# AN EXPLORATORY CASE STUDY OF THE IMPLEMENTATION OF ONE COMPUTER ASSISTED INSTRUCTION PROGRAM IN READING

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Kathleen G. Ritchie

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Kathleen G. Ritchie

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## ABSTRACT

Commercially available Computer Assisted Instruction programs and their implementation appear to be having an effect on elementary education. The indiscriminate use of these programs may pose a threat to the quality of education some students receive. This exploratory research: (1) examined the effectiveness of CAI programs in the opinion of past and present educational researchers, through a literature review; (2) discussed the structure of the reading strand of one such program currently in use in some Canadian elementary schools; and through a case study involving a 6 week computer program intervention using 6 high, middle, and low achievers from one grade six classroom (3) reflected on the relevance of this program by measuring: pre- and post-intervention performance on the Gates-MacGinitie standardized Reading Tests. Form D (1965), the Johns Basic Reading Inventory (1994), computer generated program reports and investigator constructed format of instruction attitude questionnaires and self-concept survey. A focus group session documented student perceptions about program use.

Findings in this case study indicated mixed results in terms of reading performance gains for high, middle, and low achieving students. Performance seemed to be affected by personal attributes, program characteristics, and scheduling management and resource limitations.

It was concluded that, in this case students at all levels benefited to some degree but that attitude had more influence on performance than on the entering achievement level. Students remarked on the need for more social interaction to facilitate learning. More detailed research into the

numerous factors that influenced performance is required. Findings suggest that caution is in order in the large scale implementation of computer assisted instruction programs.

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# CHAPTER I

## NATURE OF THE STUDY

In an attempt to facilitate reading instruction there has been a resurgence of commercially available Computer Assisted Instruction (CAI) and Computer Based Instruction (CBI) programs that are having an effect on elementary educational practice in the 90s. The intention to reach large numbers of students at once appears to be similar to the purpose such programs had in the 60s and 70s in Canadian and American industry, the military, and colleges when technology was used to meet very specific training needs. Many educators today welcome such technology, both as a way to offer "teacher proof" instruction and to counter the effect of reduced funding. With computer learning programs, many believe that teachers can handle larger class sizes and that remediation to assist struggling readers can be more easily implemented.

When this technology first appeared, microcomputers and educational software were viewed as a revolutionary sign post, pointing to a new era in educational training. While some computer learning programs seem to have proven themselves successful in presenting content to large numbers of people quickly and effectively there would seem to be many drawbacks to using them in elementary schools. Grade school educators are thus beginning to question the use of CAI programs for teaching reading processes. Indeed microcomputers and their various software have impacted every aspect of public and private education, and the implication is that the effect will be long lasting.

Questions to be explored are whether or not such technological methods are effective. Is the impact of computer-assisted instruction using CAI or CBI

programs what educators and other stake holders want from our educational system, at least in the elementary school years? Also, to what degree should such programs be used in our schools?

This research:(1) examines the effectiveness of CAI programs through a literature review; (2) analyzes the structure of one strand of a program aimed at enhancing reading performance *(SuccessMaker, Reading Investigations*, Computer software, 1993); and (3) reflects on the relevance of this program by conducting an exploratory case study involving six grade six students at three different levels of reading achievement (high, middle, and low) over a period of six weeks.

## Significance of the Study

### Theory

Widespread implementation of computer-assisted learning programs without adequate research into their effectiveness is a concern. Past experience and current theory (Vygotsky, 1978; Glaser & Bassok, 1989; Ruddell, Ruddell, & Singer 1994; Voss, Wiley & Carretero 1995; Palincsar 1998) provide new insight into learning, teaching, and reading processes. These theories reinforce the need to look carefully at the pros and cons of computer instruction programs. For example, Vygotsky postulates a zone of proximal development and a sociocultural theory of learning in which teachers and more knowledgeable peers provide a scaffold to help learners accomplish more than they could working on their own. Depending on implementation, computer assisted instruction programs may not allow for such social interaction. Palincsar (1998) suggests that social constructivism is founded on the co-construction of knowledge through the interaction of social and individual processes and Ruddell, Ruddell, and Singer (1994) cite the work of several researchers demonstrating the positive influence

that social interaction has on language learning.

It was expected that this study would reveal benefits that make computer software programs, as exemplified by the Reading Investigations strand of the Successmaker program, a valuable resource for some students, but not for others. Findings may or may not show that less able students benefit from using this program yet their experience and performance may expose limitations to computer- assisted learning, pointing out that caution in the implementing of such programs is essential.

Research

The underlying concern of this study is that affordable, advanced, computer technology, presently available to school systems, is rapidly changing how we learn, what we learn, and how we can learn. Teachers need to play an important role in understanding and deciding how computers can best assist in the learning process. According to Bitter, Camuse, and Durbin (1993) simulations and tutorials can be valuable learning devices if their use is integrated into the curriculum at appropriate times. Simulations should not serve as stand-alone units, but are most effective when used to illustrate skills, ideas, and experiences first explored by traditional means. According to Bitter, Camuse, and Durban (1993)

> ...the system should never be used as a complete instructional plan for all students, despite the presence of an abundant collection of computer-directed lessons. Discussions, experiments, discovery, peer learning, small group instruction, manipulation of concrete objects, art, music, and many other experiences and learning techniques have an important place in

> lessons. The computerized system does not absolve the instructor from planning for instruction... Language arts packages, in particular, must be used with care. As many writing teachers have noticed, learning grammatical subskills does not automatically contribute to increased student writing skill. The student may answer all test questions correctly for a particular grammar skill. But will they (the correct grammar rules) still be applied when the next composition is written? (pp. 75-76).

Drill and practice, tutorials and simulations can be valuable in assisting students to advance, but this focus should never be considered more than supplemental to classroom study.

Azarmsa (1991) along with Alessi and Trollip (1991) identify computer-assisted instruction as effective in drill, practice, and tutoring on previously studied content. They feel, however, that the efficiency of such instructional programs over traditional methods has yet to be proven.

Bitter, Camuse, and Durbin (1993) contend that computer-assisted programs remain linear for the most part, and ignore differences in student abilities. While conceding that branching tutorials in which users are directed to the area of study identified by pretest performance do exist in some programs, analysis shows their linear pattern is generally resumed from there.

In a discussion of CAI and CBI, Bitter, Camuse and Durbin (1993) recommend that we not prematurely accept the inevitability of robot teachers. Contemplation of the special abilities humans possess and the provision of experiences that are only possible under human guidance, understanding, and

leadership, are strongly advised.

Picciano (1998) refers to the effect educational theorists have had in promoting the use of computers in society and education, pointing out that in this last decade the tendency is to call for a more cautious approach to the use of computers and software in classrooms. Picciano rejects concepts of technocentric instruction that render classroom teachers obsolete and the idea that computer programs can do the job of instruction better than teachers.

Simple CAI, according to Bailey (1993), is gone with the fads of the 1980s. Integration has evolved into a more sophisticated set of computer-based programs. However, evaluations of the many schools that have used an Integrated Learning System program (ILS) have found that even when the use of ILS was supported by staff, outcomes were too complex to measure. There are benefits in the individualization of instruction, the extensive reporting capabilities and completeness of content, but caution was advised in placing too much faith in computer assisted programs and in investing too much time and money in them.

Summary

Both theory and research seem to suggest caution in implementing computer-assisted instruction as a means to educate large numbers of students effectively. The total impact of using such programs must be studied and findings made known to all stake holders in public education before their implementation is measured against financial costs. Only when much further study of program structure, operation, and content has been carried out should decisions on degree of implementation be made.

## Scope of the Study

A Computer-assisted instruction program typically presents information to students in various ways and guides the students through a series of exercises, such as practice and drills or tutorials, and assesses student learning. The purpose of this study is to investigate the effectiveness of one, commercially available, computer-assisted instruction program. To accomplish this a purposive group of 6 students from one classroom was selected to spend 15 minutes per day for a six week period on one strand of a program called *Reading Investigations* (Computer Curriculum Corporation, 1993), a computer assisted program designed to

> ...develop reading comprehension and thinking abilities by guiding students through interesting and challenging reading activities... has three major components...lessons based on excerpts from books, strategy lessons, and a vocabulary strand...the mix and sequence of lessons are determined by the system...on-line resources include a Hint resource...the system records their responses and provides instruction that meets individual needs. (p. 1, Teacher's Handbook).

The students were tested for: (1) growth in reading achievement as measured by the Gates-MacGinitie Reading Test (1965) and the Johns Reading Inventory (1994), administered before and after exposure to the intervention, and the computer program daily course reports and cumulative grouping reports, administered by the program itself, (2) changes in attitude toward the use of educational computer programs using the *Evaluation of Instruction Format Questionnaire* (Appendix A); and (3) changes in attitude toward self as a

competent learner using the *Self Concept Survey* (Appendix B).

Other data sources included: (1) observing students using the program with the intent of noting progress and indications of attitude changes through degree of attentiveness; (2) discussing progress and attitude with individual students periodically to discover their opinion of their own progress and attitude changes; and (3) keeping notes about each student's performance on a daily basis. A focus group session (Gredler, 1996) involving the researcher and participating students was held at the conclusion of the program with the intention of bringing closure for the students and providing an opportunity for them to share information, perceptions, and feelings (Appendix C).

## Clarification of CAI and CBI Terms

There appears to be no consensus regarding a definition of either computer-assisted instruction or computer-based instruction just as there appears to be no one clear concept of best case application. Neither is there agreement on the real benefits or total impact of such programs. Most researchers agree that more study is needed to optimize the structure and function of educational computer programs, be they CAI or CBI. Alessi and Trollip (1991) define CBI programs as similar to CAI programs in that they present information, guide the student through it, provide practice drills, and assess student learning.

Bitter, Camuse, and Durbin (1993) define CAI as the use of computers for instructional tasks. The terms educational software, courseware, CBI (Computer-Based Instruction) and CMI (Computer-Managed Instruction) are also used with no real distinction noted between them. The terms CAI and CBI are used synonymously to describe the application of computers for instructional tasks. The

types of CAI identified are drill and practice, tutorial, simulation, computer-managed instruction, and problem solving. Drill and practice exercises to develop skill or memory are included in tutorials after topics have been introduced and learners have come in contact with facts, relationships, problems and vocabulary. Presented in an interesting format with accompanying audio and graphic support, these sequential learning tasks contain written explanations, descriptions, questions, problems, graphic illustrations for concept development, and drill and practice activities, as well as follow-up exercises to assist the student in skill and subject mastery. There are typically pretests and posttests related to program objectives that determine mastery.

The distinction between "drill and practice", "computer managed instruction", and "tutorials" is often difficult as many computer programs are intended to serve many of the same objectives.

Picciano (1998) also uses the terms CAI and CBI synonymously. CAI, one of the earliest terms used to refer generically to computer applications in education, is typically defined as the use of the computer to assist in the instructional process especially in drill and practice, and tutorials. CBI is also used as a generic term, to refer to the use of a computer as part of an instructional presentation, for example, an interactive video.

Bailey (1993) defines Computer-based Integrated Learning Systems (ILS) as complex integrated hardware/software management systems using computer-based instruction. Characteristically such programs contain specified instructional objectives with related lessons that may fit any standard curriculum. The courseware usually spans several grade levels and is delivered on a networked system of microcomputers or terminals. The management system collects and records the results of student performance.

Synthesis

The definition of Computer Assisted Instruction varies from researcher to researcher much as the use varies from teacher to teacher. Generally speaking though, CAI and CBI involve the use of a computer to present various forms of instruction to students. Computer programs provide for interaction between student and computer systems and are designed to help the student learn new material or improve skills and knowledge of materials previously studied. The programs theoretically are to involve the students actively in the learning process at their own pace, providing reinforcement and immediate feedback. The program types are primarily tutorial, drill and practice, games, and simulations with the promise of discovery and problem solving in future generations of programs. Having identified the primary use as drill and practice with tutorials usually containing a linear series of exercises, these programs traditionally ignore individual student performance. Recently, advanced technology improved the presentation and flexibility of integrated learning systems. Branching and continuous student-centered placement within the programs is now possible with immediate feedback in the most recently available programs. Compared to classroom practice, simulation is one area, that for safety's sake, computer learning systems may excel - in physics, chemistry and driver education classes, for example.

CAI programs are generally viewed as more primitive than CBI programs which are more commonly tied to mainframes or are associated with microcomputers and networks. Computer Managed Information programs (CMI) use the computer to track student achievement and plot the course of studies for each student. CMI programs are more administrative in nature. The danger of integrated CAI, CBI, and CMI programs becoming the whole program and

running independently of teacher instruction is recognized by some researchers.

## Questions for Study

1. In this study, is Computer-Assisted Instruction, as represented by the Reading Investigations strand of the Successmaker program, effective for 6 grade six students. For example, do low-achievers benefit more from this program than middle and high-achievers as assessed by performance on the Successmaker Reading strand's daily course reports and cumulative grouping reports, on the Gates-MacGinitie standardized Reading Tests (1965) and the Johns Basic Reading Inventory (1994)?

2. What is the impact of this computer instruction program on:(1) attitude toward using a specific computer program as an instructional format; and (2) self-concept as measured by the respective questionnaire and surveys (see appendices), and informed by the focus group discussion?

3. Given these results, how appropriate is the use that is currently being made of one such computer-assisted instruction program?

## Definitions of Terms

Aesthetic reading. Reading that is done for the experience of reading itself rather than for what is remembered after having read.

Computer assisted instruction. CAI. As suggested, this term is difficult to define as the definition varies from author to author. Typically it is a computer program that presents information, guides the student through it, provides practice drills, and assesses student learning.

Computer based instruction. CBI. Similar to CAI depending on the author cited. Usually interpreted as a computer program intended to teach some form of skill or segment of content using drills and tutorials.

Computer curriculum corporation. CCC of Palo Alto, California. The reference is to a manufacturer of a computer-based instruction program in reading, language arts, and mathematics. It is used to refer to the computer program that the students participating in this study are familiar with.

Computer management of information. CMI. A computer program system that directs and evaluates the progress of a student through a series of studies and exercises.

Cognitive Psychology. An approach in psychology that tries to interpret behaviour, emotions, etc., in terms of the knowledge or image of reality.

Cognitive skills. Skills used by an individual in constructing an understanding of concepts or events within one's environment. Examples of cognitive skills would be reasoning or problem solving.

Computer-Based Integrated Learning System. ILS is a comprehensive system covering everything from lesson plans to integration of electronic media (Anglin, 1995) in the presentation of educational materials to students.

Constructivism. The concept that knowledge is developed by the student from all experiences and that the opportunities provided a student to 'construct' knowledge are of more significance than the previously constructed 'knowledge' presented to a student by a teacher.

Contract Learning. A unit of study containing specific objectives, like segments of information and skills, assembled in a workbook-like package, that is contracted to a student for study. The student contracts to complete the work within an agreed upon period of time and demonstrate an acceptable level of competence with the stated objectives prior to being allowed to proceed with other study.

Criterion referenced testing. Testing to measure a student's ability relative to total mastery of a body of knowledge, as for example an informal reading inventory (IRI).

English as a Second Language. ESL. The study of English by non-English speaking students.

Focus group. An interview format seeking to discover in-depth information about a small number of issues. The focus group consists of a small group of people, being used to elicit information, and a moderator, asking 6 to 10 open-ended questions to stimulate free and open discussion on certain topics. The session lasts approximately 1 to 2 hours.

Gates-MacGinitie Reading Test. A survey that measures a student's performance with regard to Vocabulary, Reading Comprehension, and Reading Rates and compares individual performance to the performance of students in the norming group.

Personal attributes. Those characteristics that factor into a person's personality. In this study, the term refers to being a self-starter, having a sense of commitment to one's studies, level of maturity, and personally valuing education.

Programmed logic for automated teaching operations. PLATO. Plato iv was a modified version of Plato designed to collect data on monthly usage.

Remediation. Concerned with the correction of faulty study habits and the raising of a pupil's general competence. Skills-based differential teaching.

Students' attitude instrument. (SAI) Used to measure the disposition of the student toward some function, object, or treatment. In this study the instrument was designed to measure changes in attitude toward the program used in the intervention as well as the use of a computer program as a format of instruction.

Schema theory. Prior knowledge that brings individual meaning to what is constructed from what is read.

Task-involved situations. Those situations where the individual becomes caught up in the activity and defines self as successful, with the activity becoming both the means and the end.

Tutorial. The presentation of intensive instruction given to an individual by a computer program acting as the tutor. Emphasis is usually concentrated more on concept and skill development being instructional than the usual drill and practice exercise.

Zone of proximal development. Cognitive development is measured by the distance between what a student can perform independently and what he or she can do with assistance. Vygotsky (1978) called this distance the zone of proximal development. Vygotsky further stated that instruction should be aimed at the zone of proximal development in order that learning lead development.

# CHAPTER II

# REVIEW OF RELATED LITERATURE

Beginning with an historical perspective on instructional methodology since the turn of the century and identifying the origin of computer instruction technology, this chapter reviews the literature on computer-assisted instruction and attempts to reveal its controversial nature. The viewpoints of various researchers reveal some of the many pros and cons of computer-assisted programs that are key concerns in this study.

## Historical Perspectives: Education and Technology

Methods of instruction have never been static because learning theories have constantly changed, as have the intentions, not only of the teacher, but also the social and private forces that often drive change. According to Anglin (1995), pre 20s curricula and instructional designs were strongly influenced by the concept that empirically tested principles could be used to formulate effective instruction. Instruction, it was felt, should lead students to accomplish socially useful goals. The abilities and achievements of the students and the effectiveness of that instruction were empirically measurable. Curriculum experts and notable researchers, Thorndike (as cited in Baker, 1973 and Saettler1968) for example, believed instructional design should be scientifically founded.

### The Twenties and Thirties

With the 20s came the beginning of an instructional shift focusing on the

individual. This thrust was to last well into the 40s and beyond. Bobbitt's (Bobbitt, 1971) concept of teaching specific skills which directed individuals into waiting social niches plus the emergence of job and task analysis that directed the piecemeal instruction of skills, led to the construction of outcomes statements and objective driven learning, one offshoot of which was contract learning. Tyler's (1949,1969), behavioral objectives and formative evaluation further encouraged this shift in focus toward the student in education in the 40s and 50s.

The 40s and 50s

In the 1940s media training, in the form of films, introduced the age of instructional technology in the training of World War II military. The media training was essentially objectives-driven. The next decade, the 50s, was characterized by a rapid growth in programmed instruction. Analytical processes important to instructional design developed, encouraged by Skinnerian operant conditioning and Bloom's taxonomy of the cognitive domain (1956). Direct instruction teaching, the form of instruction that most effectively incorporates the concept of behaviorism (Anglin, 1995), relied completely on the teacher 'informing' the student of the 'best' response or outcome. This form of instruction, especially when taken out of context was later found to have little transfer to higher order cognitive skills (Palincsar, 1998), such as reasoning and problem solving. It provided the workbook format that was later copied for early computer-based programs. Bloom's taxonomy of the cognitive domain (1956) also supported the concept and use of outcomes. The instructional design required to produce those outcomes later became basic to the structure of computer-assisted programs of instruction (Anglin, 1995). According to Pett and Grabinger (in Anglin, 1995), the 40s and 50s were remarkable for the development of audiovisual technology

> ...still pictures, charts and posters, bulletin boards and displays, slides, overhead transparencies...tape recordings, and in some places, filmstrips and motion pictures...(ASA16)...lantern slide projectors...35mm slides...had no automatic features...were teacher based and included the elements of planning, production, utilization and to a limited extent, evaluation. Research base for designing...was limited...(pp. 305-306).

The 60s and 70s

In the 60s, Glaser's (1962) criterion-referenced measures used to test the student's competency in the objectives, as described by the instructional system, encouraged a science of instructional technology. Psychological research in processes of learning and educational practice were brought closer together. In this decade audio-visual technology advances provided 35 mm, automatic and remote slide presentations; large projection, overheads; electrostatic copiers; and audiocassette recorders, that provided faster production of educational materials. This instructional technology moved into the classroom for the purpose of modeling or demonstrating and reinforcing learning, possibly better than teachers could, definitely more conveniently than teachers.

The 70s saw further development in instructional design models and the processes of analysis intended to assist in construction of the objectives of instructional systems. Cognitive psychology began to play a role in the refinement of instructional design and there was the beginning of a shift away from strictly behavioral outcomes and objectives towards needs assessment (Anglin, 1995). Computer technology was beginning to show a limited presence in schools in the latter years of this decade, with simple drill and practice programs.

The 80s and 90s

The 80s and early 90s saw a proliferation of personal computers of many varieties with printers and accompanying educational programs. The early microcomputers had limited memory and operated at slow speeds. The programs were simple. Trends in the 90s were characterized by increasing computer capacities that were faster and capable of networking to supply complex programs to larger number of students at one time. Computer costs also dropped significantly, although computers are still very expensive. Research that has implications for instruction is happening on all fronts of the technological advance.

## Theoretical Background

Social Learning Theory

Direct instruction, as emphasized in the 60s and 70s has proven to be effective in teaching content but not effective in supporting higher order cognitive processes such as reasoning and problem solving (Anglin, 1995). The studies of information and cognitive processing have become central in educational research. The sociocultural revolution and search for explanations of the mechanisms of learning have led some theorists to focus on learning in out-of-school settings and the development of learning skills through social interaction (Palinscar, 1998). John-Steiner and Mahn (1996) believe there is an interdependence of social and individual processes that function together in the co-construction of knowledge. The sharing of one's thinking with another, they feel, tends to create deeper cognitive processing.

Social origins of learning is a concept that many well known education theorists have espoused over the years. Two such are Piaget and Vygotsky. According to Piaget's sociocognitive conflict theory, cognitive conflict, created by

social interaction resulting in disequilibrium for the learner, forces intellectual development (Piaget, 1970). Students show cognitive growth when a shift in thinking is required in order to regain lost equilibrium or to gain new cognitive skills. All higher psychological functions, he claims, are internalized, social relationships and constitute the social structure of personality, according to Vygotsky's genetic law of development (Valsiner, 1987). Valsiner's quote stems from Vygotsky's theory that:

> Every function in the cultural development of the child comes on the stage twice, in two respects: first in the social, later in the psychological, first in relations between people as an interpsychological category, afterwards within the child as an intrapsychological category...All higher psychological functions are internalized relationships of the social kind, and constitute the social structure of personality (p. 67).

Stated in Vygotsky's own words (1978, p.90) "Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and with his peers". An important Vygotskian premise is that learning leads development. If learning does in fact lead development, instruction should be aimed at this zone of proximal development in order that learning and cognitive development be kept apace. According to Vygotsky, computers and other materials used to enable this learning are simply tools to assist in the construction of knowledge and problem solving. Learning is accomplished socially, however. From a Vygotskian perspective

> ...cognitive development is studied by examining the processes

> that one participates in when engaged in shared endeavors and how this engagement influences engagement in their activities. Development occurs as children learn general concepts and principles that can be applied to new tasks and problems. (Palinscar, 1998, pp. 3-4).

If learning is a social process, the question is whether computer-assisted instruction can be effective.

## Emergence of Computer-Assisted Instruction

The 1980s were characterized by the emergence and proliferation of microcomputers. Programmers started to use learning theory from psychology to establish technological engineering strategies for the production of educational software. The use of research and theory from cognitive psychology in turn encouraged the broadening of the theoretical and analytical bases upon which educational computer programs were constructed.

The gap between research in cognitive psychology in the development of computer programs in education and practice have persisted into the 90s. The promise of high quality, easily applied, programmed instruction, with the potential for 'producing' more competent students more economically, was and is something that few school divisions can resist, and it appears many of the same issues faced in the 60s and 70s when computer instruction programs first became widespread are being faced once more. Current CBI and CAI programs are more elaborate and conform more to modern theories of learning, but still fall short of the educational panacea promised. There are many benefits to these programs, but they, like everything else, come with a cost. Even though the new programs are more

sophisticated technically, often including interactive audio-visuals and some simple problem solving tasks, they are lacking in a number of ways. Blanchard, Mason and Daniel (1987) list advantages and disadvantages regarding the use of computers in teaching reading and reading assessment.

Advantages

1. There is unlimited patience. The machine/program does not show frustration with repetitive failure or lack of effort or any of those attitudes or behaviors that elicit teacher response.

2. There is unlimited potential for accelerating individual progress free from social interference. A student may progress far more rapidly than the rest of the class with no disruption to others and may also progress much more slowly and still cause no upset to class routines. Students do not need to feel peer pressure because they are not progressing as quickly as the rest of the class.

3. There is unlimited adaptability and potential for individualization. If the program is sophisticated enough it will adapt its instruction to suit the needs of each individual. The student is progressing independently and can spend extra time on those concepts that pertain to his own level of achievement.

4. There is unlimited storage and recall of results. The storage space and procedures for interpretating performance is limited only by the memory allocation of the program. Computer memory capacity is usually very large.

5. There is limited examiner and response bias. With no human interpretation of test results, there should be no bias.

6. There is immediate feedback and continued testing and level adjustment. Because the work completed by the student is assessed, task by task, instant feedback is typical of most CAI or CBI programs.

7. There is an infinite number of readily available practical exercises. Especially in the drill and practice of specific skills, any number of exercises can be ready and waiting for the student to complete.

8. There is an uninhibited environment that encourages risk taking and effort. Because interaction is with the computer program, students need not fear criticism for making errors. If errors persist the program simply reteaches the material until the student achieves at a high enough rate to be allowed to proceed.

These apparent advantages make the use of CAI and CBI programs tempting in the extreme. However Blanchard and his colleagues (1987) also list disadvantages.

Disadvantages

1. Dehumanization and depersonalization occur for both the student and the teacher. Packaged computer programs also interfere with the teacher's role of directing the student's learning.

2. Costs of hardware and software are high initially and because of the cost of developing and updating both hardware and software, site licenses are high.

3. There are computer literacy requirements. Students and teachers using computer based reading assessment must learn to use the computer, its software, and its supporting peripheral devices. Preparation for the actual running of CAI or CBI programs is often lengthy.

4. The marketplace mentality of the companies selling their product finds its way into the classrooms. The motivation of the marketplace creating a new generation of customers lends a somewhat sinister side to student involvement with educational software.

5. The confidentiality of a student's progress is easily violated. Mechanical failures are disastrous with this type of instruction. The programs are running or not and in this way flexibility is lost. There is no 'partial' solution.

6. Limited computer-based assessment research raises questions about differences between conventional and computer-based assessment. Is the computer able to test and select materials to instruct or drill a student adequately according to level of achievement? Is the program capable of properly identifying areas of learning difficulty? Can it distinguish a semantic from a syntactic error?

7. Text presentation on a screen also raises questions. There are many differences between looking at a screen and reading from a book. The clarity of images on the screen, the text presentation rate, and simple mechanics are all sources of potential problems relating to the viability of assessment.

8. Program centered learning provides few decision making options for the student. Student centered activity and self direction are not provided for adequately.

Another concern voiced by D. Hlynka (personal communication, September 13, 1999) is that quality is assumed to be automatically excellent. On the contrary, the program may be quite average.

These disadvantages should serve to caution educators against rushing unquestioningly into the wholesale use of CAI and CBI programs. Such programs need to undergo detailed testing and be implemented cautiously and appropriately in the interests of quality education. A concern for educators is that plugging students in to CAI and CBI reading and remediation programs will become acceptable practice. Such programs are ostensibly designed to test, identify weaknesses, and drill for improvement without the benefit of a qualified teacher to

monitor progress effectively. To a degree, such a practice is what some educators are convinced is a viable educational alternative. The use of these programs is not necessarily a bad thing in itself, as long as the technology is used as a tool and does not become the foundation for teaching in any subject, especially reading. The tendency is there, though, for both administration and teachers to overuse the tool that is cheapest and most convenient. A nagging concern is whether CAI and CBI computer resources will become the primary mode of instruction.

In the division in which this research was conducted, the Successmaker System, a product of Computer Curriculum Corporation (CCC) of Sunnyvale, California is the main form of remediation received by some students. The rationale behind this seems to be that the use of such programs frees the resource/remedial teacher to work with 'special needs' students, who now fall under her ever broadening umbrella. The problem is that classroom teachers either do not feel they have the time to give individual remedial instruction because of large class sizes and a high percentage of low functioning students, or do not know how to approach reading remediation within the classroom setting. Whatever the reason, in some jurisdictions, computer programs may be misused. This situation requires monitoring.

## Development of Computer-Assisted Instruction

As indicated, early computer programs consisted basically of drills on specific skills in a variety of subject areas, primarily math (Roblyer, 1985). The programs were aimed chiefly at college level and were employed by the military, colleges, and industry. From there, such programs found their way into grade schools, still focusing on the drill and practice of basic skills. Programming languages were not as user friendly as they are today. What emerged were

programs of very limited depth and scope providing only rudimentary drill on isolated basic skills. There was little interaction beyond the question-answer, right-wrong, page turning, response format. Even so teachers and students alike found the programs to be somewhat effective in a time and motion, production-line way (Bobbit, 1971). Computer programs appeared to improve cost effectiveness and provide an end product of somewhat similar quality to traditional methods. Assessments of program efficiency were often positive and their popularity gained momentum. In fact the use of CAI and CBI was touted as being more effective in teaching skills than traditional methods (Roblyer, 1985; Spencer, 1988; Blanchard, Mason, & Daniel 1987). One study (Morgan, 1981) also found that college students performed better on examinations after using computer-assisted learning programs. Morgan compared the examination scores of university students in CAI programs with those of students participating in conventional classroom instruction. With mode of instruction being the only factor differing, it was shown that compared to conventional classroom instruction students performed a 24% better on a written formal examination of skills after using the CARE CAI program. Morgan makes the same case with another CAI called PLATO, showing it to be more proficient at drilling students and at preparing them for a final examination of those skills treated than conventional instruction.

Computer programs were shown to be cost effective as well. In a program designed to track hours of use as well as record achievement in a college setting, there appeared to be no limits but day length to the hours that programs were used in a day. After initial purchase, costs per hour of instruction were significantly less than the cost of a teacher (Morgan, 1981). As long as students had access to the terminals, including evenings, the program could be used.

Although it is understandable that people would view such systems

favorably and look to computer programs for answers to many of the problems facing the then current educational concerns, like financing, time management, individual learning differences, and regulated, predictable teaching methods, the proposed panacea of the 60s and 70s did not materialize. After a cooling off period in the late 70s and early 80s, there has, however, been a resurgence of CAI programs with some real and some artificial improvements, mostly technical. This has not, however, removed all of the disadvantages. A closer look at the research and evolution of education theory provides some insight as to the source of most of these problems.

Stating a simple yet thorough definition of reading is a difficult thing to do since the act of reading itself involves such complex processing. Initial reading requires linguistic awareness to recognize letters and letter patterns that merge to form words. Through practice a student's understanding of word forms grows and a meaning vocabulary develops. Word recognition thus occurs through sight, word analysis, and the processing of spelling patterns as well as through meaning and language sense. Through practice word identification becomes automatic, thereby facilitating comprehension (Ehri, 1994). A reader's background knowledge and purpose for reading also influence meaning development. Comprehension requires the activation, maintaining, and refining of ideas and making interpretations that are reasonable and complete (Bransford, 1994). Comprehension also requires that the reader, consciously or otherwise, knows that the interpretations made make sense.

Frye (1963) discusses the need for reading narrative text in order that we know where we stand in the scheme of things. He elaborates on how our literature and our culture effects, shapes, and governs our lives. The more aesthetic reading that students are engaged in, the more aware students become of their humanity

and the sooner self realization becomes possible. Frye stresses the need for the whole picture to be made evident to the student in order for this growth to occur. The piece meal study of isolated skills on a computer is not going to give the student this world view. Sloan (1991) also stresses the need for aesthetic reading and the need to read narrative as well as informative selections. In a similar vein, Rosenblatt (1983) stresses literature experiences in the development of language and reading, and indicates setting, and personal and social experience as being intrinsic to that experience. Again, an isolated study of language features in a computer-assisted learning program cannot possibly provide for this kind of growth. With such a complex process and varied efferent and aesthetic outcomes it is questionable whether a "stand alone" computer program is sufficient.

Computers are sometimes treated as a way to facilitate reading remediation. Walker (1992), in a discussion of remediation methods, relies on the personal, interactive touch repeatedly. As discussed earlier in this chapter, Vygotsky (1978) discusses teaching to the zone of proximal development by providing scaffolding that relies heavily on the judgment of knowledgeable teachers. He believes that children construct knowledge as they grow and experience; that learning can lead development, implying that socially supported instruction and experience can lead to new growth; that personal development cannot be separated from social development; and that language evolving from social interactions is central to mental development. The emphasis on the role played by peer and teacher to support language and cognitive development, leading ultimately to personal development, is clear.

The debate continues as to the benefits and functions of educational computer programs and although there are still devotees of existing computer

programs, criticism seems to emphasize the lack of an underlying philosophy. Computer-based programs thus appear to be criticized more for their lack of teaching and learning principles than for the technical strategies they employ.

Larkin and Chabay (1992) assert that CAI programs address the existing needs of particular groups of students. They contend that specific programs tailored to the individual have the best chance of teaching effectively for the domain, topic, and specific students by shaping the presentation of practical experiences to fit the student, with specific learning objectives in mind. In their view, the exercises provided by interactive computer programs, which have the characteristics of an excellent teacher, provide the medium for interaction between teacher and student. Single CAI programs are brief and deal with only a few aspects of a domain, building the domain through the addition of segmented pieces of knowledge. Integrated Teaching Systems (ITS) implement a set of instructional principles sufficiently general to provide effective instruction for a variety of teaching tasks. An ITS program is a management system that selects and ties together other computer programs to produce a complete program of studies for a student. Larkin and Chabay suggest that these computer-assisted learning programs are strongly rooted in research on the psychology of learning and provide instruction to a broad range of students, following theories of teaching and learning and shaping student performance.

Becker (1993), however, argues that while research evidence indicates that ILS programs are becoming effective, they have not yet achieved their full potential. Some disappointing results have to do with the educational ideology of autonomous tutoring. That is, the robot replaces the teacher. Instruction is technologically driven. He feels programs must be based more on a complete and accurate theory of effective classroom instruction and learning. There must be an

appropriate level of instruction containing challenging work and there must be integration into the flow of classroom work where the computer programs become another tool, like pencil and paper.

Littlejohn (1997) questions the source of program content. Does it come from the task as provided by the program, the teacher or the students? He suggests that tasks that require students to work creatively and supply their own content are less frequently included in CAI programs than current ideologies would suggest they should be. Students are left disempowered, having limited choice or control over the tasks they perform.

Milton (1997) stresses a lack of linguistic patterns in some computer program materials. He discusses networking, text retrieval, and word processing as three areas of technological promise that encourage language learning, but states that technically and pedagogically it is more effective to provide rewriting tools in a computer program than one that models a human tutor. He also stresses, as do so many other authors, that decontextualized instruction is useless in encouraging language learning. He notes that current programs fail to allow the student to access instruction on language skills pertinent to their specific needs. Except for word processing components, little productive application of skills is provided for, only feedback as to correctness of answers. Milton suggests that the machine should either become a tool, or remain one, and not try to model an expert tutor.

Even though some research indicates that CAI programs provide demonstrably effective drill efficiently on specific skills, the question remains, are we just teaching skills? According to theorists (Sloan, 1991; Vygotsky, 1978), teaching involves an experiential, inclusive, interactive, personalized, approach which provides for student development, supported by a professional teacher,

going far beyond the capabilities of existing computer programs, integrated or not. Individual use of CAI programs may further isolate students who function poorly in the social settings of the classroom. If proficiency in isolated skills is all that is expected, the computer could well be effective. But establishing a comfortable, non-threatening milieu, where effective learning and remediation occur contiguously is a better scenario. It is desirable for students to capitalize on classroom social support to reinforce learning. The effectiveness of social interaction as reinforcement to learning which will later become internalized is well recognized by all educators. Isolation from a social learning environment means an absence of stimulation and reward that is a fundamental need for all students. The infinite patience and lack of bias in CAI and CBI programs are poor substitutes for the interaction, knowledge, emotional support, and encouragement offered by expert teachers and classroom peers.

Maurer and Davidson (1998) suggest questions to ask before buying and implementing teaching software. Will the learning outcomes be met appropriately through a computer program, or can they be achieved in some other way? Does the software engage and actually encourage the student to learn? Is there enough on-task time to advance learning according to the time and money invested? Are there features that detract from learning, either for the learner using the software, or for the others in the room?

The concept of learning being hastened by increased time on task through convenient computer access applies more at a college than elementary school level at this point in time. The use of computers is facilitative where students are mature enough to seek out computer instruction in their free time or if there is constant and easy access to CAI and CBI any time that the student wants it. This is hardly the case with most elementary school students at this time. Existing

research shows that age and achievement level are factors in the successful use of CAI and CBI (Roblyer, 1985). While the system may work well at the college level with adults in industry or in the military, and perhaps with high school students, the students who are targeted for CAI instruction in elementary schools may be low achievers who require more teacher intervention. This factor undermines one of the positive aspects of CAI use. CAI and CBI do not necessarily relieve teacher involvement and in fact may distract from other learning activities that require attention.

Another problem is that elementary students usually have to be scheduled into over-crowded computer labs during the five and a half, already busy, hours of the school day. Their progress requires close monitoring. This may have more to do with program management than with the programs themselves.

The most effective type of instruction occurs when the opportunity presents itself, at the 'teachable moment'. While isolated skills may be learned more quickly using CAI because of increased time on task and concentration, current theory and research show that learning methodologies, processes, the usefulness of information and an appreciation of the whole subject are equally as important (Schwab,1981). So although skills are necessary for mastery, the basic drill employed decades ago is no longer recognized as the single aim of learning.

According to Thompson and Montgomery (1994) there is not enough readily available and relevant research on the effectiveness of technology in teaching reading and writing. Herrmann (1986) states that without relevant research it is not possible to establish a sound theory base and lacking this, the instructional wisdom used in establishing or implementing computer programs for literacy is not reliable. Used on their own, existing programs appear to be very restrictive for language development.

Computer programs fail in teaching students how to learn effectively because they cannot supply the actual needs of the learning process, particularly in the instruction of reading. Mathematical problem solving may lend itself to computer instruction but the problem solving endemic to a reading lesson is infinitely complex, having so many reader factors, text factors, and factors of context that it is difficult to establish effective computer programs (Rude,1986). Reading is a multifaceted, complicated, thinking process that involves logic and reasoning that is anything but bipolar and linear or compatible with that of a computer.

Reading begins in early childhood with experimentation that must be encouraged according to the student's individual personality (Lipson & Wixson, 1991). It progresses with continual experimentation and support within the student's zone of proximal development (Vygotsky, 1978) throughout the student's reading career until a level of maturity and metacognition is reached that allow students to become their own best teachers through the implementation of self-structured, self-monitored, self-evaluated processes (Lipson & Wixson, 1991). All of this growth requires the coincidental development of operations such as writing, speaking, listening, spelling (including inventive spelling and interpretation), social interaction, shared reading and critiquing (Sloan,1991). This enormous process includes the development and use of supportive knowledge systems such as the use of phonics, morphemes, syntax, and semantics. According to Chomsky (1971), students should write first and then read. How a computer could interact with the initial writings of a young student using invented spellings and provide the delicate balance of support, encouragement, and direction that a teacher and classroom provide at this stage of development, is questionable. Computer programs seem focused on atomistic, bottom up skills in reading development where recent theory

suggests that reading is an integrative process (Rumelhart, 1983).

Motivational support and encouragement, so necessary for learning something new and difficult, cannot be sufficiently provided for by a final percentage on a computer generated test or a "Yes that is correct! Good for you!" comment from a computer program. Mathewson (1994) developed a model of attitude influence which would argue against this very narrow and simplistic motivational approach. In his development of the Attitude Influence concept, he shows that the cornerstone concepts are fundamental to reading and learning to read. Self-concept, values, and goals are at the heart of what drives a person to 'do' (Ruddell, Ruddell, & Singer, 1994). How do these concepts grow and mature if exposure is relegated primarily to a computer? Mathewson's attitude influence model indicates that prevailing feelings about reading are strongly affected by external motivators, incentives, purposes, norms and settings. The social plays a large part in this. Ideas reconstructed from or related to a reading selection all lead to further reading, thereby enhancing the reading process. At this point, shared reading and discussion become important. For young students to gain insight into meaningful reading there must be an exchange of ideas. Again the interaction with teacher and other students becomes important. Such complexity prohibits the role of the computer becoming dominant. Blease and Cohen (1990) identify CAI and CBI as tools, not training packages, containing tutorials, drill and practice exercises. These tools have a valuable part to play in classroom activities but tend to be restrictive. These authors believe that computers should be used as a tool in the pursuit of specified objectives defined by the users themselves. Teachers have to show students how to use the programs and must be very familiar with the programs and how to extract the exact material needed for each

child in order for the technology to become effective. Unfortunately, too often, teachers don't have the ongoing support required to make the best use of the technology and this may lead to misuse.

Simonson and Thompson (1990) state that although a combination of traditional instruction and CAI proved to be successful in raising cognitive and affective performance in disadvantaged elementary students, the students rapidly became bored with the computer programs. Although high-quality graphics, color, sound, and animation are impressive, and tend to hold the students' attention temporarily, Clark (1983) shows that technical quality alone does not improve learning. Properly designed tutorials can, however, offer real advantages to teachers and students.

## Summary

Currently, computer tutorial systems cannot reproduce the flexibility and personal knowledge of an individual teacher interacting with a student, but compared to using traditional or programmed texts can offer advantages over a single teacher attempting to present material to large numbers of students at once. In evaluating tutorials, users need to ask pertinent questions. Does the design offer opportunities for meaningful interaction with the material? Does the program allow students to practice new ideas and ask questions to test their hypothesis? Is there individualization that allows for pace adjustment to suit the individual? So-called intelligent CAI programs provide knowledge of the students difficulties, tutors to remedy these specific difficulties, and creates a guided discovery program for the student. However, traditional teacher input is required because too much student control and self-pacing can lead to lack of progress for some students. There is a growing tendency in some jurisdictions to place remedial students onto

skill-building programs rather than incorporating remediation as an ongoing part of the learning process, especially within the reading program. To isolate specific skills from their intended use is usually non-productive. Pulling students out of the regular flow of information and away from the activity of the rest of the class may also be harmful in that students may miss out on new work and fall behind other members of the class. They may be stigmatized. Missed instruction and participation in class discussion necessary to stimulate prior knowledge, or to introduce new vocabulary makes the learning task more difficult. If students are absent from such activities, whether it is for remediation or not, they will have a more difficult time keeping up with regular class progress. The weaker students need inclusion, acceptance, and encouragement, not isolation, labeling, or possibly even exclusion. With computer program use there is little communication with, and less opportunity to write to, a known audience in a meaningful way. Even if the computer is situated physically within the confines of the classroom, which is fiscally impossible in many divisions, the student is often isolated.

# CHAPTER III

# STUDY DESIGN AND PROCEDURE

## Method

A number of studies have been carried out in the general area of CAI and CBI programs over the years. One study, similar to this was conducted by Olivia N. Saracho, of the University of Maryland (1982). Although her investigation followed an experimental approach Saracho used elementary school students and examined the effects of CAI programs on basic language skills achievement and attitudes toward instruction. She used two groups, one a control that received only traditional classroom instruction, and another that in addition to classroom instruction received computer-assisted instruction, using a program published by the Computer Curriculum Corporation of Palo Alto, California. Her measures involved the pre- and post-administration of the California Test of Basic Skills (CTBS) and an attitude survey.

She found that the students who used the CAI program showed greater gains in skill level than the control group, but that the attitude of the test group toward the use of CAI was less favorable after prolonged exposure. In a discussion of results, Saracho points out that the CAI group improved in skills, for the most part more than the control group, but notes that CAI users had more time and drill on the specific skills tested than the others. That factor in itself could have had an impact on the results. If CAI use was responsible for the improvement in the test group, Saracho suggests that it was the individualized instruction, provision for active participation, immediate analysis of student responses, and instant feedback that should be credited. The fact that the subjects

were elementary students, with concepts of language already learned in Spanish, working at basic levels in English, might also have made the CAI programs more effective. Saracho suggests that her findings are consistent with similar, though not identical, studies. Other authors agree, CAI programs are more effective than just traditional instruction (Spencer, 1988; Rude, 1986; Roblyer, 1985).

Based on the design of the Saracho (1982) study, in addition to observation, this research will add standardized and criterion-referenced measures of reading achievement as well as a measure of attitude.

This research however will employ a case study approach to explore advantages and disadvantages of introducing computer-assisted instruction into a classroom reading program. Compared to experimental designs, using a case study approach allows the investigator to examine more variables such as the setting, behaviors displayed, the motivations and the relationships among these factors. As suggested by Lancy (1993), compiling case studies permits the use of narratives to describe or explain multifaceted situational information. Case studies are therefore less restricted in design and bring to light further questions for study.

Measures

In addition to daily course reports and cumulative reports tallied by the computer program itself, there were three kinds of measures used to document change as a result of the CAI intervention: (1) a standardized reading test used to measure individual standings before and after the intervention; (2) a criterion referenced reading test (IRI) used to measure personal changes in reading achievement; (3) and two surveys, one to determine attitude changes toward use of computer programs as a format of instruction and the other toward changes in concept of self as an academic.

The Gates MacGinitie standardized reading test (1965), administered to the

entire class in March of 1998, was used for the academic selection of participants and as a test of the June academic standing of the students using the CAI program. It is a standardized reading test that determines a student's level of achievement in vocabulary, comprehension, and speed and accuracy in identifying words. The vocabulary test is designed to sample meaning vocabulary. The student is presented with a key word and chooses one of five alternative responses that means nearly the same.

The speed and accuracy section tests how quickly a student reads with comprehension by offering 36 short paragraphs of similar difficulty, each ending with a question or incomplete sentence. The student has to choose the word that best completes the sentence or answers the question. The allotment of time for this section is short enough that few students complete all of it.

The comprehension section consists of 21 reading passages containing 52 blank spaces in total. Each blank is provided with five terms from which the student must chose the one that 'best' maintains meaning, similar to a cloze exercise.

The Gates-MacGinitie was chosen for several reasons: (1) the directions are clear to both teacher and students and this lowers initial frustration, allowing students to focus on the reading rather than the mechanics of the test; (2) the layout and structure of the sample items are clear on the page and confusion from written explanation is reduced by having students complete sample items prior to beginning the test; (3) the purpose of the test in this research is to give information on the level of achievement in reading comprehension, which the Gates-MacGinitie does well (Buros, 1975), the test does not isolate difficulties in specific subskills; (4) the test results are not being used to determine

level of frustration or instruction, they are simply making a statement of level of achievement at two points in time, before and after the computer-assisted intervention, (5) the sub-tests are easily scored and require only 30 to 35 minutes to complete; and (6) the tasks are familiar to the teacher and students.

The Johns Basic Reading Inventory (Johns, 1994), a published informal reading inventory (IRI), was administered to all participants before and after the intervention as a second measure of reading achievement. The Johns IRI consists of a series of graded reading selections that are used to identify a student's reading level. Whereas the Gates-MacGinitie compares performance with that of other students in a norming group and is therefore norm-referenced, the Johns IRI has more face validity because it mirrors what students are required to do in class which is to read. The IRI was used to verify academic standing in the selection of participants and as a more sensitive measure to verify improvement after the intervention.

The students were tested for changes in attitude toward the use of educational computer programs and attitude toward self as academics. Changes in attitude toward educational computer programs were observed with pre- and post-testing using the instrument in Appendix A titled "Evaluation of Instruction Format". Changes in self-esteem were observed with pre- and post-testing using the instrument in Appendix B, titled "Self Concept".

The Evaluation of Instruction Format Questionnaire. This questionnaire is a set of eighteen questions developed by the investigator, aimed at obtaining information on the students' degree of satisfaction with the use of computer programs by asking them to rate, what were considered key aspects of such programs, before and after the intervention. The Likert scale format was used and in keeping with that format there was an almost equal number of positive and

negative questions asked. Each question was followed by a set of response options consisting of an equivalent to "strongly agree", "agree", "undecided", "disagree", and "strongly disagree". The questions and response terms were altered to fit the questionnaire and be more comprehensible to the grade six students. They became "very much", "lots", "some", " not much", and "no". Directions were given that explained the task to be performed and the purpose of the scale. Students were informed that there were no right or wrong answers. The results of this instrument were not scored as such, but were used simply to give an indication of each student's satisfaction with the program. These changes were noted in relative terms.

In developing the questions, the instructions, and rating scale were read through and interpreted by students other than those in the study. Alterations were made which afforded clearest meaning. Questions one through four concentrate on personal use and enjoyment of using a computer for writing and reading student's own and others' work. Question five indicates the degree of familiarity the student has with computers in general. Questions six, seven, nine, ten, twelve, fourteen, and sixteen indicate how user friendly the students perceive computer programs to be and how much they enjoy using computers. Questions twelve and sixteen demonstrate how the student enjoys using the computer as opposed to working with another person. Questions eight, eleven, thirteen, and fifteen indicate the degree to which the student enjoys school work other than using the computer - for example with other students or with the teacher. Question seventeen was used in order not to confuse students who like to work on the computer with those who simply like to work alone. Question eighteen was provided for those students who might find it difficult to interpret questions and assign a value, using the provided rating scale. This question was intentionally

open-ended in order that students could express their opinion on the use of computers in education. The differences in student's before and after responses provided information on attitude change.

The Self Concept Survey. This survey, developed by the investigator, was aimed at measuring attitudes or beliefs the students have of themselves as developing readers. Changes in belief measured after the intervention were used as indicators that the program may have had an affect on the student's self-concept. As with the questionnaire, the self-concept survey discussed what were considered key factors before and after the intervention. The students were instructed to focus on the last six weeks of school in responding to the ten questions. This coincided with the time frame of the intervention. They were given the option of selecting more than one response on the first eight questions and were provided two questions where they could respond in their own words. The wording of questions, response terms and instructions was critiqued and altered to make them easily understood by the students. The changes noted with the post-intervention application were used as an indication of the possible effects of the intervention on self-concept.

The self-concept survey begins by determining both the students' rating of themselves as readers and how they are currently progressing in their reading. Since success or failure in other areas may colour students' attitudes toward reading, question three gives an impression of how well the students think they are doing generally. Questions four, five, and six focus on the students' disposition to working alone, with others, and on the computer. Questions eight and nine focus on likes and dislikes of using the computer in general. Questions nine and ten were intentionally open-ended to provide students an opportunity to express their feelings about computers without being restricted by given descriptors.

Design and Analysis

The small number of participants (6) from one classroom made the reliable use of statistical analysis invalid. During the computer sessions the teacher conducted observations viewing the students as they worked on the computer, noting progress, and at times discussing progress and keeping notes. A focus group session was held at the conclusion of exposure to the program to detect changes in attitude, but also in order to critique the program from the students' point of view and to function as a summing up for the students to conclude their participation in the investigation. The Focus Group session was audio taped for later, closer study.

Participants

In the current investigation, 6 grade six students were selected according to academic achievement in reading, using the Gates-MacGinitie Reading Test (1965) which was given to the entire class at the same time under the same conditions. Two high, two middle, and two low performing students were selected, based on grade level scores and on work habits demonstrated in class. A purposive sample was chosen from the students volunteering to participate in the study in order to see if achievement level and attitude toward learning would have a bearing on the effectiveness of exposure to this computer program.

Cases: High achievers. Having scored in the 6th stanine in comprehension on the Gates-MacGinitie standardized reading test and achieving a grade equivalent of 8 in reading comprehension in the Johns Informal Reading Inventory, Case # 110 was considered a high level student. She was hard working in class and wanted to do well, but was not particularly a self starter. She did not have as

strong a commitment to her studies as some in the class and homework was not always completed. She did have high expectations for achievement and became upset if she did not do as well as she expected, but did not necessarily expend the effort required. What she did was usually very well done but in class this student was a little more prone to visiting with others than just doing her work. She had enough ability that she easily excelled compared to the class averages. She was quiet spoken and liked by most of the other students. She was sensitive to others, but to a lesser degree than some students.

In short student 110 was a high-achieving, hard working student, but lacked the personal discipline that some students show. It was expected she would do quite well on the program, but might need some encouragement to work independently.

Case #112 was the top scoring student in the class on the Comprehension segment of the Gates-MacGinitie, scoring in the 7th stanine and achieving a grade equivalent of 8 on the Johns Informal Reading Inventory (IRI). As a student, #112 was a self-starter and very committed to completing his work. He was often finished class assignments far in advance of his classmates, but being inquisitive and interested in a wide range of topics, always found something to read or other work to do if he had time on his hands. He was a very popular student, liked by the whole class, was very easy-going but sensitive to the feelings of others. He had a positive and mature attitude toward achieving his goals. He set his sights high, expected to do well and usually did, but was mature enough not to be too hard on himself if he fell short.

In essence, case 112 was a mature, bright, high-achieving, committed student who was expected to do very well on the computer-assisted program.

Cases : Middle achievers. Having attained the 4th stanine on the Gates-MacGinitie standardized reading test and reaching frustration at grade 7 on the oral and grade 6 on the silent reading selections on the IRI in March, student # 114 was considered an average achiever in the group of six. She also did very well on the speed and accuracy and vocabulary sections of the Gates MacGinitie, scoring in the 6th and 8th stanines respectively. This student was very hard working with a strong commitment to her studies. She was of average ability and used her ability to the fullest, never shying away from asking questions. She was quiet, but enjoyed working with others and stuck to a task, even in a group. She was very concerned about getting work completed, being on time with work, doing extra, and achieving high scores on tests. She was new to the town and class this year and this, in part, drove her to do well and impress her new friends. She was more concerned about scores than some students, but was equally well liked by the whole class.

In short, case 114 was a hard-working, average achiever with a strong commitment to learning. It was expected this student would do very well on the program because of her drive.

Student #115 was also considered an average student having attained the 4th stanine in comprehension on the Gates MacGinitie standardized reading test and reaching frustration at grade 7 on oral and grade 6 on silent comprehension in the Johns IRI. He was a student of average ability, but was not very committed to his studies. He often had incomplete work and this was quite an issue for part of the year. He lacked interest in most things happening in class but when something did interest him he did very well at it. He had a real tendency to drift off in class and frequently required help to stay on task. He was quite willing to resign

responsibility for his work to others. He did not care much for reading and resists writing although he had enjoyed some of the word processing opportunities in language arts.

While case 115 was a capable middle-achiever, he was a disinterested student. It wasn't certain how well he would perform but an extreme was expected where he would lose interest and do very poorly or become excited about the program and the computer and do very well.

Cases: Low achievers. Having scored in the 4th stanine on the Gates-MacGinitie standardized reading test and reaching frustration at grade 6 in oral and 5 in silent comprehension on the Johns IRI in March, student #111 was considered one of the low level students. He was very quiet and quite withdrawn in class. He refused to answer questions or speak up in front of the class at all for the first few months of the year. He did not show much commitment to his studies and was easily defeated by new work, although he had responded well to the offer of extra marks for take home remedial reading work. He spoke low German at home with his parents, spoke English with an accent and was quite conscious of it. He was teased a great deal in the past and this may be part of the problem with speaking up in class. He had only one friend in class and had little to do with many of the other students at all. It was expected he would do better on the program than he did in class because he would be able to work at his own speed and not have to interact with other students.

In summary, student 111 was a low-achieving, somewhat socially withdrawn student who, it was expected, would fare better without class pressures.

Student # 113 was also considered one of the low-achieving students

having the lowest comprehension score in the group on the Gates MacGinitie, achieving only the 3rd stanine, and reaching frustration at grade 5 in both the silent and oral comprehension in the Johns IRI. This student came from an immigrant family from South America and spoke low German at home. He was easily distracted in class, needing constant reminders to stay on track, was too shy to join in discussions, showing no personal commitment to school-related tasks. From contact with the home it was apparent that there was little value placed on formal education. His other academics were poor and he was more concerned about missing recess than passing grades. This student had only one real friend in class whom he enjoyed playing or working with. Student 113 was often rejected by the other students. His friend was included in the group of six students and that was probably why he volunteered to participate in the study. It was hoped this would be enough incentive for him to give the program an honest effort.

Student 113, in short, was a low-achieving student whose response was to withdraw from class participation and social interaction. It was felt that he would be most helped with the relief from social stresses in the class. However his attitude toward academic work and the absence of someone to keep him on task might cause problems with progress on the computer-assisted program.

Instructional Intervention

Review of reading investigations strand. All of the students selected to participate in the study spent 15 minutes per day for a six week period on a CAI program called "Reading Investigations", published by the Computer Curriculum Corporation of Sunnyvale, California (1993).

The Reading Investigations strand of the Successmaker program (1993), was used as the treatment for the test group of six students. The Successmaker

program integrates learning systems containing a management program and separate computer assisted instructional strands for reading, language, mathematics, and the content areas. The publisher recommends this program as potentially appropriate for classroom presentations, but as functioning more commonly as a program for the individual, noting that dynamic audio-visual displays and interactivity spark interest while modeling strategies, reinforcing skills, developing concepts, providing information, stimulating discussion and critical thinking, and improving overall comprehension. The program begins by assessing the student in the particular strand selected by the manager/teacher. After determining the appropriate beginning level, the program instructs, drills, and continuously assesses student progress, constantly presenting slightly more challenging material for the students to work on at their own instructional level. The Reading Investigations strand only was used for this investigation.

The computer work stations were located in the resource room and the resource teacher or educational assistants were available to help students experiencing technical difficulties when needed.

The organization of "Reading Investigations" is based on three components: *excerpt lessons* from such subject areas as science, social studies and literature, *strategy lessons* and *vocabulary lessons*. Each reading passage forms the basis of a single lesson and comes with a stated synopsis and skill objectives for the teacher, and suggested writing activities for the student. The excerpts were selected for readability level using the Dale-Chall and Harris-Jacobson formula, and for quality and interest. For variation and to maintain interest there is a continual rotation through literature, science, and social studies reading selections. Each successive lesson is graded as being more difficult according to the readability formula. An introduction is given to build background and develop

motivation to read, and a writing component offered to activate prior knowledge and involve students actively at the outset. During reading, the passage is interrupted by activities and exercises requiring that students reflect on content. These activities might be either vocabulary or cloze exercises. As the student progresses through the reading, footnotes and a glossary or thesaurus are accessible by clicking the mouse on either a trailing asterisk or an icon in the tool bar. Notebook activities are used for keeping notes and making predictions, taking notes that are designed to keep students 'actively' involved. There are after-reading activities that require the stating of viewpoints, assessing the learning of factual information, and checking reading comprehension, for which a test score is given.

Each lesson focuses on several reading skills such as: constructing meaning, making inferences, concluding and generalizing, identifying main ideas, understanding time order organization, and many more. In addition there are nine strategy lessons that define, describe and illustrate a particular reading strategy and guide students through its application. The pattern for each lesson is similar, starting with definition, explanation and proceeding to application. The strategy lessons listed are: strategies for answering questions, KWL, cause-effect organization, comparison-contrast organization, time order organization, problem-solution organization, character analysis, figurative language study, and word parts. The notebook is used to summarize what has been learned and graphic organizers are used for further study. One graphic organizer is a detective's office containing labeled objects representing components of the course: a bookcase for reading selections, a file cabinet for strategy lessons, and a dictionary for vocabulary study. The vocabulary strand consists of words from readings, presenting each word in three exercise formats, allowing the student to progress to the next word only if mastery of the word is shown in each of three ways.

Program developers contend that the effectiveness of instruction is due partly to high quality graphics and the audio component with on-line voice. The graphics are to hold a student's interest and facilitate the use of the program. The audio is an electronic voice that functions to introduce lessons, ask questions, prompt, congratulate and motivate students.

Progress through the course is determined by enrollment. If given no options, by default the student goes through a common sequence of lessons and activities. Within each component of the course, student performance dictates progression. If the concepts are not grasped the first time, extra exercises are presented until mastery is gained.

Performance level is measured for each exercise. If indicated, a student may repeat a given strategy lesson more than once. If a student does not achieve a mastery level of 80% for a given skill, more exercises are presented using that skill. Writing skills are unjudged as to correctness, but time spent in notebook is noted, as are the number of characters typed and the number of files as indications of the amount of writing.

Alternative to enrollment by default, custom lesson sets or 'Student Choice' may be selected. With custom lesson sets, the student may be put into a program where the teacher selects specific lessons that deal with a certain theme, skill, student interest, or topic to enhance classroom performance. Some degree of student control is permitted. Here students choose the order of the lessons, whether they will repeat a lesson or pursue vocabulary development activities. The availability of resources gives students more control over their learning environment. The following resources are available by clicking on screen icons: (1) *hint* which gives tips in strategy (not always present); (2) ***help***, which completes the exercise for the student, but does not then credit the student with

having completed the exercise; (3) *progress report*, which provides a check on progress; (4) *audio repeat*, which uses an on-line voice that repeats the audio message most recently delivered; (5) *glossary*, which gives the definitions of words not understood; and (6) *notebook*, that allows the student to make notes or complete a written exercise.

The developer, Computer Curriculum Corporation of Sunnyvale, California, states that in order for the program to be effective the student needs to use it often. It is the teacher's role to start the student at an appropriate level to maximize the benefits of time spent on the program. In order to make some form of classroom connection, it is suggested the students share progress and strategies learned from the program with class groups, share print-outs of notebook exercises with others, use revision and rewriting exercises as a class activity, write the publisher criticizing the course, carry out library research extensions, make and display evaluation charts, earn badges of merit and write letters to their parents about the program.

Implementation

The students were started at the same levels in the reading investigations strand and allowed to progress through the program at their own pace. Students were given the freedom to interact with the program individually, making their own choices when a choice was available to them. The Resource Teacher and reading para-professional were available to students to answer questions during their sessions. Behaviour was observed and noted each day by the investigator. Usually individual follow-up discussion was used to assess levels of interest as the students worked with the program. The computer produced course reports were

collected daily and the grouping reports, which provide cumulative data on progress, either positive or negative, were collected periodically from the reporting section of the program.

The reporting section of this program is excellent. There are over 50 different kinds of reports that can be generated which keep the teacher informed of a student's progress on a daily cumulative basis. There are so many different reports that most teachers would be too overwhelmed to use them.

The reports that were used in this study were the course reports and the grouping report. The course reports are generated after each session is completed and were used as an indication of daily progress. These reports provide information on: sessions covered daily and total attendance, results of all scored exercises, time spent in notebooks and a cumulative course percentage. The grouping reports are cumulative and show progress in notebook, vocabulary and lesson totals, as well as achievement on the use of strategies. Further discussion of findings and conclusions are discussed in Chapter IV, results.

Sequence of Events

Pre-Intervention (March)

1. Administration of the Gates-MacGinitie, Level D. *Reading Test.* (1965)
2. Selection of volunteer students for exposure to program.
3. Administration of Self Concept and Evaluation of instruction format instruments.
4. Administration of Johns Reading Inventory
5. Exposure to Reading Investigations computer program for six weeks. Field notes from observational sweeps.

Intervention

Use of Reading Investigations Strand of Successmaker Program for six weeks.

Post-Intervention (June)

6. Re-administration of Gates-MacGinitie.
7. Re-administration of Johns Reading Inventory.
8. Re-administration of Self Concept instrument and Evaluation of Instruction Format.
9. Focus Group conducted.

# CHAPTER IV

## RESULTS AND DISCUSSION

Past experience and current research have caused us to view teaching, learning, and reading instruction with new insight. With these new views in mind, it is necessary to look carefully at the obvious pros and cons of computer assisted instructional programs (CAI and CBI). It was the intention of this present research to investigate the effectiveness of the reading strand of one CAI program through observation of it in operation, analyzing the reading components of the program, and examining student reading achievement, attitudes toward computer assisted instruction, and self concept. Some benefits were found for this computer software program as a resource for some of the students but limitations in the ideology, structure, and implementation of this program were demonstrated. Observations showed that less able students benefited less than high achieving students from the use of this one strand of CAI program and exposed limitations, pointing out factors that make caution essential.

### Results of Reading Investigations Review

The CAI program, as outlined in the teacher's manual, sounds excellent, and in using it both students and teacher found some excellent materials. The reporting section of the Reading Investigations strand of the Success Maker program could not be more extensive or thorough. The relative ease of getting into the program and registering students was excellent. The concept that the program is progressive and does offer some variety and choices to students, even though the students do not totally agree that it does, is good, as is the use of reading selections from science, social studies, and literature selections in providing variety to what the student is reading.

Computer voice. There were problems, however, with both the method of presentation and the exerpts themselves as far as this study was concerned. The program is recommended primarily for individual use. For optimal benefit the program should be used frequently. This means either individuals from the class are using the program and progressing at their own rate or the whole class is involved and are progressing at their own rate, within the program, which is a benefit stated by the authors.

Progression at individual rates within the program became a problem in regard to the prereading exercises which were important for introducing new vocabulary and activating or developing student background knowledge. Discussion gives the student a reason for reading the work, usually by generating pertinent questions. The reading then begins, using known vocabulary and concepts and arming the student with expectations of what is to come, thereby facilitating both comprehension and word recognition. Having a computer "talk at you" about what is going to be read may not have activated and developed background knowledge adequately for the students in this study because, in the students' words, the voice was not human.

Passages. The use of the three main subject areas, science, social studies, and English literature, on a rotating basis, was good for variety, but the selection of the passages themselves presented another problem. The materials covered were often not relevant to the students. Exerpts predominantly featured American history and American characters. "Black Star, Bright Dawn" is set in Alaska, "Charlie Pippin" focuses on the Vietnam War, "Homesick: My Own Story" is about an American in China. Other selections are set in Arkansas, Maine, Maryland, and New Mexico. Another excerpt covers 12 Americans discussing their occupations. Famous people like Neil Armstrong, Sally Ride, and Roberto

Clemente are featured. The science exerpts are less biased because, as a study, science is universal, but the problem of Canadian content still became an issue when the spelling and phraseology were not Canadian. Ideals of where one is from and pride of country were not provided for. Values were not necessarily Canadian. In math and science, units of measurement were not metric. In the math strand for primary grades, the currency pictured was American. In the Literature strand, 13 out of 19 exerpts were American, in science 4 out of 20, and in social studies 17 out of 20. The source of other literature exerpts either was not specified or was world-wide.

The writing component was individual and not shared if a student was working independently as suggested. Question and answers that worked for low-achieving students were not suitable for stronger students. Simple exercises that involved the selection of a definition, which top students found annoying, cloze exercises, which the two high achievers found to require an excessive amount of rereading, and the congratulatory smile on the corner of the screen were not reward enough to encourage low-achieving students adequately. The footnotes option was used by some of the stronger students, but the glossary icon was found to be a nuisance. Most students preferred to guess at word usage. Students made predictions, but found pulling up the notebook screen annoying. Students lost interest in the writing extension activities, partly because there was no sharing of success on before-reading predictions.

Strategies were dealt with and then left with not enough continued emphasis. The spelling component was much like a spelling book routine except that collaboration with other students using a text is more easily accomplished and the initial purchase price is less expensive. The audio was a good concept, the students in this study found the voice unpleasant.

The difficulty with repeating lessons treating a specific skill until a mastery level of 80% is achieved is that, without diligent supervision, some students fall behind. Further drilling tended to become a drudgery which can be a "turn-off", without the teacher being aware.

The problem with putting so little emphasis on writing is that appropriate writing instruction with peer conferencing is not provided for. Also, the opportunity to learn through discussion and to hear proper usage was lacking. The notebook files could be saved and teacher-graded for mechanics but an audience to add purpose and motivate was missing. The follow-up writing exercises were well constructed, but lacked authenticity, purpose and audience, usually being shared with the teacher for correction and grading purposes.

The resources available, such as *audio repeat* and *glossary*, whether useful or not to the student, did provide a form of choice within the framework of the program, but did not constitute real student control over learning.

Management and use. While frequency of use is key, one of the problems teachers face in connection with computer use is availability of time in the computer lab, which in some cases may be limited in the extreme. Scheduling was a concern in this study. The initial cost of this type of program is prohibitive when thinking of class use. The suggested sharing sessions sound like the kind of activity that students need for incentive, peer teaching, reward, audience, and all those things that come out of a classroom setting. However, the program is designed primarily for isolated student use and for students to proceed at individual rates. These two factors alone make sharing in the classroom setting difficult, especially if the program is being used for remediation. Such management problems are discussed in more depth in the next general section.

Student response. Further comments on the program itself came from the

students who actually used the program on an on-going basis. The top students commented frequently that the voice was very annoying and turned it off. High-achievers made it clear that they needed to be challenged and were bored. Obviously they should be given a broader choice of exerpts to read and the ability to select level of challenge. They also frequently commented that they would sooner be working with other students and all of the students became bored with the program to a greater or lesser extent.

The two middle level students complained that the reading exerpts and level of challenge were not interesting or adequate to stimulate them to strive to learn. The two low level students got tired of the whole thing more quickly than the others. One kept skipping or forgetting to attend his session and the other made very slow progress and achieved poor results according to the computer reports. All of the students expressed frustration with the fact that the program proceeded at a slow pace and they did not have enough control over the program to accelerate it.

## Effectiveness of CAI Instruction

### Daily Course and Cumulative Grouping Reports

The first question for examination was, "In this study, is Computer Assisted Instruction, as represented by the Reading Investigations strand of the Successmaker program, effective for 6 grade six students. For example, do low-achievers benefit more from this program than middle and high-achievers as assessed by performance on the Successmaker Reading strand's daily course reports and cumulative grouping reports, on the Gates-MacGinitie standardized reading tests (1965) and the Johns informal reading inventory (1994)?

One of the main difficulties in answering this question was the problem of regular attendance. Each student should have accomplished 6.5 hours of work on the program. Considering all of the interruptions and distractions that are part and parcel of elementary school from April to June, it was expected that an achievement of 6 hours and 15 minutes was more to be expected, allowing for 1 missed session. The attendance fell short of this in fact, for half of the students. Table 4.1 shows individual student attendance.

Table 4.1

Student Attendance

| Student | Level | Actual Time Spent | | Variance* |
|---|---|---|---|---|
| 110 | top | 5 hr. 17min. | - | 58min |
| 112 | top | 7 hr. 51min. | + | 1hr 51min |
| 114 | middle | 5 hr. 46min. | - | 29min |
| 115 | middle | 6 hr. 25min. | + | 10min |
| 111 | low | 5 hr. 39min. | - | 36min |
| 113 | low | 6 hr. 57min. | + | 42 min |

* Variance from the expected 6 hr. 15 min. time on task.

There were many reasons for interruptions and missed times for attending the program sessions. Approximately 4 days were missed because of track and field days, summer fun day, introduction to high-school day, and final exams. Other smaller interruptions caused individual students to miss specific sessions. Student numbers 110 and 111 were scheduled into the afternoon because of the amount of use the computers were getting. There were many more interruptions to the afternoons in June than there were in the mornings and this made time on task more difficult for these two students. Students 112 through 115 attended morning sessions, and were often able to extend their sessions to catch up on missed time and days. Students 113 and 110 missed several days because of health

problems. Student113 was able to catch up reasonably well by fitting into other canceled morning time slots, but 110, being slotted into the afternoon, was unable to make up the time very effectively. Student 111 was often so caught up in class activities in the afternoon that he had a great deal of difficulty remembering to attend his sessions and had to be reminded constantly. Being late frequently, even by just a few minutes, added up to overall loss of time. Student 112 was slotted into a time of day that frequently allowed him to extend his time on the computer from 15 to 30 minutes and he was able to catch up and actually complete more sessions than was expected. Student # 114 worked slowly on the computer and did not finish as many sessions as was expected. Student115 kept his appointed time slots quite well but also worked slowly.

High Achievers

Student #110. This student was identified initially as one of the high level students but, as suggested by the computer reports, did not do as well with this program as was anticipated. She covered 21 sessions but left some work incomplete. This student was absent frequently (5 times), as well as having the schedule interruptions described previously. She had some difficulty getting the program to work for her at the start and was eventually moved onto another computer. This represents a problem with computer management. Checking the attendance in minutes, it is easy to see that her use was not consistent. After a tenuous start she tried to make up for lost time and often put in two sessions at one sitting instead of the regular 15 minute blocks. The effect of rushing through the last part of the program and the confused start may account for poor results and her severe criticism of the program.

According to the grouping and cumulative reports (Table 4.2), she

completed only 5 exerpt and 2 strategy lessons. Of the total time spent on the course over 30% was notebook, which is unjudged, therefore not graded or added to final scores. Although the computer task, exercise of taking notes and writing from them, was good there was no specified audience and no real feedback. Time permitting, the notebook exercises would have been used for individual teaching but being out of sync with the other students made group sharing too difficult.

Table 4.2

Summary of Course* and Grouping** Reports

| Student# | level | absence | sessions | exerpts | strategy lessons | notebook time | notebook files | notebook chars | overall score |
|---|---|---|---|---|---|---|---|---|---|
| 110 | high | 5 | 21 | 5 | 2 | 117 min. | 7, | 13539 | 63% |
| 112 | high | 0 | 30 | 12 | 2 | 191 min. | 31, | 30940 | 78% |
| 114 | middle | 3 | 30 | 8 | 4 | 102 min. | 13, | 17762 | 67% |
| 115 | middle | 3 | 26 | 12 | 4 | 49 min. | 15, | 12269 | 49% |
| 111 | low | 4 | 20 | 7 | 2 | 68 min. | 9, | 9335 | 58% |
| 113 | low | 10 | 35 | 6 | 1 | 95 min. | 7, | 11196 | 53% |

* Daily reports on progress in the program
** Cumulative report on progress.
Exerpts are the lessons or readings presented by the program.
Overall score is calculated by the program and presented in grouping reports

The overall score of 63% on the program was not in keeping with either of the reading pretests nor this student's personal norm. Student 110's grouping report, showed that, as of the second last session there was more work needed in all of the comprehension skills except constructing meaning. Weaknesses were detected in understanding time order (20%), understanding figurative language (0%), applying information (20%), analyzing character(33%), and identifying facts and opinions (50%). Recognizing story elements and understanding comparisons and contrasts, as well as new vocabulary exercises were not attempted. An overall score on comprehension skills of 60% was attained and 59% was the last, recent

score. The student spent 1 hr. 57 mins. on the notebook, creating 7 files containing 13,539 characters. This indicates she wrote prolifically but only in response to certain topics.

Summary. Overall this student did not perform as well as expected on this program. Even though she was not a self-starter and was expected to require encouragement, she did not perform as expected. The computer management problem, her absences from school, and school interruptions, all interfered with the consistency of the intervention. There may also have been other, undisclosed problems that interfered with expected progress.

Student 112. This student was identified as the other high level student according to initial performance on the Gates MacGinitie standardized reading test and the Johns IRI. He worked through the program at a better rate than expected, achieving high scores on most of the exercises. He did not require prompting to use the program, and had some positive things to say about it both while using the program and in the follow-up focus group discussion. The course reports and field notes from observations indicate steady progress in all areas of the program. According to the grouping report (Table 4.2) he had created 31 files for 30 sessions using 30,940 characters, indicating that he was doing some extra writing. He completed 12 exerpt and 2 strategy lessons, showed mastery of 7 of the 15 reading skills recorded and scored, and in the 70%s, with 80% as mastery, in 5 other skills. He showed weakness in understanding comparison and contrast (25%), applying information (50%), and time order organization (67%). He did not work on recognizing story elements. However he has always been a strong reader and how much actual improvement was experienced due to the intervention

is a question.

Summary of high achiever performance. Most of the problems associated with the previous high-achiever, student 110, did not occur in this case. Student 112 was not plagued by computer management problems and absenteeism. He was, however, subject to the many interruptions that occur in the spring of each year but availed himself of the opportunity to extend his time slot. This put him far ahead of expectations early in the intervention. His mature, positive attitude and willingness to work at the program appear to have helped.

Middle Achievers

Student #114. According to initial scores on the Gates-MacGinitie reading test and the Johns IRI, this student was identified as a middle or average student. She worked very hard, never missing a session when she was at school, was absent only 3 times and always made up CAI time if she could be fitted into a free slot. She achieved many good scores on individual lessons and spent time on all skills but three. Her overall average was 67%. She maintained a good attitude throughout, although she did express concern that she was missing some of the classroom work and wanted to keep up in it as well as with the project. She covered 30 sessions including 8 exerpts and 4 strategy lessons. She mastered 16 vocabulary sections out of 18 tried, and spent 102 minutes in notebook, creating 13 files using 17,762 characters (Table 4.2). She had mastered constructing meaning, and concluding and generalizing, achieved (67%) on comprehending literal meaning, (62%) on making inferences, and (75%) on identifying facts and opinions. She was struggling with applying information (50%), time order (43%), problem solution organization (33%), comparisons and contrasts (33%) but was showing an improvement of 50% on recent work, figurative language (25%), and

analyzing character (33%).

For this student, attitude seemed to be the main reason underlying good progress. This also explains her good progress in class. She complained that the computer work was too easy. She suggested the provision of choices so a student could opt for harder work if desired. She expressed the concern that if the work was not hard enough, her brain would not have to work hard and she wouldn't learn properly. Her efforts were partly motivated by trying to fit in with the more academically successful students as she was new to the area this year. She also placed a very strong value on education, taught at home.

Summary. This student did not experience too much inconsistency in terms of time on task. She had no computer management problems, was seldom absent from school, and was able to make up missed computer time. Her personal drive and need to achieve caused her real frustration with end-of-the-year interruptions as did the knowledge that she was not keeping up with classroom work. Her attention to detail made her progress through the program slow but her achievement was consistently good.

Student #115. This student was the second middle level student. He put in a good effort through the first part of the program, missing only 3 sessions, and tried to catch up after an absence. His overall average was 49-50% (Table 4.2), but he showed little improvement from session to session.

The grouping report showed that he had completed 26 sessions, spent 49 minutes on notebook having created 15 files using 12,269 characters (Table 4.2). This is a tremendous amount of writing for this student, especially in such a short period of time. Much of what was written, however, was of poor quality. He had attempted 30 vocabulary selections but only mastered 16 according to the program

criteria for success, and had completed 12 exerpts and 4 strategy lessons. He had mastered only identifying facts and opinions and was showing progress in concluding and generalizing (73%), and problem-solution organization (60%). He was struggling with 9 of the 15 skills listed (scores of 25-50%) and had left understanding comparisons and contrasts unattempted.

It didn't take long for the fascination of the program to wear off for this student. The required work soon began to defeat him. He was quite capable of and did some good work, but was often extremely lethargic. At one time during the year concern was expressed regarding diet and energy levels with his mother. A medical consultant suggested no cause for his lethargy.

Summary. Consistency of intervention was not a factor for this student with the exception of the end-of-the-year interruptions that all of the students experienced. His disinterested attitude toward education and lack of energy for academic work did seem to be a factor after the initial fascination of the program wore off. This student concluded the intervention having made few gains, according to course and grouping reports.

Summary of middle achievers performance. Attitude seemed to account for the disparities between the two average achievers. Student #14 worked diligently, while student 115 lost interest and made few gains.

Low Achievers

Student #111. This student was identified as a low-achieving student according to initial reading performance. He was absent 4 days and also had difficulty getting into the program and operating it effectively because of program administration problems. He took a long time on some exercises and skipped through others without doing the work. From June 17 to 22 he appeared to have

done little but write in his notebook, read, or put in time, having answered no questions and done little on vocabulary. From June 9 to June 17 he showed good performance, spending over an hour in the notebook and according to the grouping report, creating 9 files with 9,335 characters (Table 4.2). From June 11 through June 17 he attempted a number of exercises and put in a great deal of time. Early in the intervention his scores were within acceptable limits according to CAI standards, but once he began to attempt more difficult selections scores declined rapidly. He also appeared to have skipped through a number of sessions without accomplishing anything, cramming a lot into a few, long sittings on June 9th, 11th, 15th, and 17th. These long sessions inflated time (339 minutes), but he completed only 7 exerpts and 2 strategy lessons, with an overall score of 58%. Comparing recent to cumulative work, he showed little improvement over the course of the intervention.

The grouping report indicated that this student had strengths in identifying main ideas (100%), and identifying facts and opinions (100%). His abilities in constructing meaning (68%) and understanding figurative language (75%)were acceptable, but he was having difficulty comprehending literal meaning (38%), making inferences (50%), concluding and generalizing (0%), time order (0%), problem-solution organization (0%), and applying information (50%). The vocabulary report indicated that although he mastered all of the vocabulary he worked with, he worked with only 9 out of 154 words. This student had little positive to say about the program and needed constant reminders to attend daily.

Summary. Computer management problems, end-of-the-year interruptions, and skipped sessions led to a lack of consistency in the intervention. They led to frustration and a bit of a 'giving up' attitude influenced by having to start again and

overly-long sessions intended to allow the student adequate time with the program. These factors may well account, in part, for this student's poor achievement and lack of expected progress.

Student #113. This student was identified as the second low-achieving student by scores on the Gate-MacGinitie and Johns IRI. He did quite well with the program for a short time, then had an accident and missed 10 days. This impeded his progress for a time, then he worked hard to catch up. From the course report, it is evident that he started with low performance skills at the grade 6 level, but worked diligently. He needed no prompting to go to the computer and stayed on track at the start of the program. His scores were low but he was working. He attended faithfully when present, but his efforts and progress lagged toward the end of the intervention.

The grouping report showed that he had spent 95 minutes on the notebook having created 7 files with 11,196 characters (Table 4.2). This is laudable in terms of writing and indicated that this student was working well on the program at times. He attempted 9 out of 154 vocabulary units and mastered 7 of them. He only covered 6 exerpts and 1 strategy lesson, possibly because he worked so slowly, missed so much time, and lost interest toward the end.

According to the Grouping Report, he showed mastery in understanding figurative language, analyzing character, and concluding and generalizing, and was working in the 60% range in constructing meaning, identifying main ideas, understanding cause-effect relationships, and using context clues and structural analysis. He was having difficulty with comprehending literal meaning (35%), making inferences (53%), time order organization (0%), problem-solution

organization (33%), and applying information (50%). He did not attempt understanding comparisons and contrasts, identifying facts and opinions or recognizing story elements.

Summary. Considering the numerous absences, the progress this student made was excellent. The effects of isolation appear to have been twofold. It was beneficial to be removed from the social pressures of the class and to work independently, but this was also a hindrance because, left to choose for himself, he made little progress. When the novelty faded and the student had to rely on his own incentive with no partner or teacher to encourage him, he accomplished very little. The incentive to complete the work and be up with the others was apparent in the progress he made after the students exchanged information as to where they were in the program. This exchange was impromptu, voluntary and came out of casual conversations among the students in class. The incentive to complete the work did not include an incentive to do a good job, however, and his scores were not high. The lack of personal incentive to strive and achieve, possibly through low value placed on academic achievement at home, was a real detriment to this student's progress in the program. Absenteeism and end-of-year disruptions interfered with the consistency in the intervention. The resulting large blocks of time used to catch up were contributing factors to the poor results achieved by this student.

Summary of low achiever performance. The performance of both low achievers was affected by disruptions in program use due to absenteeism and computer time disruptions.

## Overall Summary of Observations

Based on the observations from the computer generated records, the

answer to the question of whether the implementation of the Reading Investigations Strand of the Successmaker program was effective for the grade six students in this one classroom is ambiguous. Students from all three levels showed improvement in some reading skills according to the intervention program reports, but there was not consistently more improvement among the high-achieving than the middle or low-achieving students. No one group seems to have benefited more than the others. There is no uniformity or trend to be identified in the reports based on high, middle, or low-achievement groupings. The high-achiever, #112, began the intervention with better reading skills, as measured initially by the Gates-MacGinitie standardized test and Johns IRI than did any of the other students. He maintained the highest cumulative scores of all the students throughout the intervention. The other high-achiever, student # 110, did not fare as well. Her cumulative score decreased approximately as much as one of the low-achieving students by the end of the intervention and she showed no real improvement in any of the targeted skills. One of the middle-achieving students, # 115, experienced the largest drop in cumulative scores, almost twice as much decrease in cumulative scores as the next lowest student # 111, a low-achiever.

Similar variations occurred in the amount of work completed, as represented by vocabulary mastered, exerpts completed and strategies attempted. One middle-achiever, student #115, had the lowest cumulative score, 49%, but completed more of the program than all but one other student by mastering 16 vocabulary terms, completing 12 exerpts, and working on 4 strategies. The student with the highest cumulative score, (#112), who was rated as a high-achiever, only mastered 12 vocabulary terms, completed 12 exerpts, and worked on 2 strategy lessons. The reports generated by the program were designed to track the individual's growth in specific areas but do not give an overall statement

of progress that could be used to make effective comparisons. Each student benefited in his or her own way and to a greater or lesser degree than the other students.

Consistency of intervention was jeopardized to different degrees for each student for different reasons, but in each case it is assumed to have had an influence on the effectiveness of the program. Prolonged absences experienced by some of the students also had an effect on performance but there appeared to be no correlation between days missed and final cumulative scores. It should be noted, however, that the two students who missed the largest number of sessions due to absenteeism, #110, a high-achiever and #113, a low-achiever, were also the only students to show no improvement in any particular skill. The lengthy computer sessions used by the students to make up missed time on the program and the frustrations caused by computer management problems are also factors which may have influenced the effectiveness of the program. Missed time in class and concern about missing out on important class activities was a problem for one student and may also have had an effect on performance. The degree to which each of these factors influenced the effectiveness of the program for each student is impossible to estimate, as was determining the amount of growth attributable to reading ability or achievement level.

Using these observations it appears impossible to say definitively that computer-assisted instruction is more effective for some groups of students than others. Since there were students from both high and low levels of achievement who did not show improvement in any of the skills it also cannot be stated that CAI instruction is effective overall or that this form of instruction appears to be more beneficial for one level of students than others. Reading achievement scores were examined next to discover whether this pattern of ambiguity was sustained.

Reading Achievement

The question was: "Do low-achievers benefit more from CAI than middle or top-achievers as assessed by performance on the Gates-MacGinitie standardized reading test (1965) and the Johns' informal reading inventory (1994)?"

As shown in Tables 4.3 and 4.4 the changes in scores of the Gates-MacGinitie Reading Test (1965) and the Johns Basic Reading Inventory (1994) from March to June were more pronounced and varied for each student than was anticipated. In fact the varied nature and extreme changes, in some instances, made it difficult to judge if the experience with the program had as much impact on the performance of the students as suggested by daily observations during the intervention.

Table 4.3

Gates-MacGinitie Results: Stanines

| | | Comprehension | | Vocabulary | |
|---|---|---|---|---|---|
| Student # | Grouping | March | June | March | June |
| 110 | High | 6th | 4th | 5th | 6th |
| 112 | High | 7th | 8th | 8th | 6th |
| 114 | Middle | 4th | 4th | 6th | 3rd |
| 115 | Middle | 4th | 5th | 5th | 4th |
| 111 | Low | 4th | 3rd | 5th | 5th |
| 113 | Low | 3rd | 3rd | 3rd | 2nd |

| | | Speed | | Accuracy | |
|---|---|---|---|---|---|
| Student # | Grouping | March | June | March | June |
| 110 | High | 4th | 3rd | 4th | 4th |
| 112 | High | 6th | 5th | 6th | 6th |
| 114 | Middle | 6th | 7th | 8th | 8th |
| 115 | Middle | 4th | 8th | 4th | 8th |
| 111 | Low | 2nd | 3rd | 3rd | 3rd |
| 113 | Low | 2nd | 2nd | 2nd | 3rd |

High Achievers

Student 110. According to Gates-MacGinitie performance, this student was performing much better in March than she was in June. Her reading comprehension dropped from the 6th stanine in March to the 4th stanine in June, and speed fell from 4th to 3rd stanine. There were gains on vocabulary performance, however, from the 5th stanine in March to the 6th stanine (Table 4.3), with no change in accuracy.

Table 4.4

Johns Basic Inventory: Grade Equivalents

| | | Oral Comprehension | | Silent Comprehension | |
|---|---|---|---|---|---|
| Student # | Level | March | June | March | June |
| 110 | High | gr 8 | gr 7 | gr 8 | gr 6 |
| 112 | High | gr 8 | gr 10** | gr 8* | gr 10** |
| 114 | Middle | gr 7 | gr 7 | gr 6 | gr 7 |
| 115 | Middle | gr 7 | gr 7 | gr 6 | gr 6 |
| 111 | Low | gr 6 | gr 7 | gr 5 | gr 6 |
| 113 | Low | gr 5 | gr 5 | gr 5 | gr 6 |

Note The first sign of frustration is the one recorded in every case.

* This student only tested to level 8 and did not reach frustration in silent.

** This student was tested to the top level and did not reach frustration.

Reading performance as assessed by the Johns IRI also indicated better

performance on silent reading comprehension in March than in June. Her results on the Johns Reading Inventory (Table 4.4) showed a grade level of 8 in both silent and oral comprehension in March and a drop to level 6 in silent and 7 in oral in June.

Summary. The only increase shown by student 110 was on the Gates-MacGinitie vocabulary test. Other reading performance indicators showed either decline or no shift. As noted in the reading strand progress observations, this student did not perform as expected. It is probable that factors extrinsic to the study and disruptions that caused inconsistencies in the intervention interfered with progress. A decline in scores as seen on the Gates MacGinitie and Johns is unreasonable and would indicate that some factor, other than academic ability and the computer assisted learning program was influencing scores. High initial scores may represent a Hawthorne effect.

Student # 112. This student was also a high level reader. Reading test scores showed an increase in comprehension, from 7th to 8th stanine, but a decline in both vocabulary, 8th to 6th stanine, and speed, 6th to 5th stanine on the Gates-MacGinitie (Table 4.3).

The Johns IRI was not a good measure for this student since the passages only go to level 10. June results showed this student had reached ceiling level on all counts.

Summary. Student #112 showed gains in reading comprehension on both the Gates-MacGinitie standardized test and the Johns IRI. Familiarity with the test format may have allowed him to perform better on the retest. As noted in the reading strand progress and observations his positive attitude and willingness to work at the program appear to have helped him make a real success of this intervention. Even though he was subject to the many spring-time interruptions,

they did not seem to interfere with his anticipated progress nor the consistency of intervention as he availed himself of the opportunity to extend his time slot early in the study. Student 112 was very happy to be selected for this study and, as was noted, spent much more time on the program than any of the others.

Summary of high achieving performance. While one high achieving student made performance gains according to reading test results, the other made gains only on the vocabulary subtest of the Gates-MacGinitie. This discrepancy was attributed to outside factors, including disruptions in regard to time on task.

Middle Achievers

Student # 114 was considered a middle level reader and showed improvement in speed and accuracy on the Gates MacGinitie but declines in vocabulary scores from March to June. While comprehension performance was maintained at the 4th stanine from March to June, performance dropped from the 6th to the 3rd stanine in vocabulary (Table 4.3). Her scores kept her in the 8th stanine for accuracy, but she gained in speed, moving from the 6th to the 7th stanine.

On the Johns IRI, student 114 showed improvement in silent reading only, improving from grade level 6 to 7 (Table 4.4). Performance on all other measures remained the same.

Summary. It was expected student #114 would excel with this program because of her strong work commitment. She did demonstrate a slight increase in comprehension on the Johns and no appreciable change on the Gates MacGinitie. The positive attitude, personal drive, and willing attention to detail, typical of this student, helped make the experience of this intervention successful. The

frustration caused by end-of-the-year interruptions and her inability to keep up with classroom work as well as involve herself with this project, did not seem to have significant adverse effects on her progress in this program.

Student # 115. This student was also a middle level reader. He showed improvement in all 3 categories on the Gates-MacGinitie. These seemed significant with increases on the comprehension section from 4th to 5th stanine (Table 4.3) and from the 4th stanine to the 8th on speed and accuracy. The large gains in speed and accuracy may, in part, be credited to familiarity with the testing format.

On the Johns IRI, no change was noted in comprehension. Performance was maintained at levels 7 and 6 in oral and silent comprehension respectively.

Summary of middle achiever performance. As stated earlier, it was expected that student #115 would either get into the program and do very well or do little or nothing. At first glance the Gates-MacGinitie reading scores would indicate that he definitely made gains from participating in the CAI program, but when his overall performance on the computer program, daily effort and progress, and achievement in skills were examined, it became questionable that the growth shown on the reading tests could be attributed solely to participation in the CAI program.

Reading performance test scores for student #114 confirm findings from the computer program course and cumulative progress reports. The benefits of CAI were positive for her.

Low Achievers

Student #111 was considered a low level reader and showed a decline in comprehension scores on the Gates MacGinitie from the 4th to 3rd stanine (Table 4.3), but a gain from 2nd to 3rd in the speed section of speed and accuracy.

Surprisingly, this student demonstrated an overall gain in grade equivalent scores on the Johns IRI, increasing from 6 to 7 in oral and 5 to 6 in silent comprehension (Table 4.4).

Summary. It was not expect that much improvement would be seen from student #111 but it was surprising that his comprehension score on the Gates-MacGinitie dropped, especially when his averaged score on the Johns IRI showed an increase of one grade level overall. Part of the increase could be because he was more familiar with the Johns testing format and was more able to concentrate on the test itself. This particular student had to be reminded to attend the computer sessions and during the focus group discussions let it be known that he had been easily distracted and frustrated with the CAI intervention. Field notes also indicated that he was often not on task and not progressing well. Part of the improvement noted could be ascribed to a take-home reading program he was involved in from January to June. This consisted of daily, concentrated reading for up to 15, but not exceeding 20 minutes of self-selected materials, and follow-up retelling exercises. The student earned real marks for his report card for this extra work. He chose the readings himself, selecting reading levels and topics from his own sources and interacted with a person of his choice at home. The retelling and discussion were impromptu and marks were given for length of reading, accuracy of retelling, and the number of questions he could answer. The teacher had no part in this exercise except to record marks authorized by the parent and brought to school.

Since there were computer management problems, causing the student to start the program again, end-of-the-year interruptions, skipped sessions and overly-long sessions intended to allow the student to make up time, there was a lack of consistency in the CAI intervention. These factors may well account, in part, for the poor achievement as on the Gates-MacGinitie.

Student #113. This student was also considered a low level reader and maintained reading performance levels as measured by the Gates MacGinitie comprehension and speed and accuracy tests (Table 4.3). Vocabulary scores dropped from the 3rd stanine in March to the 2nd stanine in June.

Results on the Johns indicated an improvement in silent comprehension, level 5 to 6, while oral reading comprehension remained the same (Table 4.4).

Summary of low achievers. Student #113 showed improvement in comprehension on the Johns IRI and on the speed and accuracy section of the Gates-MacGinitie. This was surprising considering the missed time and slow progress this student experienced. It was suspected this student would appreciate being out of the social setting of the classroom and might benefit from the CAI interventions but it was not expected he would improve a full grade level in silent comprehension as indicated by performance on the Johns IRI. Student #113 did spend long periods of time catching up and the fact that the others were so far ahead of him seemed to give him the incentive to finish with 417 minutes on the computer program. He indicated in the focus discussions that he preferred to work on the computer and be on his own. The reading strand computer program appeared to have helped him.

Overall Summary of Reading Achievement

According to the Gates-MacGinitie results, there were changes in all three groupings in all areas of reading (Table 4.3). There were comparable gains in both middle and top level reading comprehension, but only a loss or no change at all for low level readers. Speed and Accuracy performance on the Gates-MacGinitie showed the most increase in terms of stanines for middle level students with some slight increase in the performance of low level readers and a decrease in stanines for both top level readers.

The Johns IRI results (Table 4.4) indicated that there were minimal gains on oral comprehension for two students, the performance of three students stayed the same and the performance for one student fell. Silent comprehension showed more change overall with four students showing an increase in grade level performance, one student remaining the same and one student decreasing. The performance of one of the two higher level students dropped while the other made gains, the performance of one of the middle achievers showed gains while the other remained static, and the performance of both low achievers increased.

Response to Question #1: "Is CAI instruction effective overall or is CAI instruction more effective for some groups of students than others?" For example, do low-achievers benefit more from CAI than middle or top-achievers as assessed by performance on the Gates-MacGinitie standardized reading test (1965) and the Johns informal reading inventory (1994)?

No clear pattern emerged. It was felt that the exposure to the CAI program was not long enough to gather reliable data upon which conclusions might be based. Whether or not CAI was effective overall according to the Gates-MacGinitie standardized reading test and Johns IRI is open to discussion. If any

conclusion were to be drawn simply from these tests, it would have to be that the CAI program was effective in different ways for each student and ineffective in different ways for each student.

One top level student increased his scores more than students at the other two levels, but the scores of one of the top level students decreased. It is difficult therefore, to attach too much significance to the results. Based on these results, it was difficult to state that the program was more effective with top than with middle or low level readers. Attitude seemed to have played a part.

Attitude. Recurring factors have appeared from the reading strand observations and data as well as the test results of the Johns and the Gates-MacGinitie. It became apparent immediately that attitude toward the use of the program was an important issue. If students were not motivated, either internally by personal values or externally by home values or rewards, they did not seem to do well on the program. Student 110 was enthusiastic about the program and then something external to the study distracted her. She did poorly compared to expectations based on her normal achievement level showing large losses on the Johns and the comprehension section of the Gates-MacGinitie. Student 112 began with a positive attitude attributable to several factors: (1) being selected for a novel experience, (2) finding from the Johns testing that he was reading at a very high level, (3) having a personal stake in doing well at whatever he does, (4) and having a curious mind. He did extremely well on the program, showing large gains on the Johns and the comprehension section of the Gates-MacGinitie.

Student 114 had a positive attitude and was excited about the experience of the program. Her strong work ethic as well as her regard for the value of

education helped her cope with the frustrations she felt with aspects of the program and interference with classroom work. She showed gains on the Gates-MacGinitie in speed and accuracy and on Johns IRI performance.

Student 115 did not have a very positive attitude to academics. He did not like to read and disliked writing. Once he found out that he was going to be doing both in this program, his attitude, which was initially positive, became negative. He showed gains on the Gates-MacGinitie but not on the Johns IRI.

Student 111 started with a positive attitude but ran into frustration with program management immediately. This appears to have detracted from the remainder of the experience.

Student 113 was happy to be chosen for the study and found working out of the class, and to a certain extent working alone, motivating. He showed some gains on both the Johns IRI and on the Gates-MacGinitie. Since attitude was a strong factor in class performance it is not surprising that it was also a factor in the success of this program.

Program management. Frustration with the management of the computer program may also have been a factor in the mixed results. Both of the students who had to restart because of management problems scored lower on the Gates-MacGinitie comprehension test in June than in March and one of them also showed losses on the Johns IRI.

Consistency. Consistency of intervention was another factor that appeared to have had an effect on results as measured by the Johns IRI and the Gates-MacGinitie. The student who appeared to have gained the most from the intervention was subject to the least disruption. The student who experienced the most disruption made no gains on the Gates-MacGinitie in comprehension and scored slight gains using the Johns IRI.

Based on the information to this point, the effectiveness of the Reading Investigations Strand of the Successmaker Program, for the 6 students from one classroom, as measured by performance on the Gates-MacGinitie and the Johns IRI, appeared to depend more on the individual's personal motivation, ability to deal with frustration, and commitment to doing well than it did to their existing levels of achievement.

## Results of Instructional Format Questionnaire and Self Concept Survey

The second question asked in this study was, "What is the impact of CAI instruction on: (1) attitude toward using computer programs as an instructional format; and (2) self-concept as measured by the respective questionnaire and survey and informed by the focus group discussion?"

### High Achievers

Student #110. This student did not show many extreme changes in opinion toward use of computers in education (Appendix A). In fact her opinion was unchanged in 8 of the 18 questions. According to her responses she was slightly less enthused about reading her own stories on a computer monitor now, but more enthused about reading other students' stories. She felt she now found it much easier to understand written instruction on paper (Q. # 8), a little easier to understand written instructions on a monitor (Q.#9), and needed less help understanding written instructions overall (Q.#11). She felt she was slightly less prone to be inattentive in class (Q.#13), but would prefer getting instructions from a teacher a little more than from the computer (Q.#14). She found it less difficult to ask the teacher or other students for help understanding things now (Q#15,

some to no), and did not now feel it would be easier to ask a computer than a teacher or other students (Q.#16, lots to not much). The response to question number 17 showed a 180 degree shift in attitude toward working on her own. She now would prefer to work in groups but she still saw computers as being helpful in her education (Q.#18).

Student #110 also showed little change on the self concept survey from March to June. In fact there was no change in the responses to 5 of the 10 questions. She felt her performance in the last few weeks had fallen from good to good-average. In March the response to question #7 showed she was happy not to have to work with someone else but in June she no longer saw this as being a reason to like working on the computer. In June her response to question #8 indicated that she would like to be able to ask others for answers to questions the computer did not supply and she went from having no dislikes in using the computer to being aware that sometimes computer instructions were not always the best (Q#. 10).

Summary. The effect of the exposure to a computer format for student #110 appeared to have been negative in some ways. She came away from the experience feeling that there was a place for computers in education, but that she preferred to interact with people more than with a computer. She seemed to have been getting bored with confining herself to her own work and expressed a desire to work more with other students. She thought she would find instructions from the teacher better in some ways. Similarly on the personal survey, student 110 had realized that she preferred interacting with real people more than with a computer and found that interacting with a computer was not the same as the give and take of interaction with people. She admitted she had difficulty understanding some

computer instructions and felt that she was doing less well in the last couple of weeks than she was in March. These feelings conformed with reading test results although she was not aware of these results.

Student 112. On the format questionnaire, student #112 made no changes on 8 of the 18 questions. He did not enjoy using the computer as much in June as in March (Q#1), not even simply for writing out his stories (Q#2). He did not like reading his own stories much at all from the computer now (Q#4), and indicated frustration about not being able to control the computer (Q#6). He would still like to use the computer for drill if needed (Q#7), but was not as enthusiastic as he was in March, otherwise he would not like to spend more time on the computer (Q#10). He indicated that he sometimes needed help to understand written instructions (Q#11), and would sooner get help from a teacher than a computer (Q#14). He was definite about wanting to work with another student rather than a computer (Q#14). In question number 18 he identified the value of a computer in his education for word processing.

On the self concept survey student #112 changed his responses on only 3 of the 10 questions. He recognized in June that he may not always do his share of the work in groups. He found that he didn't like working on the computer when he wasn't able to ask questions because the computer didn't offer explanations to his questions. He also, in question #10, indicated frustration with using the computer with his response, "It can be frustrating."

Summary. Student #112 showed disillusionment with the computer after using the reading program. He did not want to use the computer as much now as he did in March and found computer use frustrating. He would sooner work with other students, get instruction and explanations from a teacher, and use the

computer basically for word processing.

High achievers summary. There was agreement between the two high achievers on questions 7, 13, 14, 17. They both felt that practicing skills on the computer was a good idea. By the end of the intervention they both felt they did not have a problem with paying attention in class. They both started out feeling they would like to get instruction from a computer rather than a teacher and ended up not thinking it would be much easier. They both felt they would like to work with other students rather than alone on the computer. On the self concept survey the high achievers agreed on the fact that: they didn't like working on the computer because they couldn't ask it for explanations, the computer could be frustrating and it didn't always give the best instructions. They both started out thinking computer use in general was fun and still felt that way after the intervention.

Middle Achievers

Student #114 changed only 6 of 18 responses to questions on the evaluation of instruction format questionnaire (Appendix A). She indicated that she was now as unappreciative of reading others' stories on the computer as she was of reading her own (Q#3&4). She had used the computer a lot out of school but less than she had estimated in March. She would now not like to spend more time doing her work on the computer much, whereas in March she thought she would enjoy it much more (Q#10). She would still like to work with a computer rather than another student, but not as much as in March. She now felt she would not find it much easier to ask a computer to help her understand something than a teacher or another student, whereas in March she felt it would be much easier. She saw a role for computers as an aid in doing projects, as a resource, for games,

and for keyboarding. She did not mention the computer as an instructor or tutor.

On the self concept survey, student #114 changed responses to only 3 of 10 questions. She still saw herself as an average reader (Q#1), getting better at reading (Q#2), as doing very well in her studies lately (Q#3), and preferring to work with a partner (Q#4). She saw herself as liked by others (Q#5), but felt they may find her a little bossy at times (Q#6). In March she was happy to use a computer because no one else knew if she made a mistake. Now she liked the computer because she could progress at her own speed. She still saw the computer as good for her education but was frustrated with, and criticized it for not explaining things well.

Summary. The overall change in student #114, indicated by responses on the questionnaire, seem to be three-fold. She was less enthusiastic with the computer, having met with some of the frustrations of using it, she has realized it is much easier to get verbal explanation from a teacher or help from another student than a computer, and she now realized she prefers working with others to spending time on the computer.

The responses on the self concept survey show agreement with the questionnaire. She preferred working with a teacher and other students to working on the computer. She still enjoyed the thought of using the computer because she could move at her own pace but realized there would be frustrations with computer explanations. The uses she suggested for the computer was as a tool for helping her do her work.

Student #115. This student changed 9 of the 18 responses on the format questionnaire. He still liked to use the computer some (Q#1), but did not like to use the word processor as much now as in June (Q#2). He enjoyed reading others'

stories on the computer more but enjoyed his own less now than in March. The frustration he has experienced was obvious with the change in response from "not much" to "very much" in question 7 referring to the use of the computer for practice. He also acknowledged the difficulty he has reading instructions on the computer (Q#9&14), preferred to work with another student more than a computer (Q#12), and felt that teachers' explanations were more interesting than the computer's (Q#14). He still preferred working individually on the computer to working in groups, but would like to work with one other student. The uses he saw for the computer were helping with his math and typing skills.

On the self concept survey #115 changed 5 of 10 responses. His self-esteem had improved. He felt that he had improved in his reading the last few weeks (Q#2), although he realized he was still too complacent about standing up for himself (Q#5). His response to question #7 suggests he still preferred to work independently and but had not had the success working on the computer he thought he would have (Q#7&8). In March he felt that the computer offered a less messy alternative to producing his own written work and had found some options available in the program which impressed him (Q#9). In March he thought he might be confused with the work on the computer and in June he acknowledged frustration with it.

Summary. The overall changes indicated by the questionnaire were two-fold. Student #115 had become a little disenchanted with the computer and now realizes some of its limitations and the frustrations they can cause. He also had more of an appreciation for the information provided by the teacher.

The self concept survey results showed changes in attitude similar to those of the questionnaire but also that his self-esteem had improved. He saw himself as a better reader. Even though he acknowledged his weakness in standing up for

himself in project work he saw an improvement in reading. The results of the Gates MacGinitie and the Johns agree with his self evaluation, even though the results on the Reading Investigations strand, Course and Grouping Reports, do not.

Middle achievers summary. These two students only agreed on three items in the format questionnaire. Since the intervention they both still found it "lots easier" to understand written instructions on paper and only one still found it "lots easier" to understand written instructions on the computer. Neither one of them found it difficult paying attention to what was being talked about in class. Generally student 115 had become less enchanted with using the computer for getting information and instructions, doing work, practicing skills, and getting help understanding things.

On the self concept survey both middle achievers still had a good opinion of themselves as readers and one of them felt he had improved lately and was better at contributing good work to group projects, although both students expressed concern about their effectiveness in group projects. There had been no change in their opinions in regard to the quality of their work in other subjects. They both enjoyed being able to go quickly and produce neat work on the computer, but expressed frustration at the inability of the computer to explain things. One of them saw the computer as being good for your education and the other liked the idea of being able to express his own opinions.

Low Achievers

On the format of instruction questionnaire, student #111 did not change his opinion on 8 of the 18 questions. He indicated that he now was more in favor of

word processing his stories (Q#.2), but less in favor of reading his or other students' stories from the computer (Q.#3&4). He expressed less frustration with difficulties on the computer (#6), but indicated that he was more aware that he has difficulties understanding computer instructions (Q#9). He was very much less in favor of spending more time on the computer (#10), but would still find it much easier to ask questions if he could ask a computer rather than a teacher or other students. Question #17 indicated a 180 degree change in preferences as he now would sooner work in groups than alone. He still saw a use for computers in education and would like to use them for more 'subjects' and 'things'.

On the self concept survey, student #111 remained unchanged in his opinions for 6 of the 10 questions. He now felt his reading was getting better, but not as much as in March. He felt he had done his best work recently in groups (Q.#4), because he did his share of the work (Q.#15). He still felt he could go quickly on the computer (Q.#7), but there was some frustration expressed at the limitations to his overall rate of progress (Q.#8). He still liked computers for games and to write stories but now showed frustration that the computer can 'screw up', (his expression), and not necessarily because of something he did.

Summary. Student #111 found it easier to write on the computer, possibly because of neatness and speed factors, but did not like to read from the screen. He was still not happy asking teachers or others for help and would like to be able to get help from a computer, possibly because it wouldn't think badly of him for asking 'stupid' questions, as he might phrase it. His stated preference was for group work and he admitted that he did better work with other students, depending on the student. He wanted an expanded use of computers for education. He identified this as games.

On the self concept survey he indicated that his opinion of his reading

development was not as good as it was in March. The Gates MacGinitie supported this but the Johns did not. He was quite frustrated with the fact that he must proceed through reading exercises at the speed the machine dictated and was very unhappy with the knowledge that the computer can 'screw up' without his having done something wrong.

Student #113 changed only 8 of 18 responses to questions on the evaluation of instruction format questionnaire. He enjoyed using the computer to write and read his own and others' stories in June as much as in March (Q# 1&2), although he never did enjoy reading his own stories much (Q#4), and had only slightly enjoyed reading the stories of others (Q#3). He still found it very frustrating when he couldn't control the computer (Q#6), but he would still like to use it for skills practice if needed (Q#8). He felt he could understand written instructions very well on both computer and paper (Q#7&8), but needed help at times (Q.#11). He was no longer as convinced he would like to spend more time either doing work on the computer (Q#10) or working with a computer rather than another student (Q.#12). He felt he was more attentive in class now and that instruction from a teacher was more interesting than from a computer (Q#13). He still did not like interacting with teachers and students though and found asking a computer for help easier than asking a teacher or another student. Question #17 showed that he would sooner work on his own than with even just one other person. In March, student #113 stated an interest in word processing, informational programs, games, and the internet. In June he only mentioned the physical components of a computer, the printer and the tower.

On the self concept survey student #113 changed 6 of 10 responses to questions. His estimation of himself as a reader fell from average to below average

(Q#1), even though he felt there had been no change in his reading ability (Q#2), and that his work generally was still average (Q#3). He stated his best work was accomplished independently and no longer with a partner (Q#4). He felt that others didn't think he could contribute good work to a project and they didn't like him, not just that they didn't like working with him. He still felt he could do well on the computer and liked using it for that reason but found it frustrating when he couldn't go very fast on it. The thing he liked best about the computer was playing games and what he disliked about it most was word processing.

Summary. Student #113 did not change his attitude toward reading and still did not care to read his own work or some one else's work. He didn't really seem to like to use the computer for work but prefers it to working with others. Even though he found teacher instruction more interesting now than in March, he still did not like to interact with teachers or other students much and preferred to use the computer if he needed help with something. He liked to play games on the computer but no longer referred to the internet, or informational programs, and in fact indicated he did not like word processing much anymore. His positive attitude toward the computer had deteriorated. He had not improved his attitude toward others and his self esteem appears worse.

On the self concept survey his evaluation of himself as a reader had dropped since March without change in his performance. This indicates he was possibly comparing himself to the others in the intervention group and the privacy, which was one of the benefits of the computer program, was not necessarily assured. His self esteem was poor in that he felt the other students did not like him. Even though he found the computer frustrating and did not like word processing, he still preferred the computer to working with others who might reject him.

Low achievers summary. There was consensus between the two low achievers on questions 1, 4, 8, 9, and 10. Both of them started out enjoying using the computer and claimed the same at the end of the intervention. They shared a tendency toward not enjoying reading or getting information from the computer as much as they had since the intervention and claimed to understand written instructions on paper as well as the ones on computer. They both found it easier to pay attention to what was being talked about in class. However student #111 did not want to spend more time doing his work on the computer while #113 did.

On the self concept survey, both students still saw the use of computers as being for games and expressed frustration at the sort of management problems that arise when using the computer. One student has shifted towards wanting to work with others more than the computer and the other, who has always had difficulty associating with other students in the class, was as committed as ever to working on the computer rather than with other students.

Summary of Questionnaire and Survey

Questionnaire. When asked if they liked reading their own stories on the computer all of the students liked it less after the intervention and those who did not change opinions did not like it much before the intervention.

When asked if they would like to spend more time doing their work on the computer all but two found it less appealing, one found it "much" less appealing, and the ones who had not changed their opinions did not like it much to start with. Student #115 only liked the idea "some". Similarly, when asked if they would sooner like to work with a computer than another student, all but two students

changed their opinion to "a lesser degree", one "much less" and the ones who had not changed their opinions only liked the idea "some" or did not like the idea much prior to the intervention.

When asked if they found getting instructions from the computer more interesting than from a teacher, four students expressed "less interest" since the intervention and the two who had no change of opinion did "not like it much" or only liked it "some". Similarly when asked if they would find it more interesting to get help understanding things from a teacher or other student than a computer, all but one thought it would "not be interesting" to use the computer for this. Four did not change their opinion, one found it "much less interesting" to get help from the computer and one, #113 who had difficulty interacting in the class, found it a "little more interesting". Also in response to the idea of asking the computer for help, one found it to be "much more difficult" and another found it "very much more difficult" to ask a computer.

As far as just enjoying using the computer, there was only one change in the whole group, 112 found it "very much less enjoyable" to use the computer while the others still expressed the same amount of enjoyment for it as they had at the start of the intervention.

The effect of the experience with the computer program on different levels of achievers was varied. The high achievers both enjoyed reading their own stories on the computer "less" now than prior to the experience, and they both thought they would like getting instructions from the computer "less interesting" than from a teacher now than prior to the experience.

The middle achievers both indicated that they would sooner like to work with another student rather than a computer since the intervention.

The low achievers both indicated that they would like to spend more time

doing work on the computer "much less" now than prior to the intervention.

Few responses to the format questionnaire showed changes reflective of an improved opinion of computer use. Two students felt they would find it "less difficult" to ask a computer for explanations, only one enjoyed writing out their own work on the computer, and only one enjoyed reading other peoples work from the computer more after the intervention. Only one found it "less frustrating" when the computer would not do what he wanted it to do. Of the five positive responses to the use of the computer, four were from low achieving students. They both said that games were an important use of the computer.

Self Concept. The self concept survey for the high achievers showed agreement in changes in concept, only in that computers were fun and they could be frustrating. Student 110 now liked working with computers, not because she did not have to work with someone else but because she could progress faster. Similarly she disliked the fact that computers could not always explain things to her. Student 112 believed that he did better work with another person rather than on his own.

The middle achievers both saw the computer as giving them the ability to progress at their chosen speed now that they have experienced the intervention. Prior to this they perceived computer work as being easy and providing privacy to make mistakes. Student 115 felt that his reading and quality of work was improving. He found the frustration in using the computer more significant now and outweighing the confidentiality that the computer use offered. Both of these students appreciated that using computers can be frustrating and confusing because of poor explanations but they liked the computer because they had the option of going at their own fast rate and not having messy work.

The low achievers showed the most change in self concept as indicated by

responses on the survey. They had no changes of self concept in common. Student 111 felt his reading was not improving as well as it was and felt his best work was being accomplished now in a group rather than alone or with just one other student. He expressed frustration in using the computer because it didn't always explain and he couldn't go very fast. Student 113 now rated himself as a below average reader and he would prefer to work alone now rather than with another student. He felt the other students didn't like him and that he couldn't contribute good work to the project. He recognized that he couldn't always do the work the computer gave him and got most of it wrong. This grouping of students agreed that one of the important uses of computers was for games but that computers could "screw up" and be frustrating.

Response to Question #2. What is the impact of CAI instruction on: (1) attitude toward using computer programs as an instructional format and (2) self-concept, as measured by the respective questionnaire and survey?

1. Overall, the response to the use of computers as a teaching format was more negative after the intervention than before it. Students found coping with management problems and understanding some of the explanations difficult. There was also a general shift toward wanting to work with other people and not just with the computer. Some of the students mentioned that they saw the computer as a learning tool, but did not praise it as an instructional format. The idea of games and internet use remained popular. Many of the students still wanted to use the computer, but to a lesser degree.

Exposure to this program caused changes in opinion for all of the students. There were many instances where the majority of students in the group tended to agree in their changes of opinion. Question 9 of the questionnaire asked if

students found it easy to understand written instructions on the computer monitor and showed a large shift from "very much" to "some". Question number 4 asked if students liked reading their stories on the computer monitor and there was a strong shift from "lots and very much" to "not much". Question number 12 asked if students would sooner work with a computer than another student and there was a shift from "some to very much" to "some to no". Questions number 14 and 16 asked if students find getting instructions from the computer more interesting than from a teacher and if asking the computer for explanations from the computer rather than a teacher or other students was better. The response moved from "some to very much" to " some to no" for both. Almost all of the students expressed frustration of one sort or another with the intervention according to the questionnaire.

2. The majority of changes in self concept noted after the intervention were negative and of those negative changes more than half were ascribed to the low achieving students. Frustration with inability to progress at a chosen rate and difficulty understanding instructions were the most frequent changes. Among the low achievers, there was some lessening of self esteem in regard to self perceived reading ability and performance on the computer. Much of the negativity came from student 113, who had a very poor self image to begin with. The fact that there was a shift to further negativity, even when the use of the computer was his choice above working with others, was noteworthy. The privacy the program afforded did not do anything to alleviate his poor self esteem. The use of the CAI did not appear to improve self concept, whether or not it did more damage than time in the regular classroom would have was not certain.

The self concept survey, which dealt mostly with the student's opinion of themselves and the computer, did not reveal as much change in opinion as the

questionnaire which dealt mostly with the student's opinion of using the computer. Most students saw themselves as average readers who were getting better at reading and working best with a partner or alone. Most of them liked the computer because they could set their own pace in some ways. Only one person was concerned with making mistakes publicly. Students mostly did not like working on the computer because they couldn't ask it questions. The computer wouldn't explain for them. Only two people found lack of speed, for whatever reason, frustrating enough to note. Only one person mentioned learning to read when asked what they liked best about using the computer. Frustration with computer glitches, "screw ups", and lack of interactivity was what they disliked most about using the computer.

## Focus Group Discussion

As well as providing the students with closure to the study, the purpose of the focus group was to substantiate the findings of the format of instruction questionnaire and self concept survey by allowing students to critique the program of which they now had first hand knowledge. The response of the students to the focus group questions demonstrated areas of concern for them as the intended users of the program and pointed out attitude changes developing toward the end of this short exposure to the program.

All of the students found some of the stories were boring. They all wanted to see options to choose not only what they were reading but also the level of challenge. It was possible that some students scored poorly on the reading achievement measure because they were bored with the program. All students admitted to allowing themselves to become distracted toward the end of the

experience. They were getting bored with both computer use and the CAI program itself. All admitted that lack of choice as to subject matter, level of work, and rate of progress was frustrating.

> It may be impossible but I'd like to improve the speed of it and the voices on it and more challenging... like I said before for grade 6'ers more work. To separate 1-3 then 4-6 and then if you think you are able go on to 7's stuff.

(114 in response to the question of what would you do to improve that program.)

All of the students agreed that the program was too easy, and the subject matter was old and too simple. "I don't like the summing up. You write a lot then it asks you to write some more. And the questions. Its like reading a picture book and then answering two questions. What colour is the frog?" (112) Although some of the students claimed that the material was too easy it was probably challenging enough, but peer pressure caused them to agree with the better readers who did in fact find it too easy.

The students agreed that the slowness of both the computer and the Reading Investigations Strand of the Successmaker program were annoying and that more student control over rate of progress would be essential.

The computer voice was a problem for all of the students as were the abrupt messages that it sometimes delivered. "I'd get some real people to talk on there with their normal voices..." (student 112) One student did not appreciate the lengthy audio introduction sections that preceded each reading and another complained there was just too much talking altogether. Since all complained of the voice it was not surprising he became frustrated with it.

Even after having the whole program explained to them, none of the students were left with the concept that they were using a program that was to help them learn how to comprehend what they read. This does not say good things about the skill lessons or the program explanations. All students claimed to understand the program but did not know there was a glossary or thesaurus available, so the tutorial on the use of the program itself was lacking. These were the responses to the question "Did you use the thesaurus?" "I didn't even know it was there." (112) "What's a thesaurus?" (111) "I think I did." (113) When they were reminded, in the focus session, that the program was to teach them how to read better, they said they already knew how to read. The aim of the program was to teach comprehension skills and students did not feel it had achieved this. They were left with the impression that the content was the important factor. These were the responses to the question, "It was supposed to teach you how to read and understand the concepts. Do you think it taught you that?" "Not really. It didn't tell me anything I didn't know about reading mostly just facts." (111) If they had understood better what the real objectives were perhaps the content would have been less of an issue.

The students all agreed they liked getting out of class but it appeared to bother two of the students very much, one because she missed homework that the rest of the class was doing and the other because she felt conspicuous interrupting the class when she left. A discussion of times when the students didn't want to go to the computers, made it apparent that the students would like to use the computer on a voluntarily basis, if they had an option as to times and some choices about what they would read.

All of the students but one said that they would like a variety approach to

learning consisting of classroom work, library research, group and partner work and computer. One of them pointed out that different students need to have different amounts and kinds of explanations and that the teacher was better able to supply this than the computer.

The two students who used the program in the afternoon were very frustrated by the administrative mix ups, the time they felt they had lost, and the fact that they then had to repeat CAI work. Thereafter they felt they were behind the other students. Administrative problems and technical difficulties which interfere with progress are not unique to this project. Several students had difficulty with the program and could not get the administration or technical help they needed with it, partly because no one was around and partly because they did not feel comfortable interrupting already overtaxed resource people.

It appeared to bother some students that they did not know who they were writing their summing up reports for, stating that knowing who or what the writing was for determined the amount of effort.

At the conclusion of the program two of the students stated they liked working on their own and since the computer allowed for this they liked the computer, but both said they would sooner do regular work on their own than work on the computer.

Two of the students appreciated that the program allowed them to make mistakes without others knowing or teasing, but this was never a large issue for the whole group.

Generally all of the students had had enough of the CAI program and seemed to be happy that the project had ended.

Focus Group Summary

The student input from the focus group helped to reinforce what the instructional format questionnaire and self concept survey pointed out. The use of computers as a teaching format was more negative after the intervention in that students found that coping with management problems and understanding some of the explanations difficult and frustrating. The Reading Investigations Strand of the Successmaker program was not meeting the needs of all the students in that many found the stories boring, the exercises not challenging enough, the voice annoying, and the lack of student controlled options too restrictive. At the conclusion students expressed a desire to work with other people and not just with the computer. The students indicated that they saw the computer as a learning tool, but wanted variety in the instructional format. The idea of games and internet use remained popular and many of the students wanted to use the computer but to a lesser degree.

Frustration with inability to progress effectively at a chosen rate and difficulty with understanding instructions were the most frequent changes the student noted on the self concept survey and this was reiterated in the focus group discussions. Among the low achievers, there was some lessening of self esteem, in particular with student #113. The privacy the program afforded did not do anything to alleviate his poor self esteem.

The students did not completely condemn this particular CAI or the use of other such programs in general. Their discussion did suggest that the Reading Investigations program was not fault free and should be used with caution as one among many tools currently used in their education.

# CHAPTER V

# FINDINGS AND IMPLICATIONS

The concept of learning, especially the learning of reading, as an interactive, complex process requiring social support for the development of individual processes in the construction of knowledge, is accepted by most educators today. Teaching methods must therefore be versatile enough to meet not only the needs of a general student body, but also the specific and complex needs of the individual. The student who is not performing to expected standards, who might be referred to as remedial, having the most complex and immediate needs of all students, may require perhaps the widest range of responses. Teachers need to be aware of individual and immediate needs of the students as they change throughout the course of learning and be prepared to respond effectively. The complexity of knowing, analyzing, and responding appropriately to those needs appears too complex for computer systems, such as the one implemented, as they exist today.

The use of CAI programs has become a concern to educators who recognize the complexity of the tasks that these programs are being used to address. The needs of many of the students cannot be properly met by what this particular CAI program offers and its intended and often specified use is frequently not complied with in implementation. Budgetary concerns appear to outweigh student needs for learning by administrators and teachers alike, resulting in such CAI programs being used indiscriminately. Their use as replacement for expert teaching and adequate remediation not only render the programs less effective than they should be, but may potentially harm students.

The purpose of this study therefore was to explore the concern that such

technological methods are frequently ineffective and determine if the use of such CAI programs may be having a detrimental effect on student self-concept. It also questions what use should be made of CAI programs in the elementary school years.

To this end this research: (1) examined the effectiveness of CAI programs through a literature review; (2) analyzed the structure of one such program aimed at enhancing reading performance, *(SuccessMaker, Reading Investigations*, Computer software, 1993) and; (3) reflected on the relevance of this program by examining the effect of implementing the program with 6 selected students from one classroom over a set period of time.

The questions for study were:

1. In this study, is Computer Assisted Instruction, as represented by the Reading Investigations strand of the Successmaker program, effective for 6 grade six students. For example, do low-achievers benefit more from this program than middle and high-achievers as assessed by performance on the Successmaker Reading strand's daily course reports and cumulative grouping reports, on the Gates-MacGinitie standardized reading tests (1965) and the Johns informal reading inventory (1994)?

2. What is the impact of this computer instruction on:(1) attitude toward using a specific computer program as an instructional format; and (2) self-concept as measured by the respective questionnaire and surveys and informed by the focus group discussion?

3. Given these results, how appropriate is the use that is currently being made of one such computer assisted instruction program?

## Summary of Findings

### Reading Investigations Strand Review

A number of characteristics of this program should raise questions regarding its effectiveness. It was found that there were problems with both the method of presentation and the selection of reading passages in the CAI studied.

Instructional concerns. The individual use suggested by the manufacturer precludes social input to learning and also may result in the students being stigmatized as they are removed from the classroom for computer work. Prereading exercises, essential to activating or providing background knowledge in the development of reading skills, are not possible. If isolated use and rate of proceeding are individualized, sharing in the classroom setting becomes difficult, especially if the program is being used for remediation. The materials covered are frequently not relevant to Canadian students since exerpts predominantly feature American history and American characters. Strategies are dealt with and then left with not enough application in other than the current program situation. The format of vocabulary studies becomes a little too "workbookish" in some areas. Students found they did not like the non-human voice quality, had little or no control over their learning, and the drudgery of repetitive drills became a "turn-off" for some. Little emphasis is put on the instructional value of discussion and hearing proper language usage. In short, opportunities for modeling are lacking.

Writing. The writing component of reading was not emphasized and written work had no specified audience and no sharing. Lacking a real audience and purpose rendered the notebook exercises ineffective. Level of challenge was not sufficiently individualized as a student's ability to put forth effort may fluctuate daily. The absence of encouraging peer and teacher praise quickly caused the

students in this study to lose interest in the writing activities.

Costs. The frequency of use required for optimal benefit from exposure to the program is not possible time-wise or financially. The initial cost of this type of program is prohibitive, especially in terms of class use. Yearly site licenses are another ongoing expense as are frequent upgrades to each program.

Computer Program Progress

According to the CAI program reports, students from all three levels showed improvement in some reading skills, but there was not consistently more improvement among the high-achieving students than the middle or low-achieving students. What did become apparent was that there was no uniformity or trend to be identified in the reports based on high, middle, or low-achievement groupings. The reports generated by the program were designed to track the individual's growth in specific areas but did not give an overall statement of progress in terms such as stanines or grade equivalents that could be used for comparison. Students benefited in their own way and to a greater or lesser degree than others.

Consistency of intervention was jeopardized to different degrees for each student for various reasons. Regardless of cause, consistency of time on task was assumed to have had an impact on achievement gains from the use of the program. Prolonged absences experienced by some of the students had some effect on performance but there appeared to be no correlation between days missed and final cumulative scores, although the two students who missed the largest number of sessions due to absenteeism were also the only students to show no improvement in any particular skill. Also student #112 scored the highest overall percentage in his cumulative score (81%), mastered the largest number of skills and missed the

least number of days. The lengthy computer sessions used by the students attempting to make up missed time on the program and the frustrations caused by computer management problems were also factors which may have influenced the effectiveness of the program. Concern about missing important activities in class was a problem for one student that may also have impacted performance. The degree to which each of these factors influenced the effectiveness of the program for each student is impossible to estimate, as is determination of the amount of increased growth attributable to achievement level prior to the intervention.

Reading Achievement Test Outcomes

According to the Gates-MacGinitie standardized reading test there were mixed results in the reading performance of all levels of students. The Johns IRI results indicated gains in oral reading comprehension for one high level reader, gains for one low level reader, with no real change for the other low level reader and the middle level readers. Silent comprehension showed more change overall, with one high level students' scores increasing, one dropping, one low level student's scores increasing, and only one of the middle level students showing an increasing.

Questionnaire Findings

The experience with the computer program for different levels of achievers caused varied changes in attitude toward the use of CAI programs. At the conclusion of the study both of the high-achievers said that they enjoyed reading their own stories on the computer less than prior to the experience, and neither found it as interesting getting instructions from the computer as from a teacher.

The middle achievers both indicated that they would sooner work with

another student than a computer since the intervention.

The low achievers both indicated that they would like to spend less time doing work on the computer now than prior to the intervention.

Few responses to the format questionnaire reflected an improved opinion of computer use. Two students felt they would find it easier to ask a computer for explanations, but only one enjoyed processing his own work on the computer. Only one enjoyed reading others' work from the computer after the intervention and did not find it frustrating when the computer would not do what he wanted. Of the five positive responses to the use of the computer four of them were from low-achieving students. These students both maintained that games were an important use of the computer.

Self Concept Survey Findings

High achievers. The self concept survey showed changes in attitude of high achievers but there was agreement only in that computers were fun and they could be frustrating. Student 110 now liked working with computers, not because she did not have to work with someone else but because she could produce work faster. Similarly she dislikes the fact that computers cannot always satisfactorily explain things to her. Student 112 believed that he does better work with another person rather than on his own and would opt for that rather than work alone on the computer. These students no longer visualized themselves interacting as effectively with a computer as with another student but they still saw some uses for computer programs in education. The experience did not appear to have changed their view of themselves as achievers.

Middle achievers. The middle achievers both saw the computer as giving them the ability to progress at their chosen speed now that they had experienced

the intervention. Prior to this they viewed computer work as being easy and providing privacy to make mistakes. Student 115 felt his reading and quality of work was improving. He eventually found the frustration associated with using the computer was more significant than the privacy provided by the computer program. Both of these average students appreciated that computers can be frustrating and confusing because of poor explanations but they liked having the choice of being able coincidentally to progress quickly and neatly. Again, these students noted some pros and cons of computer programs but showed no negative shifts in their opinion of self as learners.

Low achievers. As revealed in the survey responses, the low-achievers showed the most change in self concept but they had no changes of self concept in common. Student 111 felt that his reading was not improving as well as it had prior to the intervention and now believed that his best work is accomplished in a group rather than alone or with just one other student. He expressed frustration in using the computer because it didn't explain clearly and that slowed down progress. The management error that caused him to restart the program bothered student 111 more than it did any of the other students. Student 113 rated himself as a below average reader after the intervention and would prefer to work alone rather than with another student. He was convinced that the other students didn't like him and that he couldn't contribute to a project. He felt now that he couldn't always do the work the computer gave him and he got most of it wrong. This grouping of students agreed that one of the important uses of computers is for games but that computers could "screw up" and be frustrating. Student 113 experienced a negative shift in self esteem. This shift appeared to have been caused, in part, by social rejection, but also by unsuccessful interaction with the computer program.

Focus Group Findings

Students expressed concerns as the intended users of the program that supported the findings noted above. All students found some of the stories uninteresting and were frustrated with the lack of options to select what they were reading, the level of challenge it presented, and the rate of progress they could make. All students admitted to allowing themselves to become distracted toward the end of the experience, because they were getting bored with both computer use and the CAI program itself. They found the writing portion of the program lacking audience, purpose, and challenge. They noted the slowness of the computer and found the program annoying and they deplored the lengthy audio introduction to reading selections.

The purpose of the program, helping them learn how to better comprehend what they read, was not made clear to the students. The skill lessons and program explanations appeared to be lacking here. Students did not feel the program had achieved its goal of teaching better reading skills. With better understanding of the real objectives, perhaps content would have been less of an issue and comprehension would have become the focus in their minds.

The students all agreed they would like to use the program voluntarily, as part of a variety approach to learning consisting of classroom work, library research, group and partner work, and computer. Student 114 pointed out that different students need to have different amounts and kinds of explanation that the teacher was better able to supply than the computer program.

Administrative mix-ups caused restarts and the resulting feeling of being behind frustrated some students greatly. Administrative problems and technical difficulties which interfered with progress were not unique to this project. Several

students could not get the administration or technical help needed, partly because no one was around and partly because they did not feel comfortable interrupting already overtaxed resource people.

At the end of the program, two students claimed a preference for working on their own and since the computer allowed for this they liked the computer, but both said they would sooner do regular classroom work on their own than work on the computer. Two of the students initially appreciated the computer's confidentiality concerning errors, but this was never a large issue for the whole group.

## Conclusions

### CAI

As it was used in this study, the Reading Investigations Strand of the Successmaker program was found to have numerous problem areas that make it less effective, especially as a stand-alone program of study. Each student in the intervention found many sources of difficulty in using and profiting from the program.

Although the literature review supports the concept that learning, especially the learning of reading, requires the expertise of a classroom teacher, the social supports of a classroom and personal individual instruction on a regular basis, the study also found that the use of the Reading Investigations Strand of the Successmaker program as one of many teaching resources may be helpful.

Reading strand. Recurring patterns appeared from the reading strand observations making it apparent that attitude toward the use of the program was an important factor. If the student was not motivated, either internally by personal values or externally by others' values or some form of reward, they did not do well

on the program. Student 110 was enthusiastic about the program and then something external to the study appeared to distract her, yielding poor results compared to expectations. Student 112 began with a positive attitude and did extremely well on the program showing large gains. Student 114 had a positive attitude and was excited at the prospect of the experience. Her strong work ethic as well as the value she placed on learning helped her cope with the several frustrations she encountered. Student 115 did not have a positive attitude to reading, did not like writing, and did poorly on this program, partly because of a lack of effort. Student 111 developed a negative attitude when he ran into frustration with program management. This appears to have detracted from the remainder of his experience. He also did not do as well as anticipated. Student 113 was motivated by working out of the class and showed some gains. Since attitude is a strong factor in achieving in the class setting, it is not surprising that it is also a factor in the success of this program.

Frustration with the management of the computer program appeared to have been a factor for both of the students who had to restart. They both recalled it distastefully and neither did as well as expected on the program.

Reading Achievement

In response to the question, "Is CAI instruction effective overall or is CAI instruction more effective for some groups of students than others? For example, do low-achievers benefit more from CAI than middle or top-achievers as assessed by daily and cumulative computer records, performance on the Gates-MacGinitie standardized reading test (1965), and the Johns informal reading inventory (1994)?", the following can be said.

Based on results obtained, this CAI program was not as effective overall since not all of the students made gains in reading comprehension using this program. Nor was this CAI instruction more effective for any particular groups of students, high, middle or low achievers. According to the computer generated reports there were students from both high and low levels of achievement who did not show improvement in any of the skills tested. The Gates-MacGinitie results also showed mixed results. The Johns IRI indicated gains in one high and one low achiever for oral comprehension but not for middle achievers, whereas the silent comprehension results showed one high and both low achievers making gains, one middle achiever making gains and the other staying the same. On an individual basis, the Gates-MacGinitie and Johns indicated that high achievers did better than middle or low achievers but one high achieving student did very poorly compared to both expectations and other student's performance. Therefore it can be said that this form of instruction appears to be more beneficial for some students than others, but only on an 'individual' basis, as noted in earlier discussions of attitude.

It should also be noted that consistency of intervention appeared to effect results. The student who gained the most from the intervention was subject to the least disruption. The student who experienced the most disruption made no gains.

Attitude and Self Concept

Based on the information to this point, the effectiveness of the CAI program appears to depend more on the individual's personal motivation, ability to deal with frustration, and commitment to doing well than it does their existing level of achievement. If this is true, the answer to the following questions becomes very important.

In response to the second question studied, "What is the impact of this CAI instruction on: (1) attitude toward using computer programs as an instructional format; and (2) self-concept as measured by the respective questionnaire and informed by the focus group discussion?", the following has been concluded.

1. Attitude toward the use of computers as a teaching format became more negative after the intervention as students found coping with management problems and program explanations difficult. The general shift in attitude toward working with other students supports this conclusion. At the end of the intervention, students recognized the computer as a learning tool, but did not praise it as an instructional format. Some liked the computer because they could set their own pace in restricted ways. Only one person considered the confidentiality the CAI afforded more important than working with other people. Not being able to ask questions because the computer lacked the capacity to explain was a problem for all of the students. Two students found the slowness of pace frustrating enough to note it. Frustration with computer glitches and lack of interactivity was a major problem in the computer program for these students. Only one person mentioned improving their reading when asked what they liked best about using the computer.

Exposure to this intervention caused changes in opinion of the computer program for all the students in the intervention. Students stated they found it more difficult to understand written instructions on the computer monitor and found getting instructions from the computer less interesting than asking a teacher or other students. They found they liked reading their stories on the computer monitor less and preferred to work with another student over working with the computer. Almost all of the students expressed frustration of one sort or another with the program according to the questionnaire responses.

The study was only of six weeks duration, included a variety of students, and still much negativity arose. What the results would have been with only remedial students over a prolonged period of time, which is often the use made of this program, can only be surmised.

2. The impact on self-concept was negative for the low-achieving students but appeared to have had no real impact on the self-concept of the middle or high achieving students. The amount of change in this area that is actually assignable to the CAI instruction, however, cannot be determined by this study as many other factors that were not considered could also have influenced the students.

Over half of the negative changes in self-concept noted after the intervention were ascribed to the low-achieving students. Frustration with the inability to progress at a chosen rate and difficulty understanding instructions were the most frequently noted changes. Low-achievers experienced some lessening of self esteem, especially with self-judged reading ability and performance on the computer. Much of the negativity came from student 113 who had a very poor self image to begin with. The fact that there was a shift to further negativity, even when the use of the computer was his choice above working with others, is a concern. The confidentiality afforded by the program did not do anything to alleviate his poor self esteem. The use of the CAI did not appear to improve his self concept. Whether or not the CAI intervention did more damage than regular classroom work would have is not certain.

The self concept survey, which dealt mostly with the students' opinions of themselves and the computer, did not indicate as much change as the format questionnaire which concerned student's opinion of using computer programs as the instructional format. After the intervention, most students saw themselves as average readers who were improving their reading skills, working best with a

single partner or alone.

The attitudes revealed and recommendations arising from the focus group discussion indicated that the students found faults with the suitability of the program itself, application and management. These findings coincide with the previously reported information, discovered throughout the intervention.

## Overall Conclusion

Based on these results, the third question for study, "Given these results, is the use that is currently being made of this CAI program appropriate? " may be answered as follows.

Through many year of changing theories and subsequent changes in methodology, educators have found that individual needs, background, and interests are factors that must be considered in order to supply appropriate environments and materials for each student to learn. This study seemed to confirm generalizations from the literature reviews that: (1) computer assisted instruction programs are tools that should be used to assist in the delivery of a program of studies but not become the program itself, (2) technical and management support be available for students using the programs, (3) student progress be closely monitored to ensure students maintain a level of achievement that will allow students to maintain a positive attitude, motivating them to further development, (4) programs should be implemented in such a way that there is a social context provided for the students. The study further suggested that this form of intervention was not necessarily the most beneficial for all students and that existing levels of achievement not be the only criterion used in deciding who would benefit most from this type of intervention. Teachers must be cautioned against the indiscriminate use of this type of instructional format.

Given the information gathered in this small study, it must be said that there may be a place for such computer instruction programs in education, but that educators at all levels must exercise great caution in deciding the kind and amount of use made of them in order that the costs for each student be kept to a minimum and potential benefits realized.

## Implications

### Implications for Instruction

The underlying concern of this study was that technology, presently available to school systems, is rapidly changing how students are taught, what students are taught, and how students can be taught. In many cases fiscal considerations appear to be outweighing educational concerns and the most expedient methods are being used. Teachers and educators in general are responsible for student progress through the effectiveness of instruction and they need to play a leading role in understanding and deciding how computers can best assist in the learning process. It is the business of schools, including teachers, administration and at this point in the evolution of our educational system, parents and parent councils, to ensure that materials are appropriate as well as effective.

The implications for instruction from this inquiry suggest that using CAI programs is not, as it was supposed, totally positive or totally negative. There are so many factors involved in the successful use of CAI programs that taken individually are simple to judge, but taken altogether paint an entirely different picture for each individual user. Two essential elements of effective instruction are the recognition of the individual as a whole and the presence of a social climate

conducive to learning.

Individuality is an important factor in learning and responding to individual needs is an apparent failing, suggested by the limited implementation of this CAI program. Teachers have learned to consider each student as well as the whole class and are constantly looking for ways to focus education on the needs and interests of the individual, while serving the needs of the class. CAI programs may not do this sufficiently well enough to be relied upon as the designers and publishers would have us believe.

Another major problem with this CAI program is the lack of social interaction and support, so important to learning of any sort. It has been stated that some students perform better when they are removed from distractions present in the social environment of a classroom. However, freedom from social interference may quickly turn to isolation where learned theories cannot be tested with peers.

The experience of the six students in this study indicated that this particular program, as it was implemented, does not support many current theories of learning. It is not student-centered and does not appear to provide enough control over the learning environment for students to progress at the rate they wish. The content and interest do not come from the students. Even when they are given the option to select readings for themselves, the scope of selections is program driven. The stated objectives drive the program and the program in turn drives the student and the student is pigeonholed.

This program gives segmented, piecemeal portions of the whole and provides no overall picture that represents the value of studying literature and of reading. An appreciation of the subject as a whole and the part it plays in the life of the student cannot be presented properly with piecemeal skills instruction.

There is no discussion or exchange of ideas with people whom the student identifies as an authority, or with peers, whom the student recognizes as having noteworthy opinions. There are no opportunities to "try on" the information. The program is not able to stimulate prior knowledge and provide an opportunity for spoken language and vocabulary to lead into the reading of a selection. Again the student needs to hear, from a human voice, if not a familiar and trusted voice, the language of the reading and the vocabulary that carries the meaning of the reading.

Time on task is usually commensurate with success and time on the computer is usually commensurate with time on task, but since time availability is one of the biggest stumbling blocks in this study, successful use of this program was questionable. The American bias of this particular program does not necessarily teach the kind of values and social goals that Canadian parents want their children to learn. These factors give cause to question the viability of this particular CAI program in reading in Canadian schools.

The cornerstone concepts of personal values, personal goals, and self-concepts, fundamental to construction of attitude (Mathewson, 1994), must support learning. They do not appear to be well accommodated in this program.

Optimal implementation of the computer program used in this particular study is too expensive for most schools and school districts at this point in time. The costs and already over-taxed computer facilities in this particular school made this impossible. The use that was made of this program did not render particularly good results, and many difficulties were identified. This program, like any other educational tool, has limitations. It is incumbent upon the individual teacher to know those limitations and make the best use of the tools at hand. CAI programs are not complete programs of study in themselves and their use should not be a

knee jerk reaction to fiscal restraints, nor should they be used in order for a school division to be considered technologically up to date. There must be a clear understanding of intended use and adherence to implementation guidelines.

Further Research

Through many years of changing theories and subsequent changes in methodology, educators have found that individual needs, background, and interests are factors that must be considered in order to supply the appropriate environment and materials for each student to learn. This study has shown that students at various levels of performance can benefit from the use of computer assisted instruction programs, to different degrees, but that there are definite drawbacks and costs. All of the following factors require further research.

Personal attributes. The individual student was not sufficiently considered in the development of this strand of the computer program. In this study a student's personal attributes influenced performance. In any such computer programs these personal factors may be too difficult and complex to address.

Attitude. From the study it became apparent that the students who were self starters and placed a personal value on education did better on this CAI program than a student who was not a self-starter, or saw no value in formal schooling. The attitude a student had toward the use of the computer itself was also significant. According to this study, a student's progress appeared to fall off with the amount of frustration experienced using the computer, that is: headphones, #110; keyboarding, #115; administration difficulties with the program, #110 and #111. A student's self-concept also appeared to play a part in the success or failure in the use of this CAI program, i.e. #113. These factors influenced the successful use of this program and require consideration in future

design. Classroom performance is constantly monitored allowing teachers to keep students on track, feeling good about themselves, and circumventing impediments to progress. This CAI program did not appear to do this.

Perceived value. The value that the student saw in the program was important but so was the value the student perceived other students saw in the program. Leaving the class to go for resource room help appears to have a stigma attached to it since it singles out the individual student. Optimally, all levels of student would have access to the program and be slotted into some form of it, alleviating the negative perceptions.

Theories of learning. The structure of the program itself did not appear to be founded on modern theories of learning, as was mentioned, and the computer program was not tuned in to time-management problems, from the student's point of view. Students needed to work at their own pace within classroom scheduling and being rushed or held back was not conducive to real learning.

Motivation and encouragement. The program itself is impressive technologically. It covers skills that students need, allows for some amount of individualization, provides infinite patience and an environment free from social interference, gives immediate feedback, and supplies an infinite number of exercises, according to the designers. But how can a program adapt content to the changing interests of students on a daily basis? Computer programs may be infinitely patient, but do they provide the kind of stimulation each student needs? Feedback is immediate and testing is not biased, but is the feedback tempered adequately with encouragement, appropriate to each student at a particular time, and where is the bias in favor of the student when it is needed? In other words where is the human and humane face in this form of education?

Use. Further investigations must be made into the proper and most advantageous use of existing CAI programs and statements of use must be made explicit to educators. There is little doubt there is a place for CAI programs in education, but unless teachers are aware of the pitfalls of improper use, such programs may become detrimental, in spite of offering potential benefits. CAI programs may be powerful tools of instruction when used appropriately but cannot be used as a replacement for the classroom setting or expert teaching (Rude, 1986). According to Rude (1986), social-interpersonal relationships play an important part in all learning. Microcomputers have a potential for reducing the interactions among individuals which could produce deleterious effects on the social and personal environment and success in education. The best use scenario is still drill, attempting to accomplish automaticity to allow the student freedom to cope with larger conceptual issues more effectively in a social setting where real learning takes place.

## Limitations and Assumptions

There were many limitations and assumptions that left questions unanswered in this study and cause readers to raise other pertinent questions and perhaps stimulate further research.

Time of day. Not all of the test group were able to use the computers at the same time, meaning that time of day and other activity in the resource room were not the same for all participants and each participant was missing different classroom activities. It is assumed that these differences were not significant but they may had a bearing on the effectiveness of the program.

In the school in which this study was carried out, time of day was a major problem in arranging slots for computer access. There were only two work

stations to serve a school of over 400 students and finding any free time was very difficult. This hampered the program implementation. One computer is designated upper elementary and the other is primary. Since there is no room for both computers in the same location, one is in the main part of the resource room, exposed to all of the activity in, and passing by it. The other is in a storage room that adjoins the resource room containing shelving full of resource materials. The storage room computer offered only time slots in the morning while the resource room computer offered slots only in the afternoon. Since so may slots were required, there was no option but to use both computers. The students could not be rotated from one computer to the other as they are not networked and each student account is fixed in one machine. Therefore a student in a morning slot was bound to use the storage room and afternoon slots were assigned to the machine in the resource room. Students might not have felt comfortable or were distracted by the "stuff" on the shelves surrounding the computer in the storage room and by all the other students, parents and teachers constantly coming and going from the resource room. Students in the morning may have had an advantage over students in the afternoon because language arts instruction took place in the morning. Students were fresh starting the day. There was less pressure in the morning because students from the rest of the school, who would have used the computer before or after those involved in the intervention, often did not show up in the mornings, and the intervention students could sometimes extend their time. The resource room was usually busier in the afternoon with more students, parents coming for parent-teacher conferences, and clinicians meeting with the resource teacher. The resource people were more tied up with meetings and not available to help students having difficulty using the computer at this time. The afternoon was seen as a less favorable time to be out of class since this was the time when, in

students' opinion, 'easier' subjects are covered, whereas mornings are when most of the 'hard' work is done. Therefore time of day mattered because of location, disruptions, length of time on computer, and what was missed from class, affecting performance results.

Time on task. The length of time the students were exposed to the program was very short. The lack of technical availability and the length of CAI program exposure varied, depending on individual absenteeism during the study.

Personal drive. Students had the research explained to them and their participation was strictly voluntary, but some had more personal enthusiasm for participation than others. Some participated partly because their parents felt it would be a good experience for them.

Personal experience. Different levels of exposure to general computer use and familiarity with computer functions varied within the group as did the socio-economic backgrounds of the students. Since comparisons between student achievement were made, student background became important. Some students had access to computers at home prior to the intervention and their level of computer literacy helped them.

Validity of procedures. It was assumed that the testing tools were employed and functioned correctly, the results obtained were valid, and the observations noted by the researcher supported and validated the course progress. It was further assumed that the individual role of teacher and resource personnel administering the program were carried out well enough that student results were not more influenced than they are in the usual management of the CAI program. It was further assumed that readability and grade level appropriateness of the program was as claimed and that student interaction with the program was not hampered by any physical difficulties the student may have been experiencing.

Location of hardware. The fact that the computers had to be in a central location in order to serve the entire school meant that they could not be in the students' homeroom. This created another problem. Resource staff was often too busy to monitor or help students, and there was often, especially with the weaker students, a tendency to be distracted. The focus group discussions indicated this clearly. The benefit of CAI programs for remediation became questionable at this point.

Length of exposure. The length of exposure was short at best for this study but the availability of computers and in particular for this program is one of the real problems in using CAI programs effectively. The manual for Reading Investigations states that the best results can only be achieved with maximum time on the machine, but the program purchase price, and cost of the yearly site licenses makes having enough programs available for a whole class fiscally impossible.

Finding enough time to spare, from an already crammed full day, made it difficult to provide access for the individual student to use the program effectively.

Self-motivation. Lack of self motivation, it seems, is often the causative factor in poor progress and the need for remediation. To put someone on a program of this kind without the self motivation to work at it, is to handicap the effort from the start. Students #114 and #115 were a good example of this. They were both considered average students at the start of the program. According to program results of the course and grouping reports the achievements of student #114 outstripped #115. Student #114 achieved 67% and 73% on course and grouping reports while student #115 achieved 50% and 49%. Student #115 put in 385 minutes and #114 put in 374 minutes but #114 was far more self-motivated and committed to learning than #115. She did not just go through the motions, she appears to have benefited from this experience. Even the incentives of

missing some time in class, not having someone constantly monitoring engaged time, and having parents who were enthused about this program was not enough external motivation to keep the unmotivated student on task and achieving as well as he should have.

## Conclusion

In light of the contemporary technology bandwagon in which CD-ROM based curriculum materials are being extolled, this study argues, at the very least, that caution is in order. (D. Hlynka, personal communication, September 13, 1999)

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# APPENDIX A

# EVALUATION OF INSTRUCTION FORMAT

## *PRE* & **POST** TREATMENT QUESTIONNAIRES

STUDENT # ___

PRETEST O *italics* POSTTEST X **BOLD**

WHAT YOU THINK

These questions will show me the kind of learning you enjoy most and how you would like to be taught. It is not a test and there are no right or wrong answers. I am asking for your opinion. Think carefully about each question before you answer it and be as honest as you can. Check off the blank that you think best describes how you feel.

| QUESTION | VERY MUCH | LOTS | SOME | NOT MUCH | NO! |
|---|---|---|---|---|---|
| 1. Do you enjoy using the computer? | ___ | ___ | ___ | ___ | ___ |
| 2. Do you like writing out your stories on the computer? | ___ | ___ | ___ | ___ | ___ |
| 3. Do you like reading other peoples' stories on the computer monitor? | ___ | ___ | ___ | ___ | ___ |
| 4. Do you like reading your own stories on the computer monitor? | ___ | ___ | ___ | ___ | ___ |
| 5. Have you used a computer much this year outside of school? | ___ | ___ | ___ | ___ | ___ |
| 6. Do you find it frustrating when you can't make the computer do what you want it to? | ___ | ___ | ___ | ___ | ___ |
| 7. If you had difficulty with some work would you like to work on the computer for practice? | ___ | ___ | ___ | ___ | ___ |
| 8. Do you find it easy to understand written instructions on paper? | ___ | ___ | ___ | ___ | ___ |
| 9. Do you find it easy to understand written instructions on the computer monitor? | ___ | ___ | ___ | ___ | ___ |
| 10. Would you like to spend more time doing your work on the computer? | ___ | ___ | ___ | ___ | ___ |
| 11. Do you sometimes need help from someone to understand written instructions? | ___ | ___ | ___ | ___ | ___ |
| 12. If you were given a choice would you sooner like to work with a computer than another student? | ___ | ___ | ___ | ___ | ___ |

| QUESTION | VERY MUCH | LOTS | SOME | NOT MUCH | NO! |
|---|---|---|---|---|---|
| 13. Do you sometimes find yourself not paying attention to what is being talked about in class? | ___ | ___ | ___ | ___ | ___ |
| 14. Do you think you would find getting instruction from the computer more interesting than from a teacher? | ___ | ___ | ___ | ___ | ___ |
| 15. Do you find it difficult to ask your teachers or other students for help understanding things? | ___ | ___ | ___ | ___ | ___ |
| 16. Do you think you would find it less difficult if you were able to ask a computer? | ___ | ___ | ___ | ___ | ___ |

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17. Do you work best in groups, on your own, or with one other person?

18. On the lines below tell me, in a few words, how you would like to see the computer used in your education?

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# APPENDIX B

# SELF CONCEPT

# *PRE* AND **POST** TREATMENT SURVEYS

STUDENT #
PRETEST O *and italics*
POSTTEST X AND **BOLD**

## PERSONAL SURVEY

Answer the questions by circling the response that best describes how you think you have been doing in school in the last 6 weeks. Sometimes there may be more than one response that describes you. You may circle more than one. When there is a blank line, fill in with your own answer.

1. How would you rate yourself as a reader?

__a) above average __ b) average __c) below average

2. How much change has there been in your reading in the last few weeks?

__a) getting much better __ b) getting better __ c) staying the same __d) getting worse

3. How have you been doing in your studies in general in the last few weeks?

__a) very good __b) good __c) average __d) poor

4. In what classroom situations have you been doing the best work?

__a) in a group __b) with a partner ___c) on my own

5. In group projects, I think some other students like to work with me because ...

a) I do my share of the work. __
b) I encourage them to do well. __
c) I contribute good work to the project. __
d) They can tell me what to do and I don't argue. __
e) Other reason_____

6. In group projects, I think some other students don't like to work with me because...

a) I don't always do my share of the work. __
b) I don't encourage them to do well. __
c) I don't let them have a say in how the project will be done. __
d) They think I can't contribute good work to the project. __
e) Other reason_____

7. I like working on the computer because...

a) I can go as fast or as slow as I want. __
b) I can make as many mistakes as I want and no one else knows. __
c) I can ask questions and the computer always explains them to me. __
d) I don't have to work with anyone else. __
e) I can do the work that the computer gives me and get most of it right. __

8. I don't like working on the computer because...

a) I can't go very fast and it is frustrating. __
b) It doesn't seem to matter if I do well or poorly, no one else is watching. __
c) I can't ask questions because the computer doesn't always explain to me. __
d) I can't work or share with anyone else. __
e) I can't always do the work the computer gives me and get most of it wrong. __

9. The thing that I like best about using the computer is that...

10. The thing that I don't like about using the computer is that...

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# APPENDIX C

# FOCUS GROUP QUESTIONS

1. What do you think of computer use in education?
2. What do you think of the Columbia Program (this is the term the students know it by, it is really the Reading Investigations, Successmaker)?
3. What is wrong with it for you? (re: program from Q.# 2)
4. What is good about it for you? " "
5. What did it seem to teach you?
6. What did it seem not to teach you?
7. Could you understand it?
8. How could/would you improve it (for yourself)?
9. Frustrations? did you have any frustrations using it?
10. How many times did you miss going?
11. Did the surroundings bother you?
12. When were you happy/unhappy about going?
13. What do you think of computer use in general?
14. If you had to learn something specific, would you use a computer, teacher, or other?
15. How do you now feel about working on your own?

Other impromptu questions and discussion occurred with the general information that emerged.