensive media alternative for a much cheaper drill book!

In an effort to meet the demand for educational courseware, manufacturers have rushed to the market with software of varying quality at all levels in an attempt to fill the need. However, because the needs of students and teachers have not been adequately and systematically met, educational computing has remained in danger of not living up to its potential, especially in the fields of English-as-a-Second-Language (ESL) or foreign language teaching. To paraphrase Hope, Taylor and Puscak, "The remarkable capabilities of computers [are] of very little value when programs [do] not reflect sound pedagogy." (Hope, Taylor, and Puscak, 1984).

The study I will report on today sought to determine the relative effectiveness of four manners of presentation in non-commercial C.A.I. materials designed to serve a specific educational population — i.e., selected Spanish/English Bilingual South Texas fifth graders -- for a specific academic purpose — i.e. to teach English irregular verbs. The two-hundred eleven fifth graders in the treatment portion of the study were randomly assigned to one of four treatment groups of similar composition which received C.A.I. programmed in one of four manners of presentation which I shall explain in great detail shortly.

The gist of the research was logical. After all, if a particular manner of presentation in C.A.I. were found to effect the most significant difference, a programmer would be well advised to incorporate that "best" manner of presentation into his/her software. I felt that this kind of knowledge could enable a programmer to integrate simple-to-program changes in the manner of presentation format(s) of their software designs. Should such a consideration as relative effectiveness in manner of presentation be taken into account in designing software, the academic effectiveness of the material should be more successful as well.

Before I go on any further, I would like to give you a working definition for "Manner of Presentation." For the purposes of my study, "manner of presentation" refers to the

1) VISUAL (V) = plain unenhanced text with multiple choice format for drill and practice section in which subject has only to key-in the character "A" or "B" rather than the entire word;

2) VISUAL + EMPHASIS (V+E) = enhanced text consisting of highlighted words and/or phrases with multiple choice format for drill and practice section in which subject has only to key-in the character "A" or "B" rather than the entire word;

3) VISUAL + KINESTHETIC (V+K) = plain text with multiple choice format for drill and practice section in which subject has to key-in the entire word; and

4) VISUAL + EMPHASIS + KINESTHETIC (V+E+K) = enhanced text with multiple choice format for drill and practice section in which subject has to key-in the entire word.

5) CONTROL GROUP = no Computer Assisted Instruction.

As a general rule, researchers do not undertake experiments and/or studies without having made some assumptions in advance. And, following suit, I assumed that:

1) Computer Assisted Instruction would assist bilingual students to learn effectively if the material were presented in a pedagogically sound fashion.

2) particular manners of presentation of material would prove more effective than others in teaching the specific verbal materials, and

3) learning was determined as having taken place when the student was able to write more correct irregular verb forms on a post-test administered after seven sessions with the ESL C.A.I than he or she had written on a parallel pre-test administered before instruction had begun.

The subjects in the study shared common socio-economic profiles, grade level, and language development levels. They encountered and processed the same tests, the same instructional materials, the same directions, and the same hardware/software locations within the same time frames, and deait with the same instructor — i.e., moi. Additionally, to counter possible instructional contamination, the students' classroom teachers were specifically requested to omit any instruction whatsoever on irregular verbs for the duration of the study. Statistical analyses included attention to such parameters as indicated above and were made in relation to distribution of subjects among the four different C.A.I. manners of presentation formats and the one control group. Highest statistically significant pre-post test gains indicated the most effective format for this body of subjects under these treatments.

The fact that the treatment was an addition to the subjects' regular curriculum may have introduced a fatigue factor. In contrast, of course, the fact that the experience constituted "additional" work may have extended either the subjects' increased focus or their simply getting the extra work done in as efficient and speedy times as possible. Finally, the subjects' obvious enthusiasm to work within a "high tech" environment may have developed and maintained an increased attention to on-task details and an increased dedication to high performance that may dissipate over time or may not be counted on in other settings. Whatever fatigue factors or increased focus and motivation which may have arisen were distributed among all the groups.

Through my interpretation of the data, I project that the results of this study would be applicable to other South Texas elementary school groups and to the treatment of other English grammatical concepts, particularly those of much lesser complexities than those of English irregular verbs. I further project that similar effects and viable strategies would occur with adult

E.S.L. students working through the same formats and under similar constraints.

The computer software for all four treatment group manner of presentation formats was programmed by me for use on the Commodore 64 microcomputer. Although the C-64 is a powerful little tool, it is considered by some to be at the "low end" of personal computers because of its low memory — i.e., 64K in RAM — and because of its comparatively inexpensive price — i.e., complete system approximately $800.00 in 1985, $600.00 in 1988. For the purposes of my study, large amounts of computer memory were not required, thus the C-64 provided more than adequate memory capacity. In addition, it was chosen as the machine of preference for this study over Apple IIs or IBM PCs for the very simple reason that I was lent a complete laboratory of fifteen C-64 computers and color monitors by the School of Education at The University of Texas at Austin for the duration of this study.

The software was subsequently developed by me after careful consideration of 1) which irregular verbs to use, 2) the reading level of the average fifth grade student, and 3) the interest level of the sentences constructed for the drill and practice. Each lesson consisted of a short entertaining introduction section, a short tutorial, and a drill and practice section. The content of each treatment lesson was identical and the only changes were in the manners of presentation.

Visual ("V"). As a given was the fact that all four treatments contained a visual element. However, the one C.A.I. treatment which consisted of a screen manner of presentation of simple print coupled with a multiple choice test item format in the drill and practice portion of the program I called, "Visual" or "V." The "V only" manner of presentation served to focus recognition and selection skills wherein the student was required to select the correct answer from choices labeled "A" or "B."

Visual + Emphasis ("V+E"). The second treatment group consisted of the identical material programmed for the "V" manner of presentation but was varied by the addition of "emphasis" through the highlighting of key words and/or concepts. Computer monitors generally have a dark background with lighter colored characters and emphasis is generally achieved by means of a light-colored bar with dark-colored letters superimposed on its face. I called this manner of presentation "Visual Plus Emphasis" or "V+E." This manner of presentation served to focus the activity for the student.

Visual + Kinesthetic ("V+K"). The third treatment group consisted of the identical material programmed for the "V" manner of presentation but was varied by the addition of a kinesthetic element. Instead of keying-in the correct answer via a letter in the multiple choice test item format in the drill and practice portion of the program, the student was required to key-in -- in other words, spell — the entire correct answer. The answer choices in the drill and practice, however, were not preceded by the letters "A" or "B." Instead, only the two possibilities were presented. I called this manner of presentation "Visual Plus Kinesthetic" or "V+K." This manner of presentation served to focus on production skills on the part of the students.

Visual + Emphasis + Kinesthetic ("V+E+K"). The fourth treatment group consisted of the identical material programmed for the "V" manner of presentation, plus the addition of emphasis as described above as "V+E," plus the addition of a kinesthetic element as described above as "V+K." And I called this manner of presentation "Visual Plus Emphasis Plus Kinesthetic" or "V+E+K."

Control Group. The fifth group consisted of students who did not receive any computer assisted instruction at all.

The content items in both the Pre- and Post-Tests and the treatment materials were identical. The sentences in which the content items were presented were identical for all treatment groups.

The forty-six verbs used in the study were chosen according to several criteria. Most came from the class textbook — Macmillan English (Grade 5) — but 10% were chosen from the list of irregular verbs found in Quirk and Greenbaum's A Concise Grammar of English.

Fifty-five percent of the verbs were presented in the past tense and forty-five percent were presented in the past participle form.

The nature of the treatment — i.e., C.A.I. — ensured that all treatment groups received identical general instructional content. The only significant difference in instruction was that of manner of presentation. So, the only instruction in the use of irregular verbs for the duration of the study was that presented via the computers.

The actual exposure time to the treatment followed the time schedule of the Middle School and with very few exceptions — i.e., a fire drill which affected the length of two classes — was identical for all subjects in all groups. The different manners of C.A.I. presentation were programmed to be identical in length, that is, approximately 45 minutes of computer exposure per session. Furthermore, the Pre- and Post-Tests were timed with a stop watch and were identical in length for all groups as well.

Generally, the constraints of the school class period held to a minimum the time variability of the subject's exposure to instructional materials and tests. Some manners of

presentation — i.e., those with a kinesthetic component — resulted in longer periods of time required by most students to complete the Drill and Practice sections but all groups had ample time to complete the lesson for the day. Time on task was not one of the variables examined in this study.

Some of the subjects noticed and commented on the fact that different computer screens "looked different but said the same thing" but none was concerned by such a discovery. In fact, enthusiasm for the project was quite high for all of the subjects. Nevertheless, the enthusiasm of the subjects did not pose a problem since the constraints of the extreme automated features of the C.A.I. served to contain any excessive enthusiasm and control any possible proclivity for tinkering on the part of the subjects. In short, since this was a research study, very little user control was available and the subjects were required to proceed through the treatment software with little deviation.

All fifth grade subjects were provided equal access to the treatment via C.A.I. The only selection, per se, was an arbitrary assigning of each student to a treatment group. No attempt was made to balance each individual class evenly by sex since some classes were composed of uneven numbers of males and females and I had no control over that fact. As students entered the computer lab for the first time, the master list of names was consulted and the students were given an assignment — i.e., first male = "V," second male = "V+E," third male = "V+K," fourth male = "V+E+K" then first female = "V," second female = "V+E," third female = "V+K," fourth female = "V+E+K." The next groups were assigned following the same pattern until all students were assigned to a treatment group.

Each treatment segment lasted four school weeks. Each of the ten fifth grade English/Language Arts classes contained from twenty-four to thirty students. During the first four-week period, the students from four teachers' classes participated. During the second four-week period, the students from the next four teachers' classes participated. During the last four-week period the last two teachers' classes participated. One half of each teacher's class population would remain in place one day as the other half came to the computer lab — i.e., Group A. The following day the groups would be reversed and those who had gone to the computer lab would remain with their regular teacher and those who had remained with the regular teacher would come to the computer lab.

Using the Instructional Design Models set out by Dick and Carey; Briggs, et al; and Kemp, I designed all of the materials. After determining which irregular verbs were to be used, all Pre- and Post-Tests were written; field-tested with a small group of fourth, fifth, and sixth graders in Austin, Texas for readability and for ease of administration; and, finally, mimeographed by me.

The Orientation and Practice Session materials were adapted for the C-64 from materials which I had originally developed for use on the Texas Instruments 99-4a for sessions which I taught at a children's computer camp held in Austin during the summer of 1983.

The seven C.A.I. lessons written and programmed by me on the C-64 at the fifth grade reading level consisted of three major parts:

1) The computer program began with a short section consisting of an entertaining section which varied from visual jokes to lexical jokes at the beginning of each treatment session. I wanted to be certain that the subjects began each session in a relaxed mood and chose the computer as the means for ensuring that the subjects would, in fact, feel at ease.

2) The program continued with a slightly longer tutorial section which followed the entertaining introduction to each treatment session. The tutorial sections began with the computer "telling" the students simple facts about irregular verbs — i.e., rules for using, how to recognize, et cetera — and each succeeding lesson had an increasingly more complicated set of grammatical facts and rules concerning English irregular verbs presented.

3) Following the tutorial section, the computer presented a short story in the form of sentences which contained one unmarked — i.e., present tense — irregular verb in each. Although a definite story-line was developed, this section was, in actuality, the drill and practice session. Depending upon which modality was being tested, the subject was required to either key-in a letter ("A" or "B") to identify the grammatically appropriate verb — i.e., in Past Tense or Past Participle Tense — or to key-in the entire word which would complete the sentence in a grammatical fashion. Although the subjects were required to key-in the correct answer, the two forms of the verb were displayed on the screen just as they were for the subjects who were to key-in the letter.

4) The score for each lesson was tallied by the computer and recorded by me at the end of each session. If the subject scored less than a certain percentage correctly on each lesson, the computer was programmed to automatically present a pre-determined number of additional sentences to complete and those new scores were recorded for me as well.

The "Visual + Kinesthetic" manner of presentation proved to rank highest in terms of learning effects — i.e., the Mean Score of Variable "Difference" (between the Post and Pre-Test scores) — and thus I assert that it was the most effective manner of presentation. The next highest was the "Visual + Emphasis." A Scheffe Range Test showed that the difference in the learning effects between the "Visual + Emphasis" Method and "Visual + Kinesthetic" Method was not statistically significant. The "Visual + Emphasis" and "Visual + Kinesthetic" Methods had the first and second highest scores of the five groups while the Control Group had the lowest score of all. Nevertheless, the most important result is the comparison between the pairs of groups and the control group. Whereas the difference between the "Visual" Method and "Visual + Emphasis + Kinesthetic" Method from the Control group was not statistically significant, the difference between the "Visual + Emphasis" Method and "Visual + Kinesthetic" Method from

the Control Group was statistically significant.

The tight control of this study's structural components and procedural processes allowed the four modes to be sharply compared. Each mode — the strictly visual, the elaborated-by-enhancement visual, the elaborated-by-kinesthetic visual, and the elaborated-by-enhancement-and-kinesthetic visual-provided its own specific distinctive features to surround or to contextualize each of its respective verb items. In turn, the subjects of the four treatment groups responded by perceptually registering the verb items within the encapsulations of the respective mode. For each of the seven drill and practice encounters of each of the forty-six verbs, the respective modes retained their specific component features. Thus, not only was the initial storage of a verb item coded/cued/featured/configured, but so were all of the additional encounters. The particular initial pattern of mode + verb effected, then, initial storage by pattern. And the succeeding encounters with the same respective patterns constituted intensifications of the sensory traces: the cumulative elaborations effected increased distinctiveness among the four moded information. The crux of the study, of course, lay in discovering just which patterns for cuing/coding storing/rehearsing/ retrieving would accomplish the strongest imprints.

Obviously, the "Visual + Kinesthetic" mode achieved the strongest degree of memory imprint. As each sentence with the parenthesize morph was visually presented, the two possible forms of the verb were displayed, and the student selected the most appropriate form and then spelled out the selected form. The actual spelling out per se of each answer constituted a rehearsal of the item beyond those rehearsal tasks required/allowed by the "V+E" and the "V." After all, in either the "V+E" or the "V," the student merely read the sentence with

parenthesize morph, surveyed options and then keyed-in the selected option as a simple "A" or "B." Hence, the additional rehearsal-by-spelling of each of the forty-six verbs in each of the seven drill and practice sessions mounts up to three hundred twenty-two more rehearsals than required in either "V+E" or "V." The fact of multiple, cumulative elaborations within the "V+K" provided it with an overwhelming mechanical/modalic edge for superiority over the "V+E" and "V".

The "V+E" mode followed closely behind the "V+K"; in fact, both the "V+K" and the "V+E" were not statistically different from each other, but they both were statistically different from the "V+E+K," "V," and, as propositoned, the control. The enhancement-by-highlighting in "V+E" of the parenthesize morph and of the two options provided a straight-forward focus and maintenance of attention of the verb items under consideration and required a straight-forward, efficient, speedy registration of choice with a simple "A" or "B".

The notion of "the more, the better" fell on barren ground with the "V+E+K" mode. The parenthesize morph and the two options were highlighted to focus and maintain attention on the verb item under consideration and then, in addition, the selected item had to be spelled out. The intensification of attention — the immediate focus and the replication of focus via highlighting — may have begun a processing momentum only to be impeded by the pedestrian requirement to spell out the whole answer. Chu's "amount of invested mental effort (AIME)" may have been triggered in "V+E+K" students' reluctance to perform the slower, by contrast, chore of spelling the whole answer after attending so closely to the highlighted verbs. Or, perhaps the mode multiplicity of "V" and of "E" and of "K" just caused sensory overload. For whatever the cause, the "V+E+K" proved the second to least effective of the four modes.

// All four modes, of course, scored significantly higher gains than did the control group. Interestingly, even the control group scored gains; an effect which may suggest contagion of the control group by the treatment groups. After all, playground bragging like "I'm in C.A.I. Why didn't you get to be in it?" may prompt "Oh, yeah. Well, so what? What are you learning that is so special, " and so on. The interesting distribution of significant learning, even by the control group, indicates that irregular verbs are interesting and that four particular differentiated elaborations (illustrated by the four modes) assist the learning of those verbs. In fact, two of the modes — the "V+K" and the "V+E" assist significantly, at least in the study, the learning of those verbs. Whether the "V+K" could have held its obvious lead over time, whether "V+K+ and "V+E" could have maintained their significant differences from "V+E+K" and from "V" over time, and whether the control group could have maintained their learning over time are titillating questions. The administration of a second Post-Test two weeks after the first Post-Test and the administration of a third Post-Test two weeks after the second Post-Test could have provided additional dimensions of possible gain/maintenance/loss over time and of possible rates of gain/maintenance/loss over time. In general, however, the overriding insight appears to favor the mode with the "most-est" elaborated rehearsals of the context — i.e., the "V+K," since it required the most active responses of the treatments.

Because groups two and three (the "Visual + Emphasis" and "Visual + Kinesthetic" Methods) proved to be statistically significant in comparison with the control group and because groups one and four (the "Visual" and "Visual + Emphasis + Kinesthetic") methods proved not to be statistically significant in comparison with the control group, I recommend that programmers use either the "Visual + Kinesthetic" or "Visual + Emphasis" Manner of

Fresentation when preparing C.A.I. Additional extensive research in the neglected field of "most appropriate manner of C.A. I. instruction" could reinforce the finding of this study. Such additional research should certainly involve larger subject populations. Also, an expanded length of both real-time — i.e., an expanded curricular offering and expanded assessment instrumentation — in front of the computers and extended length of "sinking-in" time for the study would strengthen the "learning" effect of the study. As a given, the inventory of irregular English verbs could be enlarged to include more examples from each of the classes of irregular verbs identified by Quirk and Greenbaum (1973). Tighter controls against possible contamination would constitute design prerequisites. A multiplicity of sites for replication may underscore recurring findings. Finally, replication with culturally and linguistically diverse subject populations might prove reassuring or problematic. As such tighter experimental design, controls, and analyses emphasize presentation probabilities for the irregular verbs, the same designs, controls and analyses could be applied to other linguistic concerns. Possibly, such design/control/analysis paradigms might be extrapolated to specific problems in contents other than language. In other words, appropriate research might eventually chart the best C.A.I. manners of presentation for problems in mathematics, social science, science, art, music, health, physical education, and other contents per se of native speakers of English. Then, corollary investigations with non-native English speakers could expand, deepen, and enrich multilingual/multicultural education en toto. The opportunity to research and, therefore, to serve specific linguistic aspects of the Mex-Tex Frontera will beckon for years to come.

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