

**THE EFFECTS OF A PRECISION TEACHING / DIRECT INSTRUCTION
READING PROGRAM ON THE READING ACHIEVEMENT OF
ELEMENTARY SCHOOL STUDENTS**

by

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ABSTRACT

This research study evaluates a reading program which was implemented in a pilot school in School District No. 56 in 1994. The reading program combines the teaching strategies of Precision Teaching, fluency-building, and Direct Instruction. The Canadian Tests of Basic Skills Reading and Vocabulary subtest scores of students in the treatment school were compared to those of students in four combined control schools in the pre-treatment and the post-treatment years. In addition to an analysis involving all students, the scores of Aboriginal and non-Aboriginal students were analyzed separately to determine whether the two groups responded in a similar manner to the reading program.

Results of this study indicate a consistent trend in that the students in the treatment school, including Aboriginal and non-Aboriginal groups, demonstrated significant and important gains in their Reading subtest scores. No differences, however, were demonstrated in their Vocabulary subtest scores. Students in the control group, including Aboriginal and non-Aboriginal students, consistently demonstrated decreases in both their Reading and Vocabulary subtest scores. Results of this study provide evidence that, although significantly behind the control group before the reading program's implementation, after implementation, the treatment school students exhibited comparable reading achievement to those of the control schools.

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INTRODUCTION

Background

In 1994, School District No. 56 decided to pilot an alternative reading program in response to a growing concern regarding the reading ability of its students.¹ This concern was voiced by administrators, teachers, and parents who believed, as a result of observing students and from analyzing yearly reading test scores, that students' reading abilities had declined in recent years. Blame for this problem was placed on various factors, and it is not within the scope of this paper to discuss them or to attempt a definitive explanation. Whatever the cause, it was believed that some of the reading programs and/or instructional methods which had been used in the past were not entirely successful in ensuring the development of acceptable reading abilities in students.

Because several learning assistance teachers in the district had been using the SRA (Science Research Associates) Reading Mastery and Decoding programs developed by Engelmann (Osborn, 1988) with a fair amount of success, and because there existed an appeal for such a traditional, "back to basics" reading approach, the School Board decided that two schools would be chosen for pilot projects to implement this program school-wide. In addition to the Reading Mastery program and its emphasis on Direct Instruction, the schools would also adopt the Morningside Model of Generative Instruction as

¹ In September, 1996, School District No. 55 (Burns Lake) and School District No. 56 (Nechako) amalgamated to form School District No. 91 (Nechako Lakes). Prior to this, School District No. 56 served the communities of Fraser Lake, Fort Fraser, Fort St. James, Tachie, and Vanderhoof. Because the reading program was implemented in 1994 and prior to amalgamation, there are several references in this paper to School District No. 56.

developed by Dr. Kent Johnson, founder and director of Morningside Academy, a private learning center in Seattle, Washington (Johnson & Layng, 1994). As well as emphasizing Direct Instruction, the Morningside Model also practices the instructional strategies of Precision Teaching and fluency-building.

Therefore, in the 1994-1995 school year, two schools were chosen as the district's pilot sites to implement the program. These two schools seemed to be logical choices as pilot sites, because students' reading abilities were a concern at both schools and the staffs were willing and committed to teaching an alternative reading program. Both schools' administrators were highly supportive of the innovation and allowed for much inservice and training of staff members. Teachers, principals, and support staff of both schools received intense training in Direct Instruction and the Morningside Model methods during the summers of 1994, 1995, and 1996. As well, during these 3 school years, Johnson and several instructors from Morningside Academy traveled regularly from Seattle to the district to provide additional inservice, assessment, and feedback regarding the program's implementation.

Although these two pilot sites were involved in implementing the treatment reading program, the Canadian Tests of Basic Skills (King-Shaw, 1989) scores of only one school are included in the present study's analysis. It was decided that the second pilot school not be involved in the study's analysis for two reasons. Firstly, this school contains students in Kindergarten through Grade 3, and because only students in Grade 3 and up are tested on the Canadian Tests of Basic Skills, small and inconsistent sample sizes existed. Secondly, Grade 3 students were excluded from the Canadian Tests of Basic Skills testing prior to 1993, and so pre-treatment data from the 1992-1993 school year

were unavailable.

The treatment school is situated in a rural-residential community in central British Columbia with a population of approximately 450. Ten staff members teach at this school and approximately 110 students from Kindergarten to Grade 7 are in attendance. Of the school's total population, approximately 25-30% are Aboriginal.² The majority of the students in this school are from families that are involved in the industries of forestry or agriculture.

Definitions

The major components of the treatment reading program - Direct Instruction, Precision Teaching, and fluency - will be described briefly here. As well, the Morningside Model of Generative Instruction's philosophy and methodology will be discussed. Additional detailed definitions and descriptions are provided in the forthcoming chapter of this paper.

Direct Instruction

Direct Instruction is a teaching approach which emphasizes a structured, skills-based, and academically-focussed learning environment. It involves the use of scripted lesson presentations, teacher signals for students to answer aloud and in unison, and immediate feedback and correcting procedures. Direct Instruction emphasizes a mastery approach, where skills are taught until fluent.

² Aboriginal ancestry includes Status Indians, Non-Status Indians, Inuit, and Metis students (Ministry of Education, 1999). Aboriginal identification is made on a volunteer basis.

Precision Teaching and Fluency

Precision Teaching involves charting and analyzing student performance of isolated skills. Both students and teachers regularly monitor and analyze the data in order to determine student achievement and program effectiveness.

Fluency can be defined as the combination of speed and accuracy in performing skills. Fluency is true mastery in that it involves automatic performance of behavior. Precision Teaching and fluency are directly related in that fluency-building is achieved through practicing isolated behaviors, and charting and monitoring this practice is a convenient method of on-going evaluation.

Morningside Model of Generative Instruction

Morningside Academy, which incorporates both Direct Instruction and Precision Teaching strategies, is described by Johnson, its founder and director, as "a learning laboratory for designing programs and procedures with a focus on essential skills for school success and a 13-year research base" (Johnson & Layng, 1994, p. 174). It first opened in 1980 for students unsuccessful in previous educational settings due to learning and/or behavior problems. Students generally spend 1 to 3 years at Morningside Academy before rejoining the public school system.

The Morningside Model of Generative Instruction is based on the underlying principle that all students can be successful if provided with proper placement, proven instructional materials, and the opportunity to practice essential skills to fluency. Reading, writing, math, critical thinking, and study skills are emphasized and taught using data-based methods, where students' performance at these skills is charted and analyzed on a daily basis so that instruction can then be adjusted accordingly.

The four major components of the Morningside program are precision placement testing, the use of Direct Instruction, fluency-building of fundamental skills so that performance becomes automatic, and the integration of component and composite skills (once fluent, lower level skills are combined into more complex and meaningful activities). The aim of generative instruction is that students learn how to become independent and self-motivated learners as a result of being given the tools to measure and improve their own skills. Independent learners are able to retain, use, and apply their fluent skills in new situations and with everyday problems (Johnson & Layng, 1992, 1994; Johnson, 1997). According to Johnson (1991), "Application practice after fluency-building is key. By building skills to rates that make them useful and automatic, and then applied in real-world contexts, student retention and application is dramatically increased" (pp. 65-66).

Morningside Academy refers to its components of Precision Teaching, fluency-building, and Direct Instruction as technologies, meaning that they can be taught to others and replicated in other settings. In 1995, the Morningside Learning Systems, a training and consulting company, was founded and has since helped to implement the Morningside Model of Generative Instruction in several schools throughout the United States in addition to School District No. 91. Another important component of Morningside Academy is its emphasis on current research. As a result, it is continuously conducting relevant classroom research to evaluate its methods and to further develop strategies and materials conducive to student success.

An important issue to note regards the degree to which the treatment school has replicated Morningside Academy's model. The major differences between Morningside Academy and Fort Fraser Elementary School are class size and curriculum. As a private

school, Morningside Academy has smaller class sizes and employs several teacher-aids and assistants. Their entire instructional day is spent on academics and those skills deemed necessary for school success. In contrast, reading classes in the treatment school can consist of up to 25 students, and the instructional day must incorporate all Ministry-mandated curricular subjects, some of which are non-academic (e.g. Art, Physical Education, Music). As a result, certain difficulties have been faced by the teachers at this school in implementing the Morningside model, most of which concern the management of charting and analyzing individual student progress in large classrooms, and in providing students with the instruction and practice necessary to achieve fluency while still ensuring that other mandated curricular objectives are met.

As a result of these difficulties and for practicality's sake, the reading program at the treatment school is not an exact replication of the Morningside model. During the first year of implementation, it was agreed that the model be followed as closely as possible in order to experience its effects and to better understand the underlying philosophy as a result. Since then, however, teachers have been able to use their professional experience and knowledge to adjust and fine-tune the Morningside model to better suit their and their students' needs. In fact, since 1994 and the implementation of the reading program, the treatment school has incorporated Morningside instructional models in writing, math, study skills, problem-solving and critical thinking skills as well. Teachers have also been using Precision Teaching, fluency-building, and Direct Instruction strategies in the teaching of content classes such as French, Science, and Social Studies. A more detailed description of the opinions of teachers involved in teaching the reading program in the treatment school is provided in Appendix A.

Problem Statement

Now that the reading program is in its 6th year in Fort Fraser Elementary School, it is necessary to determine its effectiveness. Results of this research could have major implications regarding the future choice of reading programs throughout the school district. Archival data from the Canadian Tests of Basic Skills exist in varying degrees of completeness from the late 1980s to the present, and it is therefore possible to utilize these data to conduct an evaluation of the treatment reading program. The intention of the present study, therefore, is to determine whether or not the reading program has been successful in increasing students' reading abilities as measured by the Reading and Vocabulary subtests of the Canadian Tests of Basic Skills (CTBS). Related to this general problem statement are two specific research questions:

1. Will there be an equal difference between the treatment school's (Precision Teaching/Direct Instruction reading program) and the control group schools' (combination of other reading programs) mean CTBS Reading subtest scores in the pre-treatment years and in the post-treatment years?
2. Will there be an equal difference between the treatment group's (Precision Teaching/Direct Instruction reading program) and the control group schools' (combination of other reading programs) mean CTBS Vocabulary subtest scores in the pre-treatment years and in the post-treatment years?

It is also important to determine whether differences between the treatment and control groups, if any, are equal before and after implementation of the treatment reading program due to the possibility of district-wide trends. For example, it is possible that both the treatment group and the control group exhibit equal increases or decreases in student

scores from the pre-treatment to the post-treatment years for a reason other than implementation of the treatment reading program. However, if only the treatment school's scores increase from the pre- to the post-treatment years, one could attribute the difference to some factor unique to this school, one such example being implementation of the reading program.

The two research questions will also be investigated for Aboriginal students and non-Aboriginal students as two separate groups in order to determine whether the treatment reading program is effective for both. However, means and standard deviations of Aboriginal students will not be reported in the present study due to confidentiality agreements between the researcher and the five band councils involved.

Hypotheses

The two statistical hypotheses of the study relate to the two research questions aforementioned. The hypotheses will be tested for all students as well as for Aboriginal and non-Aboriginal students as separate groups.

$$1. H_0 : \mu_{pre(r)(c-t)} = \mu_{post(r)(c-t)}$$

$$H_1 : \mu_{pre(r)(c-t)} \neq \mu_{post(r)(c-t)} ,$$

where $\mu_{pre(r)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Reading subtest scores (r) in the pre-treatment years, and $\mu_{post(r)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Reading subtest scores (r) in the post-treatment years.

$$2. H_0 : \mu_{pre(v)(c-t)} = \mu_{post(v)(c-t)}$$

$$H_1 : \mu_{pre(v)(c-t)} \neq \mu_{post(v)(c-t)} ,$$

where $\mu_{\text{pre}(v)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Vocabulary subtest scores (v) in the pre-treatment years, and $\mu_{\text{post}(v)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Vocabulary subtest scores (v) in the post-treatment years.

LITERATURE REVIEW

This literature review includes definitions and comprehensive descriptions of the treatment reading program's major components: SRA's Reading Mastery program, Precision Teaching and fluency, and Direct Instruction. Recent and relevant research concerning Precision Teaching, fluency, and Direct Instruction will be summarized and critically analyzed. As well, criticisms of the reading program's underlying philosophy will be discussed.

SRA's Reading Mastery

The Science Research Associates' Reading Mastery program is a basal reading series designed to teach reading comprehension and decoding skills. The program was developed by Engelmann in the 1960s after extensive research and field testing (Engelmann, Hanner, & Johnson, 1989; Osborn, 1988).

Reading Mastery is a traditional, "back-to-basics" program which values efficiency and productivity. It is scientific in nature, behavioristic, and emphasizes objectivity and measurability. The philosophy underlying Reading Mastery is that students who possess the prerequisite skills will learn more and in less time than if taught with other reading programs. As well, the authors of Reading Mastery claim that all students can learn given adequate teaching presentations and practice. The program's goals, as stated in the Reading Mastery Teacher's Guides (Engelmann & Hanner, 1988), include developing those composite skills believed to influence and determine future reading progress: "the ability to decode accurately, read at a reasonable rate, understand what is read, learn important relationships and facts through reading, retain information that is important, and find reading an enjoyable activity" (p. 1).

Reading Mastery involves the applied science orientation of component / composite analysis, or the task analysis of the skills needed to attain certain objectives. The program breaks down each composite skill into small, specific component tasks or subskills which are then taught to mastery using the Direct Instruction method. Lessons are based on cumulative skill development, where students are provided with practice throughout the remainder of the program in applying the skills taught. Once students have received enough practice and immediate feedback so that the task becomes automatic and mastery is achieved, it is believed that they are then able to retain the skill, apply it in more complex situations, and are prepared to learn related skills. The program's authors claim that reteaching of these skills becomes unnecessary and that every student is able to experience a high rate of success.

The Reading Mastery program consists of six levels which correspond to Grades 1 through 6. Lessons are paced in a quick and lively manner so that more material is covered in less time and so that no time is wasted. Fast pacing of lessons, according to the program developers, also results in greater student achievement, increased on-task student behavior, and decreased class management problems. Teachers must follow a script and expect students to respond in a specified manner as well. The scripts are designed so that lessons can be presented precisely, quickly, and consistently.

Continuous assessment is a major component of Reading Mastery. Through strategies such as unison responding and daily checks of oral reading and written assignments, teachers are regularly made aware of each student's progress and are then expected to plan accordingly. In this way, the program essentially follows a "teach-assess-reteach" model.

Since its development, Engelmann and his colleagues have continued to extensively field-test, revise, and design programs in order to maximize their effectiveness with students in classrooms (Grossen, 1996). According to Bateman (1991), "The documented success of Engelmann and his colleagues' Direct Instruction reading programs with thousands of hard-to-teach and high-risk children is unsurpassed in the annals of reading history" (p. 11). Grossen agrees: "The large research base of Reading Mastery distinguishes it from all other currently available commercially developed reading programs" (p. 1).

Precision Teaching and Fluency

In this section, a comprehensive description of the history, philosophy, and methodology of Precision Teaching and fluency will be provided. As well, research regarding the effects of Precision Teaching and fluency-building strategies on the development of general learning and, more specifically, reading skills, will be summarized and discussed.

History, Philosophy, and Methodology

Precision Teaching finds its roots in the behaviourist theory of the 1950s and 1960s. Teaching machines and programmed instruction as developed by Skinner (1968), the "father of behaviorism", fulfilled the scientific, objective, and measurable orientation of this era. The economic values of productivity and efficiency influenced education in that learning to read was considered a scientific process in which each skill was broken down into smaller tasks which were taught specifically and in isolation with consistent practice. Programmed instruction meant that twice as much could be taught in the same amount of time because students were kept busy and active (Skinner). As well, with Skinner's

teaching machines came the change from response rate as the only source of evaluation and measure of behavior to percentage correct or accuracy measures (Binder, 1993).

Lindsley, a student of Skinner's during the 1950s, began to question the assessment measure of percentage correct in his work with psychotic behavior in adults and children.

He stated,

Percentage ignores speed and fluency. Sole attention to percentage correct often produces highly accurate, painfully slow learners who have very low tolerance for error-filled, courageous learning. Students often become fearful of making errors, which in turn can stifle creativity and exploration. (1990, p. 10)

Lindsley's (1992) findings led him to the field of education and teacher training and, in the 1960s, to the development of Precision Teaching, which he defined specifically as "basing educational decisions on changes in continuous self-monitored performance frequencies displayed on standard celeration charts" (p. 51).

Precision Teaching involves the breaking down of composite tasks into isolated skills and regularly measuring and analyzing student performance of these skills so that decisions can be made regarding the educational program's effectiveness (Beck & Clement, 1991; Snyder, 1992; West, Young, & Spooner, 1990). Student behaviors are charted and graphed so that regular and frequent monitoring is possible by both teachers and the students themselves. Changes in behavior are made apparent and predictions can be made concerning future behavior. As well, sound decisions can be made regarding the effectiveness of instruction and curricular materials. It is believed that performance improves when appropriate and immediate feedback is available (Haughton, 1977) and that charting can both accelerate and help to predict academic performance (Lindsley, 1990). As well, Farr (1987) stated that any feedback which allows the student to

understand and then be able to correct errors is necessary for learning and retention.

According to Mercer and Mercer (1993), factors which promote student learning include established goals and expectations, monitoring progress and providing feedback, and students' self-regulation of their learning. Many teachers today base student progress on informal observations and on their own interpretations of student performance.

Although professional teacher judgment may be sound and valid, it could also prove to be inadequate and erroneous. When students record and chart their behavior, however, learning is observed at a glance, and performance can be compared to previous levels as well as to formerly established goals and aims. In addition, students take an active role by assuming more responsibility for their own learning. Precision Teaching and fluency-building, therefore, appear to fulfill at least one of the three principles of learning as stated by BC's Ministry of Education (1994), that "Learning requires the active participation of the student" (p. 1).

With the implementation of Precision Teaching came the notion of fluency. In charting and analyzing student performance, it was discovered that to achieve success at any task or composite skill, both accuracy and speed in performing the prerequisites or component skills were necessary (Binder, 1993). Fluency, therefore, can be defined as this combination of accuracy and speed. A more precise definition of fluency is given by Binder (1988):

Fluency is a combination of accuracy plus speed which ensures that students will be able to perform easily in the presence of distraction, will be able to retain newly-learned skills and knowledge, and will be able to apply what they've learned to acquire new skills or to real-life situations. Fluency is "second nature" knowledge, near-automatic performance, the ability to perform without hesitation. In short, fluency is true mastery. (p. 12)

Other terms have been used which are related to the concept of fluency, such as mastery, overlearning, and automaticity. Bloom (1986) developed the theory of automaticity in which he considered automatic behavior as being regular and efficient because it could be executed without conscious attention and also because one could be simultaneously thinking about something else. An automatic skill could be performed accurately and rapidly, with a minimum of wasted effort. Bloom believed that practice and the "overlearning" of skills resulted in automaticity. He used the training schedules of athletes and musicians as examples to emphasize the importance of practicing individual subskills daily in order to achieve automaticity and outstanding performance in the more complex skill.

Practice, therefore, is the connection between the concepts of Precision Teaching and fluency. Practice is necessary to ensure fluency, and Precision Teaching is a practical and efficient means of monitoring and assessing practice. Snyder (1992) stated, "Building fluency is the purpose of the Precision Teaching method... making it much easier for students to quickly grasp more and more complex tasks, often without the need for instruction in those tasks" (p. 31).

Teachers' observations of their classrooms and individual students have generated various theories and opinions regarding Precision Teaching and fluency. For example, Binder (1988) claimed that increased speed of response is related to improved retention, resistance to distraction, and the generalization of learning to more complex tasks. In the same article, he stated that students' performance and rates of learning can be improved by daily, timed practice sessions. Farr (1987) agreed that practice enhances fluency. He claimed that overlearning increases the degree of learning which, in his opinion, is the

single most important determinant of long-term retention, and that the greater the degree of learning, the slower the rate of memory loss. Farr stated, "Skills which have become more highly organized, cohesive, and automated through practice show negligible decay over long periods of nonuse" (p. S-8). Haughton (1977) claimed that individuals who are fluent at a task can tolerate longer durations and more repetitions due to their increased comfort level. He stated, "Indications of doing something better are high speed and accuracy of the desired performance" (p. 33). Mercer and Mercer (1993) agreed that achieving automaticity with a skill not only improves retention but also increases students' ability to solve higher-level problems.

More recent observations of Johnson and Layng (1996) further support Binder's (1988) and Mercer and Mercer's (1993) claims that fluency is related to the generalization of learning to more complex tasks. According to Johnson and Layng, not only are their students able to apply and extend fluent skills in new situations, but they are also able to independently combine these skills in creative and unique ways. For example, students fluent in component skills were observed writing advanced sentence constructions in English and constructing formulas and answers to story problems in Math without any teacher instruction. Johnson and Layng have concluded that creative thinking and problem-solving skills may be natural long-term benefits of fluency-building.

General Research

According to Binder (1996), research regarding the use of Precision Teaching and fluency-building methods is limited and support in the literature is scarce. He believes this is due to three major reasons: first, most teachers involved with Precision Teaching are practitioners whose main objective is to improve student learning and not to pursue

publication; second, Precision Teaching discoveries are occurring and progressing so rapidly that teachers are unwilling to report data which could become out-of-date by the time of publication; and, third, those who had published findings experienced discouragement at the educational community's lack of interest in their work. As Binder commented,

Thus, Precision Teaching and its discoveries have remained more an oral than a written tradition in the field of behavior analysis, based on the personal exchange of charted data from many thousands of single-subject classroom interventions and on charts presented at professional conferences. (p. 4)

The call for more research and data to prove Precision Teaching methods has also been made by Berquam (1985), who further claims that "if all the available charts could be compiled, the evidence that Precision Teaching works would be overwhelming" (p. 323).

Much of the available research on Precision Teaching and fluency is observational and non-empirical in nature, and most of the studies to be discussed in this section involve teachers' observations of their classrooms or individual students after incorporating Precision Teaching and fluency-building strategies into their teaching repertoires. As a result, valid and reliable statistical data are scarce. As well, without employing a true experimental or quasi-experimental research design that incorporates control groups and pre- and post-test measures, one cannot determine the actual independent variable responsible for the change in students' behavior and achievement levels. Whether the cause is the Precision Teaching or fluency-building method, some other teaching strategy, or simply teachers' enthusiasm at using a new technique remains uncertain.

As well, for some of the studies mentioned, the number of subjects is not available and some researchers do not indicate whether the students are average in ability or

whether they possess learning difficulties. This lack of information causes the studies' validity and replicability in the classroom to be questionable. Other cautions regarding some of the research discussed are that very small samples are used and, for some of the studies, intervention periods are short-term. This leads one to speculate whether effects are long-term or due to the novelty of the program. An additional consideration concerns the quality of teaching prior to implementation of the Precision Teaching methods, as their effectiveness may have more to do with teachers' previous ineffective strategies than the Precision Teaching itself. In spite of these criticisms and cautions, it remains worthwhile and informative to discuss several of the existing publications concerning Precision Teaching and fluency.

Perhaps the best known research in Precision Teaching involves the Great Falls Precision Teaching Project conducted in Montana in the 1970s with approximately 450 elementary-aged students (Beck & Clement, 1991). Unfortunately, the statistical significance of this study's results is unknown, as only nonstatistical comparisons of national percentile ranks on the Iowa Test of Basic Skills (ITBS) are provided. Teachers in several schools throughout the school district provided daily opportunities for students to practice basic skills (spelling, math facts, reading), chart their daily performance, and be a part of instructional decision making. Teachers who implemented these methods in their classrooms found that "students showed marked improvements in classroom assignments, overall concentration and work habits, and displayed obvious enhancements in self-esteem" (p. 8). After daily fluency practice over a 3 year period, students in Sacajawea School, the project's principle training site, demonstrated from 20 to 40 percentile points improvement in their basic skills performance on the ITBS. In a second longitudinal study

included in the project, fourth grade students from Sacajawea School who had been taught since the first grade with Precision Teaching methods were compared with other fourth grade students in the school district who had not been taught with Precision Teaching methods. The Precision Teaching students out-performed the other students by over 20 percentile points in reading and 40 percentile points in math on the ITBS. A final study in the project compared two groups of Grade 3 students from several schools within the district, one which was taught using Precision Teaching methods. Even though the control group's scores were higher prior to the intervention, the Precision Teaching group came out ahead by 24 percentile points in math and 32 percentile points in reading on the ITBS after the intervention.

Research involving individual student case studies and the analyzing of data from Precision Teaching classrooms has suggested that students who are fluent at a skill are able to work for longer durations and demonstrate increased attentions spans (Binder, Haughton, & Van Eyk, 1990). For example, individual students with severe mental retardation and behavior disorders who practiced fine motor skills such as grasping and releasing objects, putting puzzle pieces in place, and writing numbers to fluency demonstrated increased endurance and attention span not only with the skills practiced but also with subsequent, more advanced work. The authors claim that students diagnosed as ADD (Attention Deficit Disorder) are often just lacking fluency in prerequisite skills such as grasping and releasing objects and reading and writing numbers.

Research by West et al. (1990) also indicates that developing fluency in various skills allows students to learn more quickly and results in increased academic gain. Fourth grade students at Valley Dale School in California performed daily practice to build

fluency in reading, math, and spelling skills. The average improvement in national percentile rank per student after testing with the California Test of Basic Skills at the end of the school year was more than 17 percentile points.

Another study involving 34 Grade 1 children, 11 of whom were special-education students, examined the building of math facts fluency with daily timed trials. After 10 weeks, students assigned to the experimental condition not only demonstrated an increase in the percentage of math problems answered correctly, but also increased in their levels of on-task behavior (e.g. remaining focused during seatwork; being attentive during lessons) as compared to students not involved in the fluency-building practice (Miller, Hall, & Heward, 1995).

The previously discussed research seems to indicate that rather than teach to the point of accuracy alone, one must advance to the next step, fluency-building, in order to ensure not only accuracy of performance, but speed of performance as well. At Morningside Academy, for example, the focus is on "retention, endurance, and application, in addition to the accuracy of performance" (Snyder, 1992, p. 31). This is achieved through "classroom instruction followed by timed practice, charting of progress, feedback, positive reinforcement, and deciding what to learn and practice next" (Snyder, p. 29). Once fluency is reached, teachers should provide opportunities for students to apply these skills in various contexts and in new situations. For example, a study by Mercer and Mercer (1993) indicated a positive relationship between fluency of handwriting (the number of words written) and other measures of writing skills, including generating story ideas.

It would also seem necessary for teachers to ensure that students receive sufficient practice in the prerequisite skills before attempting more complex tasks. Many instructional materials today, however, do not provide an adequate number of examples or practice items to ensure that students reach the stage of fluency. Moving too quickly from component skill to composite skill without achieving fluency could lead to frustration and failure. Skinner (1982; 1984) believed that the solution was to teach component skills first, allow for sufficient practice in performing these skills, and to provide immediate and frequent feedback and reinforcement. By doing this, he felt, students would learn "twice as much in the same amount of time and with the same amount of effort" (1984, p. 947).

Reading Research

Various theories and studies specific to the teaching of reading and relating to Precision Teaching and fluency-building are also available for discussion. Stahl, Duffy-Hester, and Stahl (1998) refer to a body of research dating back to the 1920s which claims that certain principles of good phonics instruction are necessary when teaching reading. These principles include an early and explicit emphasis on letters and their sounds, the decoding of words, practice in reading words, and automatic word recognition. The recognition of letters and words should be to the point of fluency, so that recognition is possible without conscious effort. The authors conclude that the ideal reading program combines direct and systematic teacher instruction with the use of children's story-books and novels.

Carver (1990) claimed that the most important outcome of Bloom's (1986) automaticity theory is that it inspired additional research into rate and practice in the area of reading. Repeatedly practicing the recognition of words is believed to be the best way

to achieve automaticity for those words, and practice in decoding words results in increased reading rate and, therefore, less attention is required to decode and more attention is available to understand the sentence meaning (Carver; Dickinson, Wolf, & Stotsky, 1993).

Samuels, Schermer, and Reinking (1992) agreed that through practice, automaticity is achieved and tasks become easier and require less attention. They extended this theory to reading and claimed that the decoding of words must become automatic and fluent before attention can be given to the comprehension of the text. Students, therefore, cannot focus on reading for meaning (what most would consider to be the real goal of reading) until they are able to read and decode fluently.

Howell and Lorson-Howell (1990), as well, claimed that fluent, automatic readers utilize various phonic, semantic, and syntax skills without being aware of them, which therefore frees the mind to attend to text meaning. According to Bloom (1986), "While we are in the process of reading connected discourse, we may also be making judgments about the ideas, enjoying the story, getting new ideas and insights, or being involved in other conscious processes" (p. 73). If decoding is automatic, the focus of attention is at the semantic level, and the reader is able to incorporate their personal experiences and associations into the reading situation (LaBerge & Samuels, 1985).

Slocum, Street, and Gilberts (1995) believed that the pleasure gained from reading about topics of interest and comprehending what is read is a naturally-occurring reinforcement. The ability to read fluently, therefore, allows the reader to cover more text and to experience additional reinforcement. Thus begins the logical cycle of choosing to read more frequently for pleasure and, as a result, becoming yet a better and more fluent

reader due to the increased practice.

Six studies specifically relating to Precision Teaching and its effects on reading skills will be discussed in this literature review. Of the six studies, three involve very small samples, one does not state the number of subjects involved, and four of the studies have short intervention periods (between 5 and 8 weeks). As well, of the six studies, only two consist of an actual experiment using control groups, although one of these does not employ any statistical measures to back its claims. These are limitations which make a cause-and-effect relationship between the Precision Teaching methods used and increased reading achievement impossible to infer. Perhaps the students in these studies would have made similar gains with alternative teaching strategies or even with no change from the previous methods used. A conservative interpretation of the following studies' results is therefore necessary. On the other hand, their limitations do not appear sufficient to totally negate their findings, and to rule out Precision Teaching and fluency-building as possible influential factors could also be viewed as erroneous.

In a study by Rinder (1994), four Kindergarten students with learning difficulties underwent a 6-week program which involved daily timings and charting of emergent literacy skills (identifying initial consonant sounds, sight vocabulary, and printing the alphabet). Not only did all students demonstrate marked improvement in each of the skill areas targeted, but also they enjoyed being timed and charting their progress. A similar thesis conducted by Nitti (1990) involving five low-achieving students in an 8-week Precision Teaching program concluded that the continuous monitoring and fluency-building components of Precision Teaching greatly facilitated student learning by resulting in improved reading comprehension. As well, Idol and Rutledge (1993) concluded that

students with reading difficulties averaged 2 months curricular progress per month of Precision Teaching instruction and fluency practice with letter and word sounds, although the measures used to determine curricular progress were not mentioned in their article. The authors concluded that being fluent in reading sounds enabled students to decode unfamiliar words more effectively.

Another study conducted by Kessissoglou and Farrell (1995) showed that students who were taught to read words using Precision Teaching techniques demonstrated substantially more progress in reading comprehension than two other groups of students taught with other teaching methods. The authors admitted, however, that the sample in this study was small (12 students). As well, although gains were measured by the Neale Analysis of Reading Ability (NARA), no statistics were mentioned to determine whether the difference was significant. A follow-up study conducted 5 weeks after the original experiment indicated that students in the Precision Teaching group had maintained their previous levels of performance. As well, the students demonstrated positive attitudes regarding the program.

A larger study involving 10 classrooms over a 2 year period determined that after implementing Precision Teaching and fluency-building strategies, students made 40% greater gains in math and 25% greater gains in reading from previous years' achievement test scores (Mordecai, 1977). Teachers also reported that students were excited and highly motivated as a result of being involved in their own learning.

Lastly, Tan and Nicholson (1997) conducted an experiment which assigned 42 below-average readers to three reading groups, two of which employed the use of flashcards to the point of overlearning and fluency to teach word recognition. The other

reading group involved no word recognition training. Although the study consisted of only five training sessions, the results indicated that students who received fluency-building practice demonstrated significantly greater performance on measures of comprehension and passage recall than did students in the control condition.

Allington and Cunningham (1996) stated that fluency with reading and spelling words is essential to the teaching of reading and writing. Accuracy in recognizing words, therefore, is not sufficient in order to read successfully. Rather, teachers must ensure that students move beyond accurate reading and towards automatic reading. Because reading is a complex task consisting of many smaller skills, it follows that these single skills should be taught prior to the more difficult and composite task of reading. Two of the key components of both SRA's Reading Mastery program and the Morningside Model of Generative Instruction are the teaching of each skill to automaticity and providing opportunities to apply the skills in related and more complex situations.

Direct Instruction

In this section, a comprehensive description of the history, philosophy, and methodology of Direct Instruction will be provided. The Project Follow Through research study, which compared 13 instructional approaches including Direct Instruction, will be discussed, as well as several of its follow-up studies. As well, research regarding the effects of Direct Instruction on the learning of special-education students will be summarized and analyzed. Lastly, two meta-analyses of Direct Instruction research as well as findings of the Morningside Academy will be discussed.

History, Philosophy, and Methodology

In 1976, after extensive research conducted with teachers and in classrooms, Rosenshine created a definition of effective teaching as being characterized by certain essential components, which together he labelled, "direct instruction". According to Rosenshine (1979), direct instruction involved clear teacher direction using academically focused activities and sequenced, structured materials. Specific components included clear goals, monitored student performance, questions presented at a low cognitive level so that correct answers were abundant, immediate feedback, sufficient instructional time, and extensive coverage of content. Rosenshine stated, "In direct instruction the teacher controls instructional goals, chooses materials appropriate for the students' ability, and paces the instructional episode. Interaction is characterized as structured, but not authoritarian. Learning takes place in a convivial academic atmosphere" (p. 38). From his research, Rosenshine concluded that these instructional criteria were correlated with students' increased academic achievement.

Direct Instruction (with upper-case initial letters), as distinguished from Rosenshine's direct instruction (with lower-case initial letters), refers to the specific instructional approach developed by Engelmann and his colleagues. In addition to incorporating all of Rosenshine's essential instructional components, Engelmann's Direct Instruction model constitutes a specifically-developed curriculum for teaching a variety of skills and subject areas (Engelmann & Carnine, 1982). This method, like Rosenshine's, emphasizes a structured, highly-academic learning environment where students are actively involved and are experiencing a high rate of success.

Both the Reading Mastery program and the Morningside Model of Generative Instruction employ Direct Instruction. Direct Instruction involves teaching essential skills as effectively and efficiently as possible with the proactive goal of preventing academic failure (Carnine, Silbert, & Kameenui, 1997). The Direct Instruction method assumes that all students can learn, that academically disadvantaged students must be taught at a faster rate in order to catch up with their more advanced peers, and that the learning of basic skills and their subsequent application in more complex and higher-developmental tasks must be emphasized. Stemming from these assumptions are the two main principles of the model: "Teach more in less time, and control the details of what happens" (Engelmann, Becker, Carnine, & Gersten, 1988, p. 303). Direct Instruction emphasizes both a mastery approach, in which skills are learned to a level of fluency, as well as cumulative review of those skills learned (Carnine et al., 1997). It is "a system of teaching that attempts to control all the variables that make a difference in the performance of children" (Adams & Engelmann, 1996, p. ix).

The Direct Instruction method consists of five components: a physical layout where students are positioned for close monitoring and correcting of mistakes by the teacher; a fast and lively pacing of instruction wherein students are highly involved so that they remain motivated, fewer management problems occur, and more material is covered; the use of teacher signals for students to answer aloud and in unison so that immediate feedback is possible and so that all students, not only the higher performers, are frequently and actively engaged; the consistent use of simple praise which results from specific student action; and the use of specific and immediate correcting procedures. The Direct Instruction method involves the teaching of detailed tasks and activities using a scripted

presentation. In this way, the use of pretested examples and sequences allows the instructional environment to be controlled and eliminates any ambiguity of teacher communication. Skills are broken down into small tasks which are taught specifically and in isolation with consistent practice throughout lessons. Review is constant and errors are immediately corrected. Continuous monitoring and assessment of student progress enables teachers to determine whether mastery has been reached or whether remediation is necessary. Once the skill has become automatic and mastery has been achieved, students are provided with opportunities to apply the skill in related and more complex situations (Carnine et al., 1997).

Project Follow Through

Of all the research conducted on Direct Instruction, the largest and perhaps best-known study involves Project Follow Through. In 1967, as a response to U.S. President Lyndon Johnson's "War Against Poverty" initiative, a national educational experiment entitled "Project Follow Through" was launched to determine the most effective educational model to teach reading to poor and disadvantaged students. This project became the most expensive and extensive research study in the history of education (Grossen, 1996). At a cost of over \$1 billion (U.S.), 13 instructional approaches were implemented by 4000 teachers to teach reading to 84,000 children in 170 different communities across the United States (Weikart, 1985). The experimental models were based on educational philosophies which ranged from Skinner's behaviourism to those promoting child development, language experience, cognitively-oriented curriculum, and discovery learning as developed by such theorists as Dewey, Freud, and Piaget (Becker, 1978). One of the approaches chosen for implementation in Project Follow Through was

the Direct Instruction model developed by Engelmann and which had been used successfully in the early 1960s with disadvantaged preschool children. His theory maintained that disadvantaged children needed to be taught more in less time in order to catch up to their more advantaged peers (Engelmann, 1992).

Each of the experimental teaching models was implemented in various locations throughout the United States. Students' performance levels were determined when they first began the program and at the end of each school year until they completed Grade 3. These data were collected by the Stanford Research Institute and analyzed by Abt Associates, an independent agency awarded the contract for the study's data analysis (Watkins, 1996). Eleven outcome subtests were chosen for the evaluation in order to measure student performance across three broad areas: basic academic skills, problem-solving and higher-order thinking skills, and student self-concept. For each outcome subtest and at each Project Follow Through site, a nonparticipating control group was matched to the experimental group and evaluated to compare results.

The study reached its conclusion in 1973 with controversial and, still today, disputed results. According to the initial findings of Abt Associates, Engelmann's Direct Instruction model came out ahead of all the other instructional approaches in academic, cognitive, and affective measures (Stebbins, 1977). Specifically, students taught with the Direct Instruction model progressed from well below the 25th national percentile in reading, math, and spelling on the Metropolitan Achievement Test (MAT) to the 50th national percentile or above, which was considered the national norm (Becker, 1978; Becker & Carnine, 1980).

An interesting finding concerned Direct Instruction students' superior performance in self-esteem and affective measures. According to Becker (1978), although the Direct Instruction model did not intentionally set out to improve students' self-concepts, this outcome became a natural by-product of Direct Instruction as an effective teaching method. In fact, several of the study's other models which were described as humanistic and whose goals included the positive development of student self-esteem resulted in lower affective scores than their comparison groups and compared to their pretest scores at the study's inception. Other ironies included the findings that students taught with cognitively-oriented methods were relatively weak in higher-order thinking skills, and that those models emphasizing discovery and self-directed learning scored the lowest in academic and affective measures. As well, data from Project Follow Through supported the findings that IQ gains among the Direct Instruction groups were maintained through the third grade and that it was more beneficial to begin Direct Instruction at the Kindergarten level than at later grades (Becker).

Due to the controversial nature of the study, the data were reanalyzed at least three more times, each of which came to the similar conclusion that the Direct Instruction model resulted in the highest achievement scores across all measures examined (Watkins, 1996). Surprisingly, however, at the study's conclusion, the American Department of Education seemingly ignored the results, made no recognition of Direct Instruction's success, and even went on to support and recommend some of the less successful educational models (Engelmann & Carnine, 1982). Much of the controversy, some believe, stemmed from negative attitudes regarding the behavioural philosophy underlying the Direct Instruction approach. According to Pennypacker (1994), "The results were not

only unexpected, they were contrary to some cherished tenets of invented wisdom embraced by the academic educational establishment" (p. 16). Engelmann (1992) himself stated a similar opinion:

After all these years, I'm still not sure I understand why it was so important for the establishment to discredit Direct Instruction. It's true that we do not do things the way they do it in traditional classrooms. But what we do works and what they do doesn't. If society is concerned with kids, it would seem reasonable to find what works and to use it, regardless of what our prejudices might be. If we don't rely on hard data, our prejudices don't have much to support them. Apparently, the key decision-makers had a greater investment in romantic notions about children than in the gritty detail of actual practice or the fact that some things work well. (p. 6)

Regardless of Project Follow Through's outcome, it did become the precursor to additional research on Direct Instruction. Unlike the research on Precision Teaching and fluency-building previously discussed, there have been a large number of studies conducted on the effectiveness of Direct Instruction with a variety of student types and in a variety of locations. According to Grossen, an American education researcher and editor of the Association for Direct Instruction Journal, "Every educator in the country should know that in the history of education, no educational model has ever been documented to achieve such positive results with such consistency across so many variable sites as Direct Instruction" (1997, pp. 6-7).

Research Since Project Follow Through

Most of the research on Direct Instruction was conducted in the 1970s and 1980s, and many studies are longitudinal, follow-up evaluations of Project Follow Through. Of the 10 studies and two meta-analyses which will be discussed in this section, most occurred in the 1980s and 1990s. The intention was to locate the most recent and relevant research available. The studies discussed here, therefore, only represent a small fraction of

all the Direct Instruction research conducted since Project Follow Through was initiated in the late 1960s.

Almost all of the 10 studies to be discussed compare groups or classrooms of students without random assignment of subjects to treatment or control conditions. There is almost equal representation of urban and rural locations, average and learning-disabled students, and primary and intermediate aged students. Almost one half of the studies evaluate reading ability only, while the rest look at a combination of skill areas such as reading, language, spelling, and math. Unfortunately, not all of the studies include statistical measures or results to back their claims. It is necessary to keep this limitation in mind when considering their findings.

Another issue of caution worth mentioning involves the control groups used in the Direct Instruction research to be discussed. Although most of the studies do employ equivalent comparison groups which are typical of regular classroom practice, others involve the comparison of strategies and approaches which appear uncommon or not entirely conducive to teaching the skills being measured. The internal validity of such studies, therefore, may be somewhat questionable. Ideal research conditions, of course, would employ control groups most similar to conditions naturally existing in typical classrooms.

Project Follow Through Follow-up Studies. The following four studies are follow-up evaluations of Project Follow Through. In one study, Gersten, Becker, Heiry, and White (1984) conducted a secondary analysis of Project Follow Through data from 1969 to 1977 to compare the yearly academic gains of 1500 low-IQ and normal/high-IQ students taught with Direct Instruction. The results revealed that students with low- and

normal- to high-IQ demonstrated similar and substantial gains each year in math and reading on the Wide Range Achievement Test (WRAT) and the Metropolitan Achievement Test (MAT). They concluded that if taught with Direct Instruction, students with low IQs are capable of achieving the same growth as their normal-IQ peers and can therefore be mainstreamed in regular classrooms as opposed to being assigned to special-education conditions. This study also indicates that Direct Instruction intervention at the primary level can have long-term benefits for below-average students, preventing them from falling farther behind their average-ability peers throughout their subsequent school years.

Two similar longitudinal follow-up studies looked at the achievement levels of Grades 5 and 6 students on the Wide Range Achievement Test (WRAT) and the Metropolitan Achievement Test (MAT) who had been taught using the Direct Instruction model during Project Follow Through (Becker & Gersten, 1982; Meyer, Gersten, & Gutkin, 1983). Both used Cohen's d index to calculate effect sizes, which involves dividing the difference between the experimental group's and comparison group's mean scores by the groups' pooled standard deviation (Cohen, 1992). According to Cohen, when testing the difference between independent means, an effect size of 0.20 is defined as small, an effect size of 0.50 is defined as medium, and an effect size of 0.80 is defined as large. The study by Becker and Gersten (1982) involved over 1000 Grades 5 and 6 students who were tested on the reading subtest of the WRAT. Effect sizes between Project Follow Through and non-Project Follow Through students ranged from 0.38 to 0.56. Chi-square values also indicated that Project Follow Through students achieved significantly higher scores in math problem-solving on the MAT. Meyer et al. (1983) used

scores from the MAT to determine that 91 Follow Through students maintained scores at or above grade level in Grades 5 and 6, and that these students also scored higher than the remainder of students in the district. Meyer et al.'s analysis resulted in effect sizes of 0.58 in Math and 0.38 in Reading of Follow Through students at the end of third grade. The results of these two studies indicate that the low-income Direct Instruction students maintained their advantage over the middle-class comparison groups in reading and math problem-solving throughout their intermediate years.

A final longitudinal Project Follow Through study looked at the achievement levels of low-income, disadvantaged students once they reached high-school and beyond (Gersten & Keating, 1987). Files were retrieved from the high-schools to which the Follow Through students and comparison group students had dispersed, and comparisons between the two groups were based on math and reading achievement tests, graduation rates, and college applications and acceptance. The study indicated that, at the Grade 9 level, 172 Project Follow Through students demonstrated higher achievement levels in math and reading than 279 comparison group students. As well, results showed that the Project Follow Through students experienced fewer attendance problems, repeated fewer grades, dropped out less often, and had higher high-school graduation and college acceptance rates. For example, 60% of the Project Follow Through students graduated from high-school, as compared to 38% of non-Project Follow Through students. As well, 34% of Project Follow Through students were accepted to college, whereas only 17% of non-Project Follow Through students were accepted. Direct Instruction, therefore, appears to result in long-term positive effects that extend to the high-school level and beyond. It is also important to note that despite coming from disadvantaged, low socio-

economic areas, these students were able to achieve substantial, long-term progress as compared to their middle-class peers.

Special-education students. Direct Instruction and the Reading Mastery program are often described as being best-suited for special education students. Six studies will be discussed which involve non-average learners. The authors of these studies refer to their subjects as "learning-disabled" (Stephens, 1993), "low-achievers" (Brent, DiObilda, & Gavin, 1986), "disadvantaged" and "lacking language skills" (Dowdell, 1996), or as possessing "mild disabilities" (Marston, Deno, Kim, Diment, & Rogers, 1995) or "reading difficulties" (Francis, 1991; Somerville & Leach, 1988). The studies' sample sizes range from 40 to 176 elementary-aged students. Four of the studies involve 1 year intervention periods, while the remaining two studies' interventions are 10 weeks and 12 weeks in duration.

The results of Somerville and Leach's (1988) study demonstrated significantly greater reading achievement gains for the experimental Direct Instruction group as opposed to a comparison group taught with psychomotor and self-esteem enhancement approaches. These alternative approaches are considered to be beneficial by educators who support the theory that psychomotor delay and/or low self-esteem may be the underlying causes of difficulty in learning basic skills.

The results of Brent et al.'s (1986) study demonstrated significantly greater reading achievement gains for the experimental Direct Instruction group as opposed to a comparison group taught with a regular classroom reading program. Brent et al.'s study also examined the effects of experienced and non-experienced Direct Instruction teachers on students' reading ability. They determined that students of teachers with two years of

Direct Instruction experience demonstrated significantly greater reading performance than those taught by teachers possessing only one year's Direct Instruction experience. Perhaps this finding relates to other studies' findings that teachers trained in Direct Instruction often begin with skeptical and even negative attitudes toward the program. After they have taught the program for an extended period of time and after having experienced its effects, teachers' negative attitudes generally change considerably for the better. Two such studies are discussed in greater detail later in Appendix A. In consideration of Brent et al.'s study, however, it does seem reasonable to suggest that teachers' attitudes toward an instructional program have the potential to influence students' achievement in that program.

In the study by Marston et al. (1995), six teaching strategies were compared. Results indicated that two of these teaching strategies, Direct Instruction being one, produced significantly greater achievement gains in students' reading ability. The alternative reading approaches employed in this study were of a wholistic, cognitively-oriented nature, such as peer-tutoring and reciprocal teaching strategies.

The experimental group receiving Direct Instruction and the control group receiving a regular classroom reading program in Dowdell's (1996) study received very similar post-test scores on the Iowa Tests of Basic Skills (ITBS). However, the subjects were not randomly assigned, and the pre-test determined that differences between the two groups were apparent from the start. The Direct Instruction group began instruction with lower scores than the control group and after one year, experienced a statistically significant gain of 1.06 years, as compared to the control group's 0.45 year's gain. Although a gain of 1.06 years is the average expected growth for students in a school

year, it can probably be assumed that students would have experienced less progress, as was the case with the control group, if they had not received Direct Instruction. This study indicates that students with low abilities are capable of demonstrating average achievement and, therefore, defeating the cycle of falling farther behind their peers with each school year.

The study by Francis (1991), which compared 261 students in Grades 3 to 6 taught with either Reading Mastery and Direct Instruction or with a regular classroom reading program, indicated that the Direct Instruction students achieved higher Vocabulary and Reading Comprehension scores on the Gates-MacGinitie Reading Tests. However, statistically significant gains were only found with Grade 6 students in Reading Comprehension and Grade 3 students in Vocabulary. Francis also notes that teachers expressed extremely positive attitudes regarding the teaching of Reading Mastery and Direct Instruction and the observed progress of their students.

The final study by Stephens (1993) employs a one-group pre-test-post-test design to determine the effects of implementing a Direct Instruction reading program on students' reading achievement. The results determined that 73% of the students involved in the Direct Instruction implementation gained 1 or more grade levels in reading as measured by the Kaufman Test of Educational Achievement (K-TEA). Pre-tests administered prior to implementation of the program indicated that these students were 2 to 6 grade levels behind in reading achievement. Due to these positive results, Stephens recommended that schools incorporate a Direct Instruction reading program in the primary grades which employs a structured format, increased time on task, and which teaches to mastery. This, she believed, would prevent increasing failures by students in the higher grades and, as a

result, may also prevent these students from being labelled as handicapped or learning-disabled. Additional positive side-effects that Stephens mentioned as a result of her study, and which have also been experienced in the treatment school involved in the present study, include increased collaboration and improved morale among teachers.

As these six studies indicate, Direct Instruction appears to be an effective teaching strategy to assist students who possess some degree of learning disability or reading difficulty. It is also interesting to note that although two of the studies discussed consist of short intervention durations of 10 weeks (Marston et al., 1995) and 12 weeks (Somerville & Leach, 1988), both significantly favoured Direct Instruction as the more effective teaching strategy. Their findings, therefore, demonstrate that even short-term use of Direct Instruction can produce substantial gains in special-education students' reading ability.

Meta-Analyses. In addition to the studies mentioned above, two relevant meta-analyses of Direct Instruction research have been conducted in the last decade which are worthy of discussion in this literature review. White's (1988) meta-analysis involves 25 studies of special-education students, whereas Adams and Engelmann's (1996) research examines 34 studies involving both regular and special-education students. Both meta-analyses involve studies' results gathered through searches of databases and recent publications. Both used Cohen's d index to calculate the effect sizes for each study, which involved dividing the difference between the experimental group's and comparison groups' mean scores by the groups' pooled standard deviation (Cohen, 1992). The overall effect size was then determined by averaging all of the comparisons' effect sizes. According to the authors of both meta-analyses, an effect size of 0.25 is considered to be educationally

significant. This refers to interventions which produce a change in students' performance by 0.25 of a standard deviation. Adams and Engelmann claim that effect sizes of 0.50, whereby students' performance has changed 0.50 of a standard deviation, are uncommon in educational research.

White's (1988) meta-analysis includes only those studies in which subjects were assigned to experimental and comparison groups before an intervention occurred. The results of his research indicated that the Direct Instruction groups demonstrated an overall average effect size of 0.84. As well, White's meta-analysis indicated equally high effect sizes for both lower-level thinking skills such as word-attack and higher-level thinking skills such as reading comprehension.

Adams and Engelmann's (1996) meta-analysis includes only those studies which used comparison groups, had similar pre-test scores between groups, included necessary statistical information, and incorporated Direct Instruction curriculum developed by Engelmann and his associates. From the 34 studies which met these criteria, 173 individual comparisons were analyzed. As a result, an overall average effect size of 0.87 was calculated for these comparisons. In addition, Adams and Engelmann conducted a simple polling of means to determine the percentage of studies favouring Direct Instruction. Their results indicated that 87% of the studies showed Direct Instruction to be more effective than alternative teaching strategies. Due to the simplicity of this polling procedure, Adams and Engelmann also polled the statistically significant differences, using an alpha level of .001, which again resulted in the majority (64%) of studies favouring Direct Instruction.

Adams and Engelmann (1996) also examined several variables as part of their meta-analysis. This examination showed similar, educationally significant effect sizes for regular and special-education students, elementary and secondary school-aged students, and interventions lasting up to a year and those lasting more than a year. As well, effect sizes for nine different academic subject areas were all 0.35 or greater, with 0.69 being the effect size for reading. For the sake of comparison, Adams and Engelmann cited a meta-analysis on the Whole Language reading approach conducted by Stahl and Miller (1989) which yielded an overall effect size of 0.09.

Overall, Adams and Engelmann's (1996) meta-analysis demonstrates extremely positive results in favour of Direct Instruction. As well, their findings appear valid considering the statistical measures employed and considering the method of determining studies worthy of inclusion. Of particular relevance to the present study are the large effect sizes for Direct Instruction in teaching reading and with average students. Some educators consider Direct Instruction and Reading Mastery as best suited for special-education students. This research appears to indicate otherwise.

In summary, a large body of research on Direct Instruction in teaching various skills and with learners of various ages, abilities, and socio-economic statuses exists. Although not all of the studies discussed meet ideal research conditions, this does not appear sufficient to negate the evidence which favours Direct Instruction as an effective teaching strategy.

Morningside Academy

Limited research has been conducted which examines the effect of both Precision Teaching and Direct Instruction combined in an instructional program. Perhaps the

longest-running study which does incorporate both strategies involves Morningside Academy, the private learning center in Seattle, Washington, whose teaching methods have been adopted by the present study's treatment school.

Morningside Academy offers a money-back guarantee that their students will gain, academically, a minimum of two years for every one year in their school. In the 11 years from 1981 to 1992, students at Morningside Academy experienced a gain average of 2.5 grade levels per year in Reading, Language Arts, and Math as measured by the California Achievement Test and the Metropolitan Achievement Test (Johnson & Layng, 1992). When this school's curricular program was implemented with adults at Malcolm X College in Chicago, similar and even higher gains in student test scores were the result (Binder, 1993; Johnson, 1997). Johnson, Morningside Academy's founder and director, attributes the success of these schools, for the most part, to their emphasis on fluency-based instruction (Johnson & Layng, 1994).

Morningside Academy has also analyzed data from the standardized Gates MacGinitie Reading Tests to determine the reading program's effectiveness in the two schools involved as pilot sites in School District No. 56. The results indicate that in the 2nd year of implementation, the two schools experienced gains of 1.5 to 3.5 years in reading and writing (Johnson, 1997). Although the present study examines the same general research topic and involves one of the schools, its analysis differs from Morningside Academy's in that it utilizes data from the Canadian Tests of Basic Skills over several years and involves control schools for comparison.

Criticisms of the Reading Program

There are, as is to be expected and as is the case with any teaching method, several criticisms of the philosophy underlying Precision Teaching, fluency-building, and Direct Instruction. These instructional components are all based on the behavioural theory of education. The major principles associated with the behavioural approach are that behaviour is learned, is influenced by the context in which it occurs, and must be observable. Teaching and learning, therefore, involve changing student behaviour (Blackman, 1984). In order to determine the extent to which student behaviour has changed, data-based evaluation and the gathering of empirical evidence is necessary. According to Binder (1995), "Without direct, standard measurement of outcomes, it is not possible to objectively evaluate or compare interventions" (p. 106). Those who take exception to Skinner's behaviourist theory because of its technical and seemingly non-humanistic orientation will most certainly find fault with data-based instruction, fluency-building exercises, and teacher-directed instruction. They might say that a scientific, analytic, and empirical approach to education neglects the emotional and social aspects of teaching and learning, and that students cannot be considered "robots" or "guinea pigs" whose every behaviour teachers set out to control and manipulate.

There seems to exist some animosity and rejection regarding rote learning of basic skills as well. Some believe that it stifles creativity, initiative, and imagination in students and that drill and practice strategies are boring and seemingly without purpose from the students' perspectives. The trend in education today appears to have a combined humanistic and cognitive-developmental emphasis wherein students' self-image and social development are accentuated in addition to their problem-solving and critical thinking

skills. As Skinner has commented:

...the solution conflicts with deeply entrenched views of human behavior. [Some] tend to feel threatened by any kind of scientific analysis of human behavior, particularly if it leads to a "technology" that can be used to intervene in people's lives. A technology of teaching is especially threatening. (1984, p. 948)

Binder and Watkins (1990) claim that behavioural methods in education are rejected because they are out of fashion. They boldly state that educators "don't want systems that disturb the normal distribution of grades in the student population" (p. 74). Solity's (1991) opinion regarding behavioural methods' lack of representation in the school system concerns accountability:

Becoming aware of a child's failure to progress rarely becomes an opportunity for critical self-reflection on the part of the teaching profession. An approach to teaching which adopts this as its starting point is, therefore, less likely to find favour than one which rests more readily with the alternative construction, namely that a failure to learn can be attributed to specific learning personal characteristics of the child, or the child's home environment. (p. 163)

Jones and Slate (1996) conducted a study involving 504 teachers who were asked to agree or disagree with statements relating to behavioural methods in education. Results showed that of the many behavioural issues represented by these statements, teachers were generally supportive of all except for two. Statements relating to the use of objective and scientific measures to evaluate student learning were commonly rejected, as were statements concerning teacher accountability and responsibility for student learning. Instead of holding teacher instruction and instructional materials responsible, teachers tended to blame other factors for students' learning difficulties, such as society, parents, and television. The study's authors concluded that "Rejection of scientific standards is likely to result in decisions being based on faulty criteria such as opinion or emotion" (p.

38).

The behavioural perspective, on the contrary, places full responsibility for student learning on teachers and instructional materials. The underlying premise is that every child can achieve if given adequate instruction (Skinner, 1984). Engelmann (1992) claims that "The system is sick because the vast majority of people in it--from educational researchers to teachers--lack technical understanding of the single aspect of the school that justifies their existence--instruction" (p. 13).

Mothus (1997), from research which will be discussed later in this paper, suggests that teaching practices, and not the student, are responsible for student learning, and that educational practice needs to be driven by proven classroom research as opposed to current trends or fads. Stahl et al. (1998) state their concern that current classroom reading programs are based "...on false allegations popularized by the media and accepted by some legislators and administrators describing the limited success of past reading programs" (p. 351). Carnine (1992) states that education needs to be more like the medical profession, which is not characterized by fads but which has a scientific perspective and access to carefully-evaluated tools. Another opinion is that of Axelrod (1992) who believes that effective teaching strategies and materials have been developed and are available, and it is now the responsibility of behavioural educators to make these practices known. He places partial blame for the general rejection of these practices on many universities' lack of behavioural courses and faculty trained in these approaches.

Another criticism concerns the emphasis on teaching subskills in isolation and out of context as opposed to a more "top-down", meaning-oriented, wholistic approach. This view is held by Allington and Walmsley who, in 1995, stated that "skills hierarchies

dissected literacy learning into so many parts that in both testing and teaching we lost sight of the forest by focusing on individual trees" (p. 5). Goodman (1986) also claimed that "When schools break language into bits and pieces, sense becomes nonsense, and it's always hard for kids to make sense out of nonsense" (p. 8).

Despite this controversy, it seems as though the goals of both a wholistic approach and a "bottom-up" approach, at least in the case of reading, are similar. The ultimate goal of a subskills approach to reading is that students become fluent readers, able to comprehend story meaning and able to bring their own experiences and associations to the reading process. Bloom (1986) stated, "Reading to automaticity cannot be developed if children read only for classroom purposes. The *habit of reading* (ital. orig.) for several years is necessary for automaticity to develop" (p. 76). Demonstration of a love of literature and language, reading for purpose and understanding, and the ability to apply thinking skills are the long-term goals of the Reading Mastery program (Engelmann, Osborn, Osborn, & Zoref, 1988), goals which appear not unlike those of any wholistic approach to reading instruction.

Carnine et al. (1997) attribute failure in today's schools to a number of factors, including insufficient teaching of preskills, the teaching of too many skills at a superficial level and without adequate review and practice, not enough time spent in actual reading, and the lack of reading instruction for unmotivated students due to the belief that learning to read is a natural and intrinsically-motivated process. The answer, according to these authors, lies in improving teaching practices and methodology, which they believe can be achieved by implementing effective, efficient, research-proven methods such as Precision Teaching and Direct Instruction.

Summary

The debate over which educational theory or reading approach is superior will never be solved. Many teachers would agree that an open and flexible view towards combining the best in all approaches while maintaining the overriding goal of attempting to meet students' needs is where the answer lies. The purpose of the present study, therefore, is not to claim one right teaching style, but rather to provide a small though necessary piece of evidence in an area where such research is limited. Not only will the study hopefully be able to provide some insight into the benefits of Precision Teaching, fluency-building, and Direct Instruction in the classroom, but it will also be able to determine, at least to some extent, the effectiveness of combining these components into an instructional reading program, where Direct Instruction is used to teach foundational skills and concepts, and Precision Teaching is used to assist students in achieving fluency and as an assessment and decision-making tool.

METHOD

The present study involves an evaluation of the reading program in the treatment school. This is achieved through a comparison of the treatment school's and four control schools' Canadian Tests of Basic Skills Reading and Vocabulary subtest scores in the pre-treatment and post-treatment years. Because different groups of students were in attendance and tested in the pre-treatment and the post-treatment years, the study's analysis involves a between-groups comparison.

The present study is described as quasi-experimental. Random assignment of subjects to treatment or control conditions was not possible, because students were in predetermined, intact classrooms. Also, the treatment reading program was purposefully, and not randomly, implemented in the treatment school prior to the researcher's interest in the study.

Control schools were included as part of the present study's analysis to investigate trends in students' Canadian Tests of Basic Skills scores over the past several years. For example, if both the treatment school's scores and the control schools' scores increase from the pre-treatment to the post-treatment years, one could attribute the increase to a factor other than the reading program, such as district-wide programs, or a difference in overall student population over time due to socio-economic or community changes. However, if only the treatment school's scores demonstrate an increase from the pre- to the post-treatment years, one could attribute the difference to some factor unique to this school, one such possibility being implementation of the reading program. As well, a difference, if any, in the treatment school's scores between pre- and post-treatment could be underestimated without a comparison to the control schools, because the control

schools may exhibit an overall increase or decrease in scores between pre-treatment and post-treatment not exhibited by the treatment school. For example, if the treatment school exhibits no difference between pre- and post-treatment scores, one might assume that the program has had no effect. However, if the control schools all exhibit substantial declines between pre- and post-treatment scores, then the no difference exhibited by the treatment school indicates that the reading program has had some effect in comparison to the control schools' results.

This chapter includes a description of the subjects, measures, procedures, and ethics involved in the present study. The reading program in the treatment school, the reading approaches in the control schools, and the Canadian Tests of Basic Skills will be described in detail. Reference will also be made to the Provincial Learning Assessment Program as an additional measure of comparison.

Subjects

Before amalgamation in 1996, School District No. 56 covered approximately 160,000 square miles with a population of 22,000 (Vanderhoof District Chamber of Commerce, 1996). The school district consisted of 11 elementary and elementary-secondary schools, two of which were the pilot sites for the treatment reading program. Of the nine remaining schools, four were chosen as controls for the present study. Of the five not chosen, three schools were not included as controls due to incomplete Canadian Tests of Basic Skills data from the years involved in the study's analysis. Another school is situated in Tachie, an Aboriginal reserve north of Fort St. James, and was not included in the study due to its unique implementation of curriculum and instructional methods. The final school not included in the study is quite unlike the treatment school in that it

typically has no Aboriginal students in attendance.

The one treatment school involved in the present study is located in the community of Fort Fraser, and the four control schools are located in the communities of Vanderhoof, Fraser Lake, and Fort St. James. These communities can be classified as rural-residential, where forestry and agriculture are the largest industries. The treatment school consists of Kindergarten to Grade 7. One of the control schools consists of Grades 4 to 12 (although data from students only in Grades 4 to 7 were used), and the remaining three schools consist of Kindergarten to Grade 7.

Approximately 230 student scores from the treatment school and 2300 student scores from the control schools were used in the study. Data from students who were involved in the treatment reading program for a minimum of one year were included for analysis. School records were used to determine which students met this criterion. Because the Canadian Tests of Basic Skills is designed to test individuals at a Grade 3 level and above, students in the study ranged from Grade 3 to Grade 7 and in age from 8 to 13 years. The mean age of the students in the treatment school was 10.8 years. The mean age of the students in the control schools was 11.0 years. Table 1 provides descriptive information regarding the grades of students involved in the study.

Table 1
Numbers of Students Involved in the Study

| School | Year | | Grade 3 | Grade 4 | Grade 5 | Grade 6 | Grade 7 | Total |
|-------------------|----------------|---------|---------|---------|---------|---------|---------|-------|
| Treatment | Pre-treatment | 1991-92 | --- | 17 | 15 | 16 | 9 | 57 |
| | | 1992-93 | 20 | --- | --- | 14 | --- | 34 |
| | Post-treatment | 1995-96 | 17 | 11 | 9 | 16 | 21 | 74 |
| | | 1996-97 | 10 | 16 | 13 | 9 | 18 | 66 |
| Control 1 | Pre-treatment | 1991-92 | --- | 48 | --- | --- | 50 | 98 |
| | | 1992-93 | 36 | --- | --- | 33 | --- | 69 |
| | Post-treatment | 1995-96 | 28 | 27 | 49 | 31 | 35 | 170 |
| | | 1996-97 | 40 | 20 | 17 | 47 | 34 | 158 |
| Control 2 | Pre-treatment | 1991-92 | --- | 26 | 37 | 25 | 19 | 107 |
| | | 1992-93 | 41 | 32 | 29 | 39 | 27 | 168 |
| | Post-treatment | 1995-96 | 22 | 30 | 31 | 40 | 30 | 153 |
| | | 1996-97 | 17 | 18 | --- | --- | --- | 35 |
| Control 3 | Pre-treatment | 1991-92 | --- | 42 | 32 | 36 | 54 | 164 |
| | | 1992-93 | --- | --- | --- | 33 | --- | 33 |
| | Post-treatment | 1995-96 | --- | 32 | 38 | 40 | 40 | 150 |
| | | 1996-97 | --- | 34 | 31 | 38 | 21 | 124 |
| Control 4 | Pre-treatment | 1991-92 | --- | 45 | 47 | 53 | 53 | 198 |
| | | 1992-93 | 53 | 48 | 58 | 50 | 54 | 263 |
| | Post-treatment | 1995-96 | 39 | 56 | 39 | 52 | 46 | 232 |
| | | 1996-97 | 40 | 38 | 49 | 37 | 33 | 197 |
| Combined Controls | Pre-treatment | 1991-92 | --- | 161 | 116 | 114 | 176 | 567 |
| | | 1992-93 | 130 | 80 | 87 | 155 | 81 | 533 |
| | Post-treatment | 1995-96 | 89 | 145 | 157 | 163 | 151 | 705 |
| | | 1996-97 | 97 | 110 | 97 | 122 | 88 | 514 |

Aboriginal ancestry is an ethnic variable which the Ministry of Education requires all schools to collect. Students in School District No. 91 are designated as Aboriginal if they identify themselves, or if a family member identifies them, as having Aboriginal ancestry. Approximately 24% of the students involved in the study from the treatment school were of Aboriginal ancestry, and approximately 17% of the students involved in the study from the four control schools were of Aboriginal ancestry.

Numbers of male and female student participants were fairly equal across all the schools involved. In the treatment school, 54% of the students involved in the study were

male and 46% were female. In the control schools, 51% of the students involved in the study were male and 49% were female.

The number of special-education students involved in the study was not available. This is due to the schools' many and diverse definitions of "special-education" students, which range from those possessing mild learning difficulties to those with severe learning disabilities and physical handicaps. In addition, students with special needs are not always easily identified in the school system. The Canadian Tests of Basic Skills' scores of students designated by district testing as EMH (Educably Mentally Handicapped), however, were not included in the study.

Measures

The Canadian Tests of Basic Skills (CTBS) Elementary Multilevel Battery consists of six different test levels designed for students from age 8 to age 14 (King-Shaw, 1989). The purpose of the CTBS is to determine where students are in the development of basic skills necessary for success in society. This knowledge is useful for evaluating instructional programs and materials as well as for making instructional decisions regarding individual students.

The tests are nongraded and are made up of a continuous scale from low level Grade 3 to high level Grade 9. Each test level consists of the following subtests: Reading, Vocabulary, Language (Spelling, Capitalization, Punctuation, Usage, Expression), Work-Study (Visual Materials, Reference Materials), and Mathematics (Concepts, Problem Solving, Computation). The Reading and Vocabulary subtests were determined as measures of the variable of interest in the present study, that of reading achievement. Therefore, only these two subtests' scores were analyzed.

The Reading subtests of the CTBS were developed to represent as many sources of students' everyday reading as possible. Emphasis is placed on understanding and drawing inferences from the passages. With each increasing test level, there is an increase in the number and complexity of items requiring higher-order thinking skills.

The Vocabulary subtests of the CTBS were developed by employing two classification systems. The first system, the content-area skills classification, is a computer-based system which generates words taken from a variety of required and recommended school textbooks. The second system, the linguistic/structural classification, ensures that words depicting different parts of speech, such as nouns, verbs, and connectives, are given equal representation on the subtests.

The CTBS test editions prior to 1998 were standardized in 1987 using approximately 3200 students per grade level and samples representative of all Canadian provinces and school sizes. Test norms are provided in grade equivalents, percentile ranks, and stanines. The CTBS claims to be valid in that it is based on over 50 years of continuous research. Minority and gender concerns were addressed by careful test item construction and review.

Internal-consistency reliability refers to the correlation among items on a single subtest, that is, whether subtest items measure the same trait or ability. The internal-consistency reliability (Kuder-Richardson formula 20) of the Reading subtest ranges from .90 to .94. The internal-consistency reliability of the Vocabulary subtest ranges from .83 to .88. These scores were judged by the researcher as adequate indicators of internal-consistency reliability for the two subtests.

Intercorrelations among subtest scores refers to the similarity with which students score on both tests. The intercorrelations among the Reading and Vocabulary subtest scores range from .70 to .78 (King-Shaw, 1990). A separate and independent study by Wright (1976), which involved approximately 2700 students in Grades 4, 6, and 8, demonstrated similar intercorrelations between the CTBS Reading and Vocabulary subtests ($r = .80$ to $.82$). These intercorrelations were judged by the researcher as being sufficiently high to suggest that although the Reading and Vocabulary subtests are separate scales, they are also related.

It must be assumed that all teachers who administered the CTBS over the years included in the present study's analysis followed the outlined procedures in a nearly-identical manner. As well, the variability of student characteristics such as boredom, fatigue, motivation, and illness during the tests' administration must be considered as relatively equal across the various groups and settings.

Procedures

Random assignment of subjects to treatment or control conditions in the present study was not possible. Instead, intact classrooms and groups of students were utilized. The independent variable in the study is the reading program. It consists of two levels: the reading program in the one treatment school, and the reading approaches in the four control schools. The dependent variables are the Canadian Tests of Basic Skills Reading and Vocabulary subtest scores.

Reading Program in the Treatment School

Since 1994, the reading program in the treatment school has consisted of the SRA (Science Research Associates) Reading Mastery and Decoding basal reading programs

combined with the Precision Teaching instructional strategy as adopted from the Morningside Model of Generative Instruction. Direct Instruction is emphasized throughout all aspects of the program. Most of the teachers at this school have received training in Direct Instruction and the Morningside model.

Reading in all the groups is taught for approximately 90 minutes per day for 5 days a week. The reading groups range in size from 5 to 25 students, with the average reading group size being approximately 15 students. Students are arranged in groups according to their ability levels and not their ages or grades, although a maximum age difference of 3 years is generally allowed due to the emotional and physical differences between students who range in age by this number.

Student placement into specific reading groups is determined by various test scores from both the fall and spring, although previous program levels completed and teacher input are just as influential in making this decision. Students who find certain program levels too difficult or not challenging enough are moved into more appropriate levels. Reading levels include Reading Mastery I, II, III, IV, V, and VI, as well as Reading Mastery Fast Cycle I and II (for use with Grades 1 and 2 students of above-average ability levels in reading), and Decoding B1, B2, and C (for use with students who are more than 2 years below grade level and/or who experience difficulty in decoding sounds and words). Students who have completed Reading Mastery VI are taught a literature-based program which emphasizes novel studies, higher-order thinking skills, and more advanced levels of reading comprehension and written skills. A similar but lower-level literature-based program is also available for younger students who read at or above grade-level.

Prior to 1994, reading programs used by teachers in the treatment school ranged from teacher-directed, structured, phonics-based, basal reader programs to less structured, whole language, literature-based programs. As well, reading programs which utilized various combinations of these approaches were common.

Reading Approaches in the Control Schools

The Ministry of Education's Language Arts English Primary-Graduation Curriculum Guide (1990) identified its central aim as: "to enable each student to experience literature and to use language with satisfaction and confidence, striving for fluency, precision, clarity, and independence" (p. 16). This was to be achieved through the program's goals, which were to provide students with opportunities for using language in communication, culture, thinking, and learning. These opportunities could exist in a wide variety of forms and experiences which embodied the four communication strands of speaking, listening, reading, and writing. The teacher was viewed as the "instructional decision maker" (p. 11) and was granted professional autonomy in choosing a language arts program that met the mandated curriculum's program goals.

In 1996, the Ministry of Education, Skills and Training published an updated version of its Language Arts English Curriculum Guide entitled English Language Arts K to 7 Integrated Resource Package. This new version incorporates many components from the 1990 version and continues to allow teachers the freedom to use a language arts program of their choice which fulfills the Ministry-mandated requirements. The goal for the new English Language Arts K to 7 curriculum is to "provide opportunities for students to learn to use and appreciate language through a variety of communication forms in a variety of contexts" (p. 3). This is to be achieved by providing a language arts program

that encourages students to

...communicate effectively in written, spoken, and visual forms; develop positive attitudes toward language learning; make connections to other areas of study and to life outside the classroom; think critically, creatively, and reflectively; appreciate their own culture and the culture of others'; and use technology. (p. 2)

Because teachers possess the professional freedom to choose the instructional materials and methods to meet the Ministry's curriculum requirements, there exists a wide variety of language arts programs in use throughout the school district. An anonymous questionnaire was given to elementary teachers in the four control schools and one treatment school to determine what types of reading programs and teaching strategies had been used over the past few years (see Appendix B). Approximately 65 questionnaires were given out and 16 completed questionnaires were returned. The 16 completed questionnaires represented all 5 schools involved in the study and were therefore judged to be indicative of the types of reading programs and teaching strategies found there. Because no personal gain or incentive existed for teachers to return the questionnaires, a 25% return rate was not viewed as unexpected or inadequate.

According to the completed questionnaires, teachers have used basal reading series, literature-based reading series, phonics-based programs, novel studies, and teacher-made reading programs fairly equally since 1990. There did not appear to be a general shift or trend in the use of reading programs in the control schools from pre-1990 to 1997. However, many teachers responded that their use of reading programs had changed over the past few years, although their descriptions of the changes were quite varied and did not indicate a trend towards the use of any particular reading program.

The completed questionnaires also indicated that teachers have taught reading using small groups, the whole class, same-ability grouping, mixed-ability grouping, a traditional style, and a wholistic style fairly equally since 1990. There did not appear to be a general shift or trend in the use of strategies to teach reading in the control schools from pre-1990 to 1997. As was the case with reading programs, most teachers stated that their use of strategies in teaching reading had changed over the past few years, although the changes were varied and did not indicate a general trend towards the use of any specific teaching strategy.

Most reading classes in the control schools are heterogeneous regarding students' reading abilities. Most classrooms consist of 20 to 30 students, and most fulfill the Ministry's recommended time allotment for teaching Language Arts, which is approximately 90 minutes per day, 5 days a week.

An additional issue warranting discussion regards the teaching of components of the treatment reading program in the four control schools. For example, many learning assistance teachers throughout the school district have used and are currently using Reading Mastery in their special-education classrooms, although without the Precision Teaching or fluency-building components. As of the 1999-2000 school year, the four control schools use various components of the treatment reading program only in the occasional classroom or by the occasional teacher and, in most cases, in an adapted format. Considering the quasi-experimental nature of the study, however, and given the fact that classrooms and schools, in general, are dynamic, changing, and unpredictable situations, it can probably be assumed that the location and analysis of pure control groups with absolutely no exposure to any of the treatment reading program's components would

be an impossibility. As well, it can accurately be stated that the treatment school is the only one of the five schools involved in this study to implement a reading program school-wide that follows the Morningside model and which incorporates the combined components of Reading Mastery, Direct Instruction, and Precision Teaching.

The Provincial Learning Assessment Program

Because students were not randomly assigned to the treatment and control conditions of the present study, it may be useful to consider the results of a different available assessment measure, the Provincial Learning Assessment Program (PLAP). The results of the PLAP can provide some comparisons with other levels of the school system, and it may therefore be useful to compare the treatment school's outcomes of available PLAP evaluations with the school district's average outcomes. This comparison may provide evidence regarding similarities or differences between the treatment school and other schools in the district, including the four control schools. However, it must be stressed that the PLAP is only one assessment measure of only a limited group of students.

The PLAP consists of annual assessments mandated by the Ministry of Education for students in Grades 4, 7, and 10. A different subject area is evaluated each year, although not all annual assessments are administered province-wide. The purpose of the PLAP is to measure student achievement of the curriculum to determine whether change has occurred over time and to assist in the identification of schools' and districts' strengths and weaknesses. The Ministry of Education produces a report after each full provincial assessment which consists of results at the provincial, district, and individual school levels, as well as recommendations for areas identified as those requiring attention.

The most recent PLAP assessment results are reported and graphed so that statistically significant differences between schools', districts', and provincial results, if any, are easily identified. Estimated means and their 95% confidence intervals (within which the true average percent correct will fall) are graphed. Overlapping confidence intervals of provincial, district, and/or school means indicate no significant difference. Less recent assessments, however, only provide the mean percent correct for each school and district. Statistically significant differences, therefore, are unavailable for these evaluations. The available full provincial PLAP assessment results reported for the present study include Reading (1984), Reading (1988), Math (1990), Math/Science (1995), Social Studies (1996), and Reading (1998). Although the Math assessment results are not necessarily indicative of students' reading achievement, they will, nonetheless, provide some information regarding the academic performance of students in the treatment school as compared to all students in the school district.

Table 2 lists the mean percent correct of Grades 4 and 7 students in the treatment school (TS) and all Grades 4 and 7 students in School District No. 56 for the six PLAP assessments mentioned. The results of the Math/Science 1995 and Social Studies 1996 assessments include information regarding statistically significant differences between the school's and district's outcomes. No statistically significant differences existed between the treatment school's Grade 7 students and all Grade 7 students in the district for the Social Studies 1996 or the Math 1995 assessments. As well, no statistically significant differences existed between the treatment school's Grade 4 students and all Grade 4 students in the district for the Math 1995 assessment. Statistically significant differences did exist between both Grades 4 and 7 students in the treatment school and Grades 4 and

7 students in the district for the Science 1995 assessment, with the differences favoring the treatment school. The results of the remaining three assessments appear to somewhat equally favor both the treatment school and the district. About one half of the treatment school's listed mean percents correct are higher than the district's. However, it is unknown whether these differences are statistically significant.

Table 2
Provincial Learning Assessment Program Results

| Subject/Year | Grade 4 | | Grade 7 | |
|--------------|---------|-------|---------|-------|
| | TS | SD#56 | TS | SD#56 |
| Reading 1984 | 69.25 | 69.05 | 66.08 | 72.94 |
| Reading 1988 | 75.40 | 72.58 | 70.38 | 68.48 |
| Math 1990 | 44.00 | 46.00 | 48.00 | 49.00 |
| Math 1995 | 56.80 | 54.60 | 48.10 | 49.20 |
| Science 1995 | 70.00 | 58.80 | 60.00 | 54.80 |
| Socials 1996 | --- | 63.40 | 62.20 | 61.50 |
| Reading 1998 | 64.60 | 61.10 | 52.00 | 60.60 |

Note. TS = Treatment School; SD#56 = School District No. 56.

^aData were not available for the treatment school's Grade 4 students on the Socials 1996 PLAP assessment.

From this examination and comparison of the available PLAP results, it appears that no important differences exist between the academic achievement of Grades 4 and 7 students in the treatment school and all Grades 4 and 7 students in School District No. 56. In making this claim, however, it must be acknowledged that data of only one assessment measure were examined and with only a small sample of students.

Collection and Treatment of Data

Since 1993, the Canadian Tests of Basic Skills have been administered to students in the spring of each school year. Prior to 1993, tests were administered to students in the

fall. Completed tests are sent to Toronto, Ontario for scoring. Scored tests are returned and copies of the results are kept at both the School Board Office and at the individual schools. Although it is mandated by the district that all schools administer the Canadian Tests of Basic Skills to students in Grades 3, 6, and 9, many schools have chosen, at the elementary level, to administer the test to all students in Grades 3 through 7. The Canadian Tests of Basic Skills data from the schools and years involved in the present study were entered into an SPSS file by a graduate research assistant at the University of Northern British Columbia.³

Due to convenience and availability of the Canadian Tests of Basic Skills data, four years of Reading and Vocabulary subtest scores will be analyzed for each of the five schools, at two points before the treatment reading program's implementation in 1994, and at two points after the program's implementation. The Canadian Tests of Basic Skills scores from October, 1991 and May, 1993 were chosen as pre-treatment data because they were complete and available for all the schools involved (school district records of Canadian Tests of Basic Skills data prior to 1991 are incomplete and inconsistent). As well, sample sizes in the treatment school were largest for these two years. The Canadian Tests of Basic Skills scores from May, 1996 and May, 1997 were chosen as post-treatment data for several reasons. First, Canadian Tests of Basic Skills data from 1995 were not available from the School Board Office for any district schools. Second, earlier editions of the Canadian Tests of Basic Skills (prior to 1998) were normed in 1989. A

³ This work was funded through a School District No. 91 research grant under the administration of Peter MacMillan at the University of Northern British Columbia.

new norming sample was used for the 1998 edition of the Canadian Tests of Basic Skills, making that year's test scores not useful for comparison with previous years' scores. As well, returned results of the newer edition which schools in School District No. 91 wrote in 1998 do not include the Vocabulary subtest scores.

It is acknowledged that percentile ranks are a less-reliable measure of achievement than raw test scores (May & Nicewander, 1994). However, the Canadian Tests of Basic Skills results which are returned to schools and school board offices after being scored do not include students' raw test scores. Also, grade equivalencies are not considered useful or meaningful for the present study's analysis since numbers of students and their grades vary both between the schools and also between the pre-treatment and post-treatment years. National percentile ranks, however, provide a consistent and meaningful measure and national standard across all schools involved and for both testing periods. Therefore, in spite of their lower reliability, national percentile ranks will be reported as opposed to raw scores or grade equivalencies in analyzing data for the present study.

A final consideration which was made in the present study's treatment of data concerns the high percentage of Aboriginal students in School District No. 91. The Canadian Tests of Basic Skills Reading and Vocabulary subtest scores of Aboriginal students and non-Aboriginal students will therefore be analyzed separately to determine whether the two groups of students respond in a similar manner to the treatment reading program. The benefit of this analysis is that the results of Aboriginal students will not be buried in the results of the greater group. Aboriginal students are identified by consulting school records, since Aboriginal ancestry is an ethnic variable which the Ministry of Education requires all schools to collect. Students in School District No. 91 are

designated as Aboriginal if they identify themselves, or if a family member identifies them, as having Aboriginal ancestry. Of the sample for the present study, approximately 24% of the students from the treatment school are of Aboriginal ancestry, and approximately 17% of the students from the control schools are of Aboriginal ancestry.

As a preliminary analysis, the Canadian Tests of Basic Skills Reading and Vocabulary subtest scores of the four control schools, both pre- and post-treatment, will be compared using analyses of variance (ANOVA). The results will determine whether the four control schools can then be combined to form one control group for further analysis. If the results of these ANOVAs determine that it is viable to combine the control schools into one control group, independent samples t-tests will be conducted to compare the Reading and Vocabulary subtest mean scores of the treatment and control groups in the pre-treatment years and then again in the post-treatment years. Independent samples t-tests will also be conducted to compare the Reading and Vocabulary subtest mean scores of both Aboriginal students and non-Aboriginal students in the treatment and control groups. Effect sizes using Cohen's d statistic (Cohen, 1992) will also be calculated for the mean difference scores of the treatment and control groups between the pre- and post-treatment years for all students as well as for Aboriginal and non-Aboriginal students as separate groups.

Ethics

Throughout the present study, ethical guidelines concerning the policies of the School Board and the University of Northern British Columbia were strictly followed. The Canadian Tests of Basic Skills data are collected annually by individual schools and the school district as part of regular and ongoing evaluation procedures, and approval was

obtained from the School Board to analyze these previously collected data from all schools and years deemed necessary for the study (see Appendix C). Principals of the schools involved were informed of the study and its intentions regarding the use of their school's data (see Appendix D). Permission to analyze the results of Aboriginal students as a separate group was granted by the five Aboriginal Band Councils which operate within the School District's boundaries (see Appendix E). As well, whole school data as opposed to specific classroom data were reported, and the anonymity and confidentiality of the schools were preserved by not using school names.

RESULTS

The general problem statement of the present study asks whether or not implementation of the reading program in the treatment school has been successful in increasing students' reading abilities as measured by the Reading and Vocabulary subtests of the Canadian Tests of Basic Skills (CTBS). This section summarizes the study's results as they correspond to the two specific questions related to this problem statement:

1. Will there be an equal difference between the treatment school's (Precision Teaching/Direct Instruction reading program) and the control group schools' (combination of other reading programs) mean CTBS Reading subtest scores in the pre-treatment years and in the post-treatment years?
2. Will there be an equal difference between the treatment school's (Precision Teaching/Direct Instruction reading program) and the control group schools' (combination of other reading programs) mean CTBS Vocabulary subtest scores in the pre-treatment years and in the post-treatment years?

These two questions will also be investigated for Aboriginal students and non-Aboriginal students as two separate groups in order to determine whether the treatment reading program is effective for both.

Preliminary Analysis

As a preliminary analysis, the CTBS Reading and Vocabulary subtest scores of the four control schools, both pre- and post-treatment, were compared using analyses of variance (ANOVA). As might be expected, these tests, followed by Scheffe's multiple comparisons, yielded one significant difference between the highest- and the lowest-performing school on the Reading subtest, $F(3, 1095) = 3.25, p < .05$, and on the

Vocabulary subtest, $F(3, 1093) = 3.80, p < .05$, and only at the pre-treatment level (see Table 3). No significant differences existed between any of the four control schools in the post-treatment years on the Reading subtest, $F(3, 1214) = 1.92, p > .05$, or on the Vocabulary subtest, $F(3, 1214) = 1.22, p > .05$.

Table 3
Analysis of Variance Summary for Comparison of the Control Schools

| Source | | Sum of squares | df | Mean square | F | p |
|-------------------------------|---------|----------------|-------|-------------|------|------|
| Pre-treatment Reading NPR | Between | 8,457.35 | 3 | 2,819.12 | 3.25 | .02* |
| | Within | 950,378.20 | 1,095 | 867.93 | | |
| | Total | 958,835.60 | 1,098 | | | |
| Pre-treatment Vocabulary NPR | Between | 9,473.59 | 3 | 3,157.86 | 3.80 | .01* |
| | Within | 907,820.80 | 1,093 | 830.58 | | |
| | Total | 917,294.40 | 1,096 | | | |
| Post-treatment Reading NPR | Between | 4,697.62 | 3 | 1,565.88 | 1.92 | .12 |
| | Within | 987,877.90 | 1,214 | 813.74 | | |
| | Total | 992,575.50 | 1,217 | | | |
| Post-treatment Vocabulary NPR | Between | 2,696.65 | 3 | 898.88 | 1.22 | .30 |
| | Within | 891,915.90 | 1,214 | 734.69 | | |
| | Total | 894,612.50 | 1,217 | | | |

Note. NPR = national percentile rank.

* $p < .05$.

As well, Levene's test for equality of variances, the standard test of this measure available through the SPSS computer program, indicated equal variances between the four control schools in both the pre-treatment years, $F(3, 1095) = 2.75, p > .01$, and the post-treatment years, $F(3, 1214) = 0.78, p > .01$. An alpha level of .01 was used as recommended by Milliken and Johnson (1992, pp. 22-23). Because the results indicated no significant differences in variance and no apparent outliers, the four control schools were combined to form one control group in order to compare its CTBS results to those

of the one treatment group. In the analysis that follows, however, the results of the four control schools are presented both separately and combined. It was considered useful to present the scores of each control school in order to provide evidence that the combined score was not a result of an individual control school's score that varied greatly from the other three control schools' scores.

Main Analysis

For the present study's main analysis, a descriptive comparison of the treatment and control groups' means, standard deviations, and mean difference scores will be presented. As well, a statistical comparison of the two groups will be provided through a summary of independent samples t-test results. Finally, effect sizes (Cohen's d) will be reported for the treatment and control groups' mean difference scores from the pre-treatment years to the post-treatment years.

Descriptive Comparison of the Treatment and Control Groups

Mean scores and standard deviations of the Reading and Vocabulary subtests for all students for the pre-treatment and post-treatment years will be summarized. Mean scores and standard deviations of Aboriginal students, however, will not be reported in this study or presented in the tables or figures due to confidentiality agreements between the researcher and the five band councils involved. Instead, mean difference scores from pre- to post-treatment for Aboriginal and non-Aboriginal students will be reported.

All students - Reading. The numbers of subjects, mean national percentile ranks, and standard deviations for the Reading subtest are presented in Table 4. Results are shown for the one treatment school and for the four control schools, both individually and combined. The treatment school was the only group to exhibit a national percentile rank

gain from pre- to post-treatment (+6.21). All four control schools exhibited a decrease in national percentile rank, ranging from -2.17 to -6.23, and with a weighted mean decrease of -5.05. For greater clarity, graphic representation of these results is provided in Figure 1.

1. As is indicated, the treatment group went from considerably below the control group in the pre-treatment years to above the control group in the post-treatment years.

Table 4
CTBS Reading Subtest Data

| School | Pre-treatment | | | Post-treatment | | | NPR mean difference (post-pre) |
|-------------------|---------------|----------|-------|----------------|----------|-------|--------------------------------|
| | n | NPR mean | SD | n | NPR mean | SD | |
| Treatment | 91 | 35.46 | 24.72 | 140 | 41.67 | 31.02 | +6.21 |
| Control 1 | 167 | 43.57 | 31.61 | 328 | 39.89 | 28.35 | -3.68 |
| Control 2 | 275 | 48.07 | 27.96 | 188 | 41.84 | 27.43 | -6.23 |
| Control 3 | 197 | 40.20 | 29.08 | 274 | 38.03 | 28.20 | -2.17 |
| Control 4 | 460 | 42.37 | 29.69 | 428 | 36.39 | 29.33 | -5.98 |
| Combined controls | 1,099 | 43.59 | 29.55 | 1,218 | 38.54 | 28.56 | -5.05 |

Note. NPR = national percentile rank.

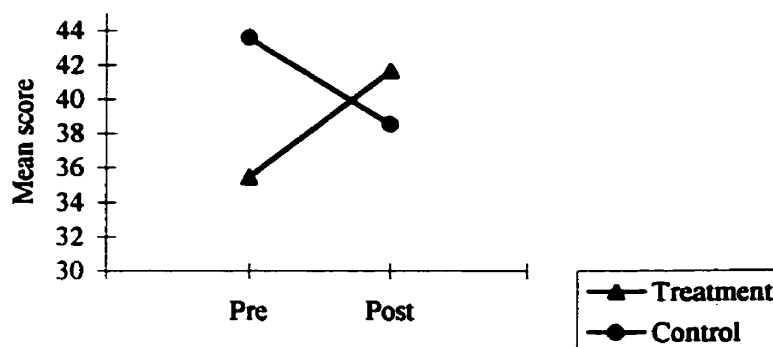


Figure 1. CTBS Reading subtest national percentile rank means of the treatment and control groups before and after treatment.

All students - Vocabulary. The numbers of subjects, mean national percentile ranks, and standard deviations for the Vocabulary subtest are presented in Table 5. The treatment school and the four control schools all exhibited a decrease in national percentile rank from the pre-treatment to the post-treatment years. However, the treatment school exhibited the smallest decrease (-2.17), while the four control schools' decreases ranged from -2.70 to -8.39, with a weighted mean decrease of -5.99. This decrease is also evident in Figure 2. However, it is apparent that the treatment school went from slightly below the control group in the pre-treatment years to slightly above the control group in the post-treatment years.

Table 5
CTBS Vocabulary Subtest Data

| School | Pre-treatment | | | Post-treatment | | | NPR mean difference (post-pre) |
|-------------------|---------------|----------|-------|----------------|----------|-------|--------------------------------|
| | n | NPR mean | SD | n | NPR mean | SD | |
| Treatment | 91 | 42.01 | 26.38 | 140 | 39.84 | 28.90 | -2.17 |
| Control 1 | 166 | 47.51 | 29.99 | 327 | 39.12 | 25.34 | -8.39 |
| Control 2 | 275 | 48.13 | 27.43 | 188 | 41.61 | 27.44 | -6.52 |
| Control 3 | 197 | 40.29 | 28.66 | 274 | 37.59 | 27.01 | -2.70 |
| Control 4 | 459 | 43.14 | 29.26 | 429 | 37.39 | 28.29 | -5.75 |
| Combined controls | 1,097 | 44.54 | 28.93 | 1,218 | 38.55 | 27.11 | -5.99 |

Note. NPR = national percentile rank.

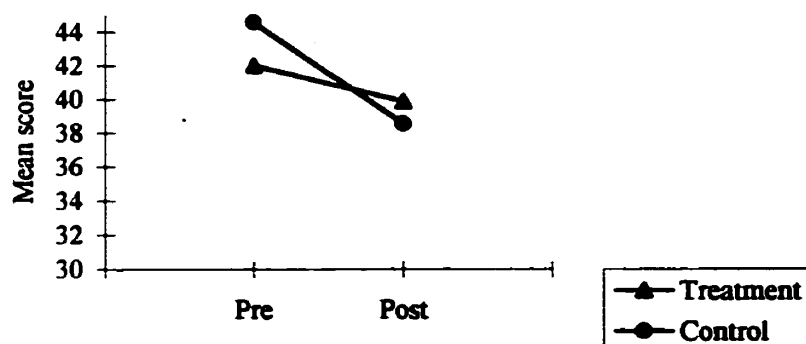


Figure 2. CTBS Vocabulary subtest national percentile rank means of the treatment and control groups before and after treatment.

Aboriginal students - Reading. The numbers of Aboriginal students and their mean difference scores on the Reading subtest from pre- to post-treatment are presented in Table 6. The largest gain in national percentile rank from the pre-treatment to post-treatment years was exhibited by the treatment school (+8.89). Two of the control schools also exhibited gains (+1.02 and +4.10), and the remaining two control schools exhibited decreases. The four control schools' weighted mean difference was -3.74. As is also indicated in Figure 3, the treatment group went from considerably below the control group in the pre-treatment years to above the control group in the post-treatment years.

Table 6
CTBS Reading Subtest Difference Scores of Aboriginal (AB) and Non-Aboriginal (Non-AB) Students

| School | Pre-treatment (n) | | Post-treatment (n) | | NPR mean difference (post - pre) | |
|-------------------|-------------------|--------|--------------------|--------|----------------------------------|--------|
| | AB | Non-AB | AB | Non-AB | AB | Non-AB |
| Treatment | 17 | 74 | 38 | 102 | +8.89 | +7.77 |
| Control 1 | 40 | 127 | 72 | 256 | +4.10 | -6.50 |
| Control 2 | 31 | 244 | 23 | 165 | -20.26 | -4.24 |
| Control 3 | 38 | 159 | 62 | 212 | -6.55 | -0.35 |
| Control 4 | 57 | 403 | 81 | 347 | +1.02 | -5.64 |
| Combined controls | 166 | 933 | 238 | 980 | -3.74 | -4.38 |

Note. NPR = national percentile rank.

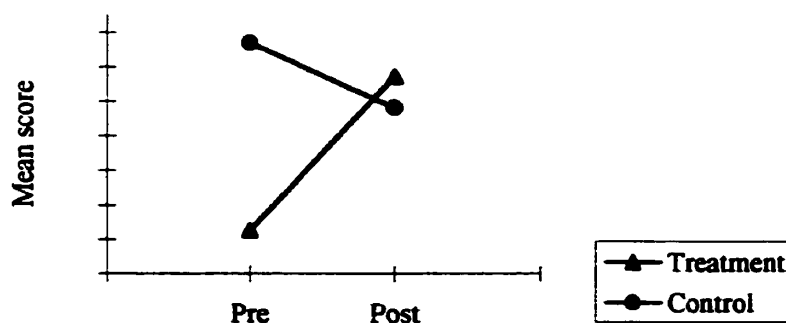


Figure 3. CTBS Reading subtest national percentile rank means of Aboriginal students in the treatment and control groups before and after treatment.

Non-Aboriginal students - Reading. The numbers of non-Aboriginal students and their mean difference scores on the Reading subtest from pre- to post-treatment are also presented in Table 6. The treatment school was the only group to exhibit a national percentile rank gain from pre- to post-treatment (+7.77). All four control schools exhibited a decrease in national percentile rank, ranging from -0.35 to -6.50, and with a weighted mean decrease of -4.38. As is also indicated in Figure 4, the treatment group

went from considerably below the control group in the pre-treatment years to above the control group in the post-treatment years.

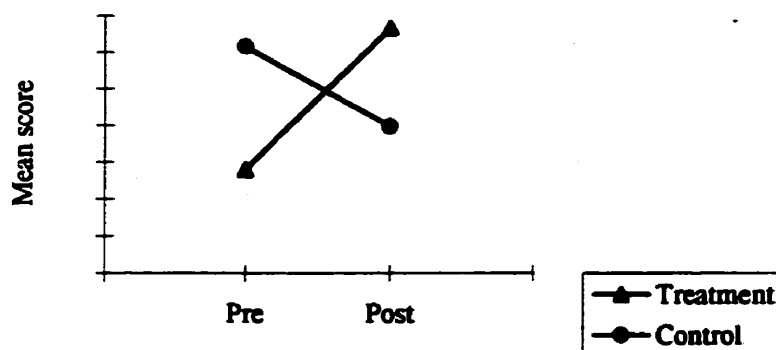


Figure 4. CTBS Reading subtest national percentile rank means of non-Aboriginal students in the treatment and control groups before and after treatment.

Mean difference scores of Aboriginal students (+8.89) and non-Aboriginal students (+7.77) on the Reading subtest were similar in the treatment school (see Table 6). As well, mean difference scores of Aboriginal students (-3.74) and non-Aboriginal students (-4.38) on the Reading subtest were similar in the control schools. As is indicated in Figure 5, both Aboriginal and non-Aboriginal groups in the treatment school exhibited similar substantial gains from pre- to post-treatment in comparison to Aboriginal and non-Aboriginal groups' performances in the control schools.

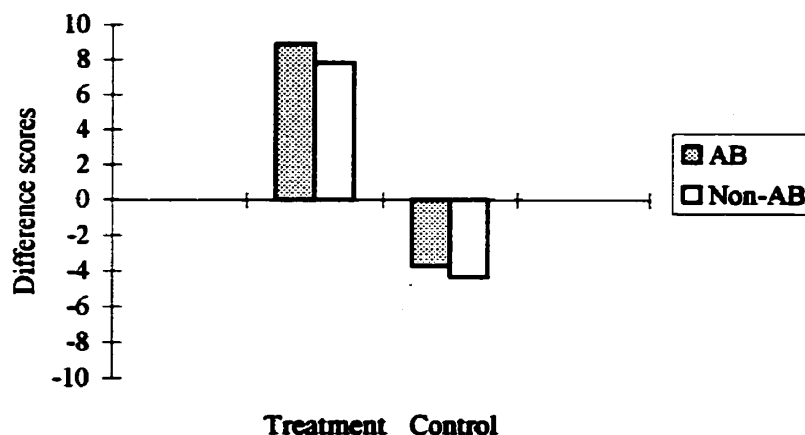


Figure 5. CTBS Reading subtest mean difference scores of Aboriginal (AB) and non-Aboriginal (Non-AB) students in the treatment and control groups.

Aboriginal students - Vocabulary. The numbers of Aboriginal students and their mean difference scores on the Vocabulary subtest from pre- to post-treatment are presented in Table 7. The treatment school and the four control schools all exhibited a decrease in national percentile rank from the pre-treatment to the post-treatment years. The treatment school exhibited the second-smallest decrease (-1.84), while the four control schools' decreases ranged from -1.46 to -13.07, with a weighted mean decrease of -4.92. This decrease is also evident in Figure 6.

Table 7
CTBS Vocabulary Subtest Difference Scores of Aboriginal (AB) and Non-Aboriginal (Non-AB) Students

| School | Pre-treatment (n) | | Post-treatment (n) | | NPR mean difference (post - pre) | |
|-------------------|-------------------|--------|--------------------|--------|----------------------------------|--------|
| | AB | Non-AB | AB | Non-AB | AB | Non-AB |
| Treatment | 17 | 74 | 38 | 102 | -1.84 | +0.49 |
| Control 1 | 39 | 127 | 72 | 255 | -1.46 | -10.77 |
| Control 2 | 31 | 244 | 23 | 165 | -13.07 | -5.50 |
| Control 3 | 38 | 159 | 62 | 212 | -4.56 | -1.59 |
| Control 4 | 58 | 401 | 81 | 348 | -3.94 | -4.49 |
| Combined controls | 166 | 931 | 238 | 980 | -4.92 | -5.29 |

Note. NPR = national percentile rank.

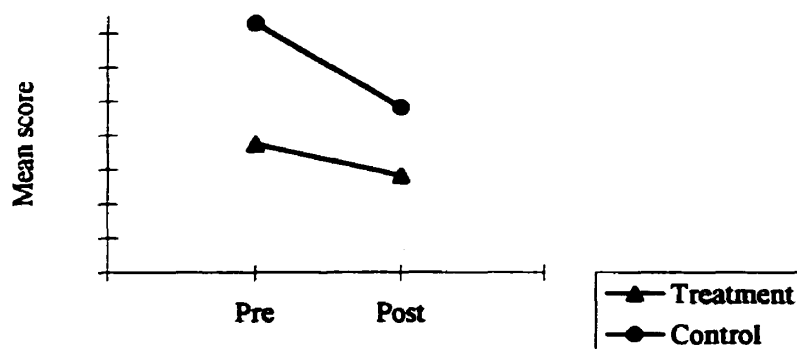


Figure 6. CTBS Vocabulary subtest national percentile rank means of Aboriginal students in the treatment and control groups before and after treatment.

Non-Aboriginal students - Vocabulary. The numbers of non-Aboriginal students and their mean difference scores on the Vocabulary subtest from pre- to post-treatment are also presented in Table 7. The treatment school was the only group to exhibit a national percentile rank gain from pre- to post-treatment, although this gain is

approximately zero (+0.49). The four control schools' decreases ranged from -1.59 to -10.77, with a weighted mean decrease of -5.29. This decrease is also evident in Figure 7. However, it is apparent that the treatment school went from slightly below the control group in the pre-treatment years to above the control group in the post-treatment years.

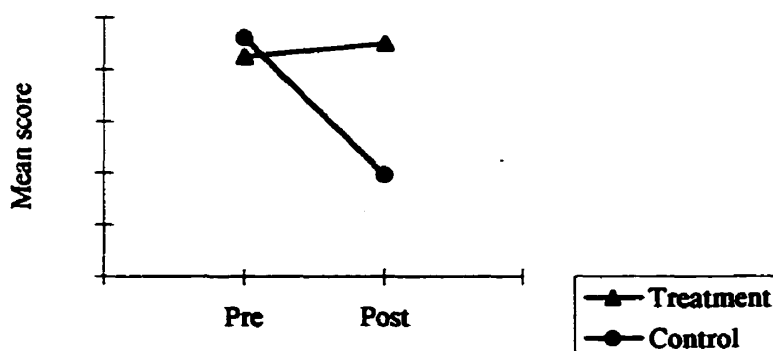


Figure 7. CTBS Vocabulary subtest national percentile rank means of non-Aboriginal students in the treatment and control groups before and after treatment.

Mean difference scores of Aboriginal students (-1.84) and non-Aboriginal students (+0.49) on the Vocabulary subtest were similar in the treatment school (see Table 7). As well, mean difference scores of Aboriginal students (-4.92) and non-Aboriginal students (-5.29) on the Vocabulary subtest were similar in the control schools. As is indicated in Figure 8, the treatment school's Aboriginal group exhibited a small decrease in its Vocabulary subtest mean scores, while the non-Aboriginal group exhibited a small increase, although these differences are approximately zero. Both Aboriginal and non-Aboriginal groups in the control schools exhibited a decrease in their Vocabulary subtest mean scores.

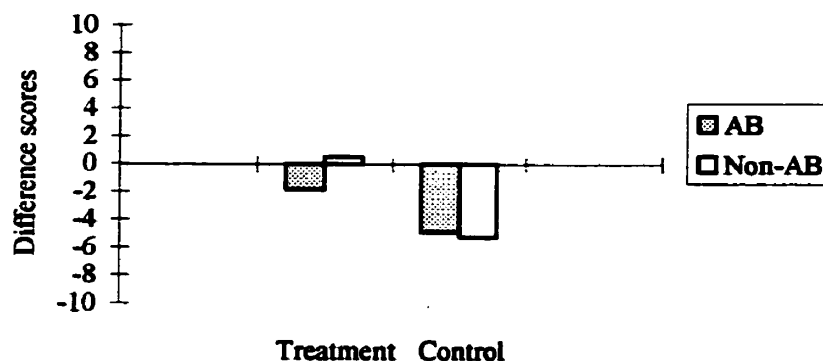


Figure 8. CTBS Vocabulary subtest mean difference scores of Aboriginal (AB) and non-Aboriginal (Non-AB) students in the treatment and control groups.

Statistical Comparison of the Treatment and Control Groups

Because the present study involves only two groups, the treatment group and the control group, statistical analysis was conducted using independent samples t-tests to compare the treatment and control groups' Reading and Vocabulary scores as two separate variables in the pre-treatment years and then again in the post-treatment years.⁴ In the cases where Levene's Test for equality of variances indicated that the homogeneity of variance assumption was not tenable ($p < .01$), the t-test for unequal variances was

⁴ Because there is a known correlation between the Reading and Vocabulary subtests of the CTBS (King-Shaw, 1990), scores of the treatment and control groups on these subtests as a combined variable were first compared using a multivariate analysis of variance (MANOVA). The results indicated a significant difference between the treatment and control groups in the pre-treatment years, $F(2, 1183) = 5.46, p < .01$, and no significant difference between the groups in the post-treatment years, $F(2, 1353) = 0.99, p > .01$. However, it was considered more useful and relevant for the present study to determine whether the treatment reading program had a similar effect on each of the Reading and Vocabulary subtest scores. Therefore, further statistical comparisons of the treatment and control groups were conducted using a univariate analysis of each separate subtest.

employed. The criterion for statistical significance was set at an alpha level of .05.

The t-test results indicate a significant difference between students in the treatment group and students in the control group on the Reading subtest in the pre-treatment years, $t(112.42) = 2.97, p < .01$. No significant difference exists between the treatment and control groups on the Reading subtest in the post-treatment years, $t(1356) = -1.22, p > .05$. As well, no significant difference exists between the treatment group and the control group on the Vocabulary subtest in the pre-treatment years, $t(1186) = 0.81, p > .05$, or in the post-treatment years, $t(1356) = -0.53, p > .05$.

Independent samples t-tests were also conducted to compare the CTBS Reading and Vocabulary subtest mean scores of both Aboriginal students and non-Aboriginal students in the treatment and control groups. When considering Aboriginal students, the t-test results indicate a significant difference between the treatment and the control groups on the Reading subtest in the pre-treatment years, $t(41.16) = 3.40, p < .01$. No significant difference exists between the groups on the Reading subtest in the post-treatment years, $t(274) = -0.42, p > .05$. As well, no significant difference exists between Aboriginal students in the treatment group and the control group on the Vocabulary subtest in the pre-treatment years, $t(181) = 1.15, p > .05$, or in the post-treatment years, $t(274) = 1.03, p > .05$.

When considering non-Aboriginal students, the t-test results indicate a significant difference between the treatment and the control groups on the Reading subtest in the pre-treatment years, $t(89.44) = 2.17, p < .05$. No significant difference exists between the groups on the Reading subtest in the post-treatment years, $t(1080) = -1.82, p > .05$. As well, no significant difference exists between non-Aboriginal students in the treatment

group and the control group on the Vocabulary subtest in the pre-treatment years, $t(1003) = 0.21, p > .05$, or in the post-treatment years, $t(1080) = -1.79, p > .05$.

Effect Size

Effect sizes (Cohen's d) were also calculated for the mean difference scores of the treatment and control groups between the pre- and post-treatment years. Effect size was calculated as the control group's national percentile rank difference score minus the treatment group's national percentile rank difference score divided by the weighted average of the control group's pre-treatment and post-treatment standard deviations. According to Adams and Engelmann (1996), "For educational purposes, an intervention that changes the performance of students by 1/4th of a standard deviation (an effect size of 0.25) is educationally significant" (p. 35). Very few educational approaches, in their opinion, achieve this criterion. Adams and Engelmann go on to claim that an effect size of 0.50 is rare in educational research. According to Cohen (1992), when testing the difference between independent means, an effect size of 0.20 is defined as small, an effect size of 0.50 is defined as medium, and an effect size of 0.80 is defined as large.

An effect size of 0.39 was found when comparing the Reading subtest mean difference scores of all students in the treatment and control groups. This is interpreted as a small effect size according to Cohen (1992), and as educationally significant according to Adams and Engelmann (1996).

An effect size of 0.51 was found when comparing the Reading subtest mean difference scores of Aboriginal students in the treatment and control groups. This is interpreted as a medium effect size according to Cohen (1992), and as rare in educational research according to Adams and Engelmann (1996).

An effect size of 0.42 was found when comparing the Reading subtest mean difference scores of non-Aboriginal students in the treatment and control groups. This is interpreted as a small effect size according to Cohen (1992), and as educationally significant according to Adams and Engelmann (1996).

Less than small effect sizes were found when comparing the Vocabulary subtest mean difference scores of all students in the treatment and control groups (0.14), and Aboriginal students in the treatment and control groups (0.13). A small effect size of 0.21 was found when comparing the Vocabulary subtest mean difference scores of non-Aboriginal students in the treatment and control groups.

Summary

As the data presented in this chapter indicate, the treatment school has made significant and important gains in its students' Reading subtest scores since implementation of the treatment reading program. This was also the case for both Aboriginal and non-Aboriginal students. The treatment school has made no significant gains, however, in its students' Vocabulary subtest scores. This was also the case for both Aboriginal and non-Aboriginal students. The four control schools have made no significant gains in their students' Reading or Vocabulary subtest scores since the pre-treatment years. In fact, in most cases, the control schools have exhibited decreases in their students' mean national percentile ranks. These results and their implications will be discussed in greater detail in the next chapter.

DISCUSSION

This final chapter summarizes the rationale, methodology, and results of the present study. An interpretation of the study's findings will be provided, as well as a comparison of its results with those of other related research previously discussed in the review of the literature. The limitations of the present study will be described and, lastly, implications regarding its relevance for practitioners and recommendations for future, related research will be discussed.

Summary of the Study

The present study involves the evaluation of a reading program which was implemented in a pilot school in School District No. 56 in 1994. Initial implementation was made as a response to the general and growing concern regarding the reading ability of students throughout the school district.

The treatment reading program combines the teaching strategies of Precision Teaching and fluency-building with Reading Mastery and its emphasis on Direct Instruction. Relevant research concerning Precision Teaching, fluency, and Direct Instruction was discussed and analyzed in the present study's review of the literature. Although available studies investigating the effects of Precision Teaching and fluency are scarce and often non-experimental in nature, the findings of those discussed appear to indicate that these teaching strategies are effective in the development of students' reading skills and general learning. Much research has been conducted on Direct Instruction as a teaching strategy although, again, several of the studies previously mentioned are non-experimental in nature. Results of the studies discussed, which included follow-up studies of Project Follow Through, studies involving special-education students, and two meta-

analyses, support the view of Direct Instruction as an effective teaching strategy.

To evaluate the effectiveness of the treatment reading program, the Canadian Tests of Basic Skills (CTBS) Reading and Vocabulary subtest national percentile ranks of students in the treatment school were compared to those of students in four combined control schools both in the pre- and the post-treatment years. In addition to an analysis involving all students, the scores of Aboriginal and non-Aboriginal students were analyzed separately to determine whether the two groups responded in a similar manner to the treatment reading program.

Results of the descriptive comparison of the treatment and control groups' mean national percentile rank difference scores between pre- and post-treatment indicated that students in the treatment school, including Aboriginal and non-Aboriginal students, exhibited substantial gains on the Reading subtest, whereas students in the control group, including Aboriginal and non-Aboriginal students, exhibited decreases. Students in the treatment group, including Aboriginal and non-Aboriginal students, exhibited differences of approximately zero on the Vocabulary subtest from pre- to post-treatment, whereas students in the control group, including Aboriginal and non-Aboriginal students, exhibited decreases. The mean difference scores between pre- and post-treatment for both the Reading and the Vocabulary subtests were similar for Aboriginal and non-Aboriginal students in the treatment group. This was also true for the control group.

Independent samples t-test results indicated a significant difference between the treatment and control groups on the Reading subtest in the pre-treatment years, but no significant difference between the groups in the post-treatment years. This was the case for both Aboriginal and non-Aboriginal students as well. No significant differences

existed between the treatment and control groups on the Vocabulary subtest in either the pre-treatment or in the post-treatment years. This was the case for both Aboriginal and non-Aboriginal students as well.

Last, effect sizes (Cohen's d) were calculated when comparing the Reading subtest mean difference scores of all students, Aboriginal students, and non-Aboriginal students in the treatment and control groups between the pre- and post-treatment years. No educationally significant effect sizes were found when comparing the two groups' Vocabulary subtest mean difference scores.

Interpretation of the Results

The results of the present study indicate a consistent trend in that the students in the treatment school, including Aboriginal and non-Aboriginal groups, demonstrated significant and important gains in their Canadian Tests of Basic Skills Reading subtest scores. Gains were not made, however, in students' Vocabulary subtest scores. This may be considered as somewhat of a discrepancy in light of the relatively high intercorrelation ($r = .80$) between the two subtests' scores of students involved in the study. It is also an unexpected finding that the Vocabulary subtest scores did not increase considering the emphasis which the treatment reading program places on vocabulary development. One may speculate, however, that if the reading program had not been implemented, the treatment school might have exhibited decreases in their Vocabulary subtest scores such as those exhibited by the control group. Even though significant gains were demonstrated in only one of the two subtests, however, it is reasonable to claim that the treatment reading program has indeed been successful in increasing students' reading abilities. After all, it may be argued that the Reading subtest is a more valid indication of students' reading

achievement because it evaluates both decoding and reading comprehension, whereas the Vocabulary subtest simply evaluates students' knowledge of a selected group of words.

For both the Reading and Vocabulary subtests and for all students, including Aboriginal and non-Aboriginal groups, the treatment group's scores went from below the control group's scores in the pre-treatment years to above the control group's scores in the post-treatment years. This occurred in every case except for one, where the treatment group's Aboriginal student scores on the Vocabulary subtest remained below those of the control group both in the pre- and the post-treatment years. The results of the independent samples t-tests consistently demonstrate this same trend. The significant difference existing between the treatment and control groups' Reading subtest scores in the pre-treatment years and the non-significant difference existing between the groups in the post-treatment years provide evidence that, although significantly behind the control group before the reading program's implementation, after implementation, the treatment school exhibited comparable reading achievement to that of the control schools. The educationally significant effect sizes (Cohen's *d*) which were calculated in every case for the Reading subtest further support this trend.

There also appears to be somewhat of a downward trend demonstrated by the control group in both its Reading and Vocabulary subtest scores since 1991. This slight downward trend serves to further emphasize the reading program's effectiveness in the treatment school, where consistent and substantial increases in Reading subtest scores were demonstrated. Also, because only the treatment group's scores increased and the control group's scores did not, it is reasonable to attribute this difference to the treatment reading program and not some other factor, such as district-wide programs or a difference

in overall student population over time due to socio-economic or community changes. Without implementation of the reading program in the treatment school, it may be speculated that similar decreases in student scores would have occurred. It is also worth noting that, in her research study involving high-school students in School District No. 56 (Nechako), Maksymchak (1998) documented a similar downward trend in Math and Physics achievement.

Last, it is also encouraging to note that the treatment reading program is equally effective for both Aboriginal and non-Aboriginal students. In fact, when comparing all the groups, the greatest national percentile rank gain was exhibited by the treatment school's Aboriginal students on the Reading subtest.

Two statistical hypotheses were examined in the present study. The null hypothesis is rejected in the first case, because the difference between the treatment and control groups' mean Reading subtest scores in the pre-treatment years and in the post-treatment years was not equal:

$$H_1 : \mu_{\text{pre}(r)(c-t)} \neq \mu_{\text{post}(r)(c-t)},$$

where $\mu_{\text{pre}(r)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Reading subtest scores (r) in the pre-treatment years, and $\mu_{\text{post}(r)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Reading subtest scores (r) in the post-treatment years.

The null hypothesis is accepted in the second case, because the difference between the treatment and control groups' mean Vocabulary subtest scores in the pre-treatment years and in the post-treatment years was equal:

$$H_0 : \mu_{\text{pre}(v)(c-t)} = \mu_{\text{post}(v)(c-t)},$$

where $\mu_{\text{pre}(v)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Vocabulary subtest scores (v) in the pre-treatment years, and $\mu_{\text{post}(v)(c-t)}$ is the difference between the control group's (c) and the treatment group's (t) mean CTBS Vocabulary subtest scores (v) in the post-treatment years.

Comparison of the Research

Comparisons can be made between the present study and the various studies previously discussed in this paper's review of the literature. One must be cautious in making such comparisons, however, considering that all but one of the studies discussed involve the evaluation of only Precision Teaching, fluency-building, or Direct Instruction alone. The only known study which does incorporate all three strategies involves Morningside Academy. Students here experience an average academic gain of 2.5 years per school-year. Similar gains were exhibited in the two pilot schools in School District No. 56 after 2 years of the reading program's implementation (Johnson & Layng, 1992). It is difficult to compare these findings to the present study, however, because different standardized tests were administered and grade equivalencies were reported as opposed to national percentile ranks.

Another study by Francis (1991) was similar to the present study in that it evaluated a reading program which incorporated both Reading Mastery and Direct Instruction. It did not, however, involve the strategies of Precision Teaching or fluency-building. Results indicated that students achieved significantly higher scores on both the Reading and Vocabulary subtests of the Gates MacGinitie Reading Tests after 1 year of the program. Again, a different standardized test was administered than in the present

study. It is also interesting to note that Francis' study resulted in Vocabulary subtest score increases, whereas the present study did not.

Every study which utilized national percentile ranks as part of its analysis reported substantially greater score increases than those exhibited by the present study's treatment school. Although intervention periods in these studies were similar to the intervention period of the present study, different testing measures were employed. National percentile rank increases included 20 points (Beck & Clement, 1991), 25 points (Stebbins, 1977), and 17 points (West et al., 1990). National percentile rank increases exhibited by the treatment school of the present study ranged from approximately 6 to 9 points. The treatment school's increases, however, may be underestimated considering the slight downward trend exhibited by the control group.

The two Project Follow Through follow-up studies that reported effect sizes as part of their analyses claimed results that replicated the present study's calculated effect sizes of 0.39, 0.42, and 0.51 for the Reading subtest. Becker and Gersten (1982) reported effect sizes which ranged from 0.38 to 0.56, and Meyer et al. (1983) reported an effect size of 0.38. It is interesting to note that the effect sizes reported in the two meta-analyses of Adams and Engelmann (1996) and White (1988), however, were far greater than these (0.87 and 0.84, respectively).

An additional study which replicated the findings of the present study was conducted by Dowdell (1996). The results of Dowdell's study determined that students who pre-tested significantly below a comparison group on the Iowa Tests of Basic Skills were able to match the group's post-test scores after implementation of a Direct Instruction program.

The numbers of students in the present study possessing low, average, or high academic abilities are unknown. Although students designated as EMH (Educably Mentally Handicapped) were not included in the study's analysis, many students possessing learning difficulties and/or learning disabilities were included. Because these students' scores were combined with those of students possessing average and above-average abilities, it is difficult to compare the present study's findings with those of the many studies which evaluated the effects of Precision Teaching, fluency-building, or Direct Instruction on the achievement of special-education students. Most of these studies report substantial and significant gains in the reading achievement of students with learning difficulties or disabilities as a result of implementing reading programs which emphasize Precision Teaching, fluency-building, or Direct Instruction strategies. Although studies which involve students of average ability all indicated similar increases in academic ability, it appears that in most cases, the greatest gains are reported in the studies which involve special-education students. This could simply be attributed to the fact that there are more studies available which involve students with learning difficulties. Another explanation, however, could be that the below-average students are farther behind their average-ability peers to begin with and therefore have greater gains to make. Perhaps, therefore, those students in the present study possessing below-average academic abilities exhibited the greatest national percentile rank gains. This, of course, is only speculation and cannot be determined without analyzing the scores of below-average students and average to above-average students as two separate groups.

In summary, the present study's results are similar to those of the studies discussed in this paper's review of the literature in that they all indicate gains in student achievement

as a result of employing the teaching strategies of Precision Teaching, fluency-building, or Direct Instruction. The present study is unique, however, in that the treatment reading program involves a combination of these teaching strategies, and also because students of all ability levels are involved. As well, no other studies were found which evaluated the effects of Precision Teaching, fluency-building, or Direct Instruction on the reading achievement of Aboriginal students.

Limitations of the Study

Schools and classrooms from which the data were collected for the present study were previously intact, and random assignment to treatment and control groups was impossible. Selection, therefore, is a threat to the study's internal validity. However, although the subjects in the treatment school were not selected randomly from the population, it is known that they are representative of the entire sample with respect to the variables of sex, age, and Aboriginal ancestry. Another limitation of the study's analysis is that it involves a between-groups comparison, as different groups of students were in attendance from the pre-treatment to the post-treatment years.

Because the four control schools involved in the present study have used various components of the treatment reading program, although only in the occasional situation and usually in an adapted format, it is erroneous to consider them as a pure control group. This is a threat to the study's internal validity and could result in a diffusion effect, where the control schools exhibit partial effects of the treatment reading program. One could speculate as to whether the true impact of the reading program in the treatment school was reduced as a result. Perhaps the control schools would have exhibited greater score decreases between pre- and post-treatment with no exposure to the treatment reading

program's components.

The use of national percentile ranks as opposed to raw scores in the present study's analysis could also have influenced its results. Percentile ranks are a less-reliable measure of achievement than are raw scores (May & Nicewander, 1994), and the chances of a Type II error occurring (failure to reject the null hypothesis when it is false) are therefore increased. One could again speculate as to whether the use of raw scores in the present study's analysis, if indeed possible, would have resulted in greater increases between the treatment school's pre- and post-treatment scores although, of course, this would be equally true for the control group as well.

Another limitation of the present study concerns the influence of extraneous variables which may be considered as "rival plausible explanations" to the research outcomes. For example, teacher styles, student-teacher ratio, homogeneous vs. heterogeneous grouping, numbers of special-needs students, and attendance of students may all be influential factors. Some of these factors, however, such as teacher styles (for example, use of Direct Instruction), student-teacher ratio, and homogeneous vs. heterogeneous grouping, are a part of the treatment school's program design. It is uncertain whether one of these program components or a combination of them are responsible for the study's results. However, it remains beyond the scope of this study to determine whether individual components of the treatment reading program are more or less critical or responsible for its outcome. One may also argue that the vocabulary or content taught in subjects other than Language Arts could influence test performance. However, the probability of this occurring may be assumed to be relatively equal for both the treatment and the control groups.

The external validity of the present study includes its replicability. Replicability of the treatment reading program in other schools is dependent upon a number of factors. Adequate funding is necessary for inservice and training of teachers in the teaching strategies involved. Administrators and staff-members must be willing and committed to teaching an alternative reading program and to putting in the necessary time and effort to do so. It is important that the staff is cohesive and shares similar goals towards adopting the program and all of its components. If these criteria are not met, successful implementation of the reading program may not be possible, and increases in students' reading achievement such as those exhibited by the treatment school may not be experienced.

A final limitation of the study which must be acknowledged concerns experimenter bias. The researcher's involvement in teaching the reading program in the treatment school since its implementation has resulted in strong, positive opinions regarding its effectiveness. The results of the study, however, should remain unaffected by this bias, assuming that the standardized testing was administered in a nearly-identical manner by all teachers involved, and because scoring of the test was conducted by an independent agency.

Implications for Practice

The results of the present study indicate that a reading program which combines the teaching strategies of Precision Teaching and fluency-building with Reading Mastery and its emphasis on Direct Instruction is effective in increasing the reading achievement of elementary school students. This is an important and relevant finding, especially because children's reading ability appears to be a current issue of concern for educators and non-

educators alike, both in central British Columbia and beyond. In School District No. 91 this concern may be legitimate, considering that the national percentile rank means of students in both the treatment and the control groups of the present study were consistently below the 50th percentile national norm, even in the post-treatment years.

In a relevant study by Mothus (1997), the term "cumulative deficit" is used to describe how students with learning difficulties fall behind their peers a little more each school year and never seem to be able to catch up. As a result, by the time these students reach high-school, they tend to experience high absenteeism and eventually resort to dropping out of school. A solution lies in teaching them more in less time in order to end this debilitating cycle. As well, it is crucial to deal with this cumulative deficit well before the student enters high-school, because the gap between the learning-disabled student and his or her peers is smallest in the lower grades. Therefore, Mothus states the need for prevention as opposed to remediation. Her data also indicate a disheartening trend, that the reading ability of the elementary students evaluated for her study appears to be decreasing. Mothus assumes that this downward trend not only exists with these students but is a district-wide problem. She is referring to School District No. 57 (Prince George), the district next in location to School District No. 91, both of which, it is probably correct to assume, enroll students of similar experience and ability. Mothus suggests a solution, that "Different and better instruction is required, especially since the problem of reading disability appears to be increasing" (p. 114). It is believed from the experience of those involved in the treatment school that one such example of "different and better instruction" has been discovered, and one which addresses the problem of cumulative deficit by providing students with the opportunity to learn at an accelerated rate.

The treatment reading program has been proven effective with all students, and not only those possessing learning difficulties or disabilities. It is also equally beneficial for both Aboriginal and non-Aboriginal students. This finding is especially notable considering the Ministry of Education's (1999) recent report on Aboriginal education results in British Columbia. The purpose of the report is "to improve understanding of the performance of the school system in educating Aboriginal students" (Ministry of Education, p. 1). Two of the eight recommendations made by the Ministry of Education as a result of this report are "Use the school accreditation process to carefully monitor the academic and social progress of Aboriginal students, individually and collectively"; and "Find what works in helping Aboriginal students learn, and share the results" (p. 22).

The findings of the present study are also relevant given the fact that the treatment reading program can be implemented in any school of any size. It has been experienced by staff-members at the treatment school, however, that successful implementation requires two essential ingredients. Firstly, it is necessary to provide extensive training and inservice in the teaching strategies involved. Secondly, a school must have a dedicated and cohesive staff that has similar goals and that is committed to adopting the program's methodology. Schools that are able to meet these criteria may, as a result, experience increases in students' reading achievement similar to those exhibited by the present study's treatment.

Implications For Future Research

There are a number of additional topics which are conducive to further and future investigation and which are unfortunately beyond the scope of the present study. One such issue regards the relationship between student achievement and the number of years

in the treatment reading program. Do students demonstrate greater progress with each subsequent year of being in the program? Do they demonstrate equal gains at all ages? Becker's (1978) longitudinal follow-up study of Project Follow Through indicated that it is academically beneficial to begin Direct Instruction at lower grades and, preferably, in Kindergarten. Adams and Engelmann's (1996) meta-analysis, however, resulted in similar educationally significant effect sizes for studies involving interventions of less than 1 year and those involving interventions of more than 1 year. Additional studies of this nature would allow educators to determine whether there is an optimum age when first exposure to the program is most beneficial and whether there is an optimum number of years that the program should be taught.

Gersten et al. (1986) have examined another interesting issue of whether certain essential components of Direct Instruction exist which are necessary for producing the most student progress, while other program components are less crucial. Some program components of Direct Instruction, for example, include teacher scripts, unison responding, mastery learning, task analysis, homogeneous grouping, corrective procedures, and reinforcement strategies. Results of Gersten et al.'s research indicated that the teacher performance variables most strongly related to students' academic growth included frequent feedback and correction procedures, maintaining a brisk pace throughout the lessons, and ensuring student success rates of at least 80% for unison group responses. Additional studies which further compare these individual components and their effects on student achievement could prove informative.

Many studies have been discussed which demonstrate the benefits of Precision Teaching, fluency-building, and Direct Instruction in teaching both special-education

students as well as students of average ability. It would be interesting to further compare the treatment reading program's effectiveness with low-ability students vs. students with average and/or above-average abilities. More research, as well, is necessary in determining the effects of Precision Teaching and Direct Instruction on higher-order thinking skills and problem-solving, since few such current studies are available. Such studies which have been discussed, however, claim similar findings of increased higher-level thinking skills as a result of teaching with these strategies (Johnson & Layng, 1996; White, 1988).

Previously-discussed studies have indicated that teaching with Precision Teaching, fluency-building, and Direct Instruction strategies results in higher measures of students' self-esteem (Beck & Clement, 1991; Stebbins, 1977), and higher levels of on-task behavior and lower levels of disruptive behavior (Miller et al., 1995). Although teachers in the treatment school have experienced similar results first-hand, further investigation concerning the reading program's effects on students' self-esteem and/or behavior would make relevant research topics.

The issue of parents', teachers', and students' attitudes toward the treatment reading program and its components would be another interesting topic of examination. Related to this are the results of two previously-discussed studies which indicated that students were highly-motivated and developed positive attitudes as a result of increased reading scores (Kessissoglou & Farrell, 1995; Mordecai, 1977). Although generally supportive and positive opinions have been expressed by those involved in our school's reading program, a more valid and reliable investigation could prove worthwhile.

Almost all of the related research which has been conducted investigates either Precision Teaching, fluency-building, or Direct Instruction alone. Therefore, more studies like the present one are needed to examine the combined effects of these teaching strategies. It would be informative to continue the present study's analysis with the Canadian Tests of Basic Skills data from the years beyond 1997. As well, a valid indication of the treatment reading program's long-term effectiveness could be determined through a longitudinal analysis of the present study's subjects in their high-school years and beyond.

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Appendix A**Opinions of Teachers in the Treatment School**

Opinions of Teachers in the Treatment School

As part of the present study, it may be interesting to relay the opinions of teachers who have been involved in teaching the reading program in the treatment school.⁵ The treatment reading program has been accused by some in the educational community of being rigid, artificial, authoritarian, and reductionistic. Such critics may claim that it stifles teacher and student creativity, promotes passive learning, is inconsiderate of individual differences, and ignores higher-order thinking skills. Although the program is structured, sequenced, and scripted, the teachers do not sense a loss of creativity or the need to be denied their individual teaching styles. Direct Instruction demands continuous monitoring and evaluation of student progress, and constant decision-making is necessary to determine whether concepts need re-teaching and whether additional practice is necessary. The teachers agree with Sprick (1992) who stated, "Anyone who gets bored teaching Direct Instruction is not focusing on the right things--stay focused on the needs of the students because this provides endless diversity" (p. 12). Teacher creativity and flexibility, therefore, are necessary and important in ensuring that lessons are taught as effectively as possible.

Another criticism of Direct Instruction is that it ignores the development of higher-order thinking skills in students. The teachers have discovered, however, that students who are fluent at basic skills are better able to modify and adapt their knowledge in more

⁵ All sections of this paper referring to informal observations regarding the reading program and its effects were made available to staff-members involved in its implementation at the treatment school. They agreed that these statements are accurate representations of their opinions.

complex and real-world situations, and they try to provide many opportunities for students to be challenged with creative and higher-order skills throughout the remainder of the school day.

The teachers would also argue that Direct Instruction, with its underlying philosophy that all children can learn and its creed that "if the student has not learned, the teacher has not taught" (Adams & Engelmann, 1996, p. ix), is an extremely humanistic and child-centered teaching approach. Proper student placement is a major priority so that they receive the best possible instruction at their level, data is collected and analyzed daily for each student, and students are involved in their own learning through Precision Teaching strategies. Students are hardly passive, but respond and interact frequently and in varied ways during each lesson. As well, the teachers all work hard to provide warm, cooperative, positive, student-centered classrooms.

Another highly-debatable issue concerns the use of homogeneous grouping during reading instruction. Many within the educational community argue that same-ability grouping is detrimental to the self-concepts of older students with weaker abilities who are placed with younger students. From the teachers' experience, they believe the reverse to be true. Prior to the program's implementation, when reading was taught to same-aged students of mixed abilities, students were always well-aware of who their weaker peers were, regardless of the program used. This common knowledge can have negative and lasting effects on students' self-esteem. With homogeneous grouping, however, these students are successful, and the teachers have all experienced the positive effect which success has on students' self-images. It also needs to be noted that students spend a considerable proportion of each day with their same-aged peers in other subject areas. As

well, the homogeneous groups, in general, do not span more than three years difference in age due to students' differing emotional and physical characteristics at these ages.

One could also argue that Precision Teaching and fluency-building strategies do much to promote the development of self-esteem in students. Much has already been said about the rewards of students monitoring their own academic development. As well, building fluency in small steps provides frequent reinforcement and assurance regarding their progress. It has been the teachers' experience that when students are fluent readers and writers, they are generally able to complete tests and assignments quickly and accurately, and when students experience success in school and have earned that success through hard work, they often also experience positive feelings about themselves and school as a result.

The teachers have also noticed that their students appear to possess better work habits and improved cooperative learning skills (students do daily fluency and peer-coaching exercises with assigned partners). As well, most students enjoy the reading program and are motivated, positive learners. The behaviour of many students who previously displayed resistant or apathetic attitudes has improved. Some attribute this to the predictable and structured methods which provide necessary security and stability for many students, and to the frequent reinforcement contingencies which contribute to a more motivating and positive atmosphere.

As well, the staff at the treatment school has become more cohesive as a result of working toward a common goal. As teachers, their instructional skills, data collection techniques, and evaluation strategies have improved. With each subsequent year since first beginning the program, the teachers have noticed less time and energy spent in

•

review, since students appear to be retaining previous learning. As well, each year fewer students are on modified programs and more students are working at or above grade level. Students no longer "fall through the cracks", for everyone is placed in the most appropriate learning environment possible.

Another important result of implementing the reading program in the treatment school is the support and positive feedback received by the vast majority of students' parents. They are pleased because their children, in general, are happy and experiencing success in school. Such positive opinions were evident as a result of the treatment school's 1995 accreditation, a mandatory program which all public schools in British Columbia undergo every six years. The purpose of the accreditation process is to provide schools with the opportunity to examine and identify their strengths and weaknesses and to develop long-term School Growth Plans which consist of goals aimed at maintaining their strengths and at improving their weaknesses. This is achieved through a lengthy and rigorous process of collecting and assessing data and evidence which is eventually reviewed by a visiting External Committee (Ministry of Education, 1997).

As part of the treatment school's accreditation process, surveys were distributed to students and parents to determine their opinions and attitudes toward various aspects of the school. Questions relating to reading and the reading program were included in the surveys, especially since the reading program had only been in effect for one school-year at the time of the accreditation. Ninety percent of primary students responded with a "Yes" to the survey statement, "I am learning to read". Ninety-one percent of intermediate students agreed or strongly agreed to the statement, "The school does a good job teaching me to read". Of the 50 parents who responded to the question, "How would

you rate the way students at your school are learning the basics of reading and writing?", 68% answered "Good" and 18% answered "Excellent".

As a result of these positive opinions and due to teachers' perceptions of improved reading achievement, one of the school's stated strengths in the accreditation's final Internal Report was: "The school offers a coordinated language arts program which allows students to demonstrate success in the acquisition of basic skills in literacy and expression". The External Committee, as well, agreed with this stated strength after their week-long examination and review of the school.

Many of the teachers' opinions of the reading program, however, were not always so positive. It is probably fair to state that the first year of the program was difficult for all who were involved. The instructional methodology was quite unlike that which had been used in previous years and many of the teachers had received teacher-training based on wholistic and cognitive-developmental philosophies. Some teachers, therefore, began the pilot project with negative and pessimistic attitudes regarding its outcome. Not only did the program's behavioural emphasis contradict their educational belief systems, but incorporating the program was hard work. Almost all of the teachers received training sessions in the summer of 1994 in order to learn Precision Teaching charting strategies, fluency-building strategies, Direct Instruction methodology, and to become acquainted with the Reading Mastery curricular materials. For the first two months of the program's first year, staff meetings were held almost on a daily basis, usually unplanned and spontaneous in nature, to discuss and compare discoveries, agonize over frustrations, and celebrate student progress.

It was not until the end of the program's first year and when the second year's implementation began that perceptions started to shift. The teachers had gradually become fluent at using Precision Teaching and Direct Instruction strategies and, as a result, were able to incorporate more of their individual and creative teacher styles into their instruction. The philosophy and theory underlying the program became more clear and reasonable as they grew familiar with its components. Most influential in changing their attitudes, however, was observing student progress. From the teachers' experience and informal comparisons of student performance, they all agreed that the program was effective.

It is interesting to note that the teachers' experience with the program's initial implementation replicates findings of two earlier studies. In a study conducted by Gersten, Carnine, Zoref, and Cronin (1986), teachers from seven schools and in the first year of implementing a Direct Instruction program experienced feelings of misunderstanding, philosophical conflict, and even anger at having the program imposed upon them. Some described it as an extremely difficult and painful time due to the overwhelming changes in instructional strategies which they felt forced to make. It was not until the second year of teaching the program, mainly due to seeing student improvement, that these teachers began to alter their opinions and experience positive attitudes towards the implementation.

In a second study, Engelmann, Becker et al. (1988) conducted interviews over a two year period and found that, initially, teachers commonly experienced negative reactions to the structure and regimentation of using Direct Instruction methods, but that their attitudes changed considerably and for the better after several months of day-to-day

observation of student progress and the program's effectiveness. It can probably be expected, therefore, that educators who are not familiar with Precision Teaching and Direct Instruction will experience negative reactions when first reading about it or observing it in action. Teachers generally become strong advocates of the program only after using it for an extended period of time and after experiencing its effectiveness through student performance and progress.

Now that teachers at the treatment school have been using Precision Teaching and Direct Instruction strategies for five years, they are comfortable in adjusting components of the program to better suit their and their students' needs. They believe that it is important, however, to always maintain the integrity of the program's underlying theoretical philosophy when making any adjustment because it is based on years of proven, empirical, classroom-tested research. Another recent development at the school is the addition of supplemental activities and materials to promote students' critical thinking and problem-solving skills. The teachers believe that this step is progressive and developmental in nature and has become necessary because many of their students are now fluent at the essential skills which are prerequisite to more complex and higher-order learning.

At the treatment school, teachers have not become stagnant in their instructional methods, but rather attempt to evaluate the programs' effectiveness on a regular basis in order to adjust and supplement them accordingly. It is not their intention, therefore, to use Direct Instruction forever with all students. The teachers have found that the program's sequence and structure is necessary for teaching basic skills and new concepts, for review of these skills and concepts, and in instructing those students who are behind

their peers in academic performance. Once the students are fluent at the basic skills and have a firm foundation of knowledge and strategies necessary to achieve success at more complex tasks, they are then ready to move beyond Direct Instruction and towards more wholistic instruction that maintains a high level of interactivity, active participation, and higher-order thinking skills. The teachers would agree with the statement of Morningside Academy's founder and director: "It eventually becomes necessary for students to progress from having to say something, to having something to say" (K. Johnson, personal communication, April 16, 1998). It is, after all, their goal as educators to provide opportunities for students to become competent, problem-solving, self-directed, positive, and responsible future members of society.

Appendix B
Elementary Teacher Questionnaire

December 8, 1997

ELEMENTARY TEACHER QUESTIONNAIRE

Dear Elementary Teachers:

I am a teacher at Fort Fraser Elementary School and I am working on my Master's thesis through the University of Northern British Columbia. My research study involves examining the effects of an experimental reading program on students' reading abilities as measured by the Canadian Tests of Basic Skills. The experimental reading program was implemented in our school in 1994. I will be comparing the test scores of students in Fort Fraser Elementary School with the test scores of students in four other elementary schools in what used to be School District No. 56 (Nechako).

As part of my thesis, I will be describing the various reading programs and strategies used over the past ten years or so throughout our district. As well, I am interested in seeing whether there has been any kind of general change or shift in use of reading programs or strategies since the late 80s. This is where I need your help! I would greatly appreciate your filling out the anonymous questionnaire attached and returning it to me at Fort Fraser Elementary via the School District courier pouch or by faxing it to me at 690-7338 by December 19th. If you need more room to provide your answers, please attach additional pages.

Thank you very much for your assistance at this busy time of year! Please feel free to contact me with any questions or comments you may have regarding this questionnaire and/or my research study.

Sincerely,

Tammi Rothenbusch

ELEMENTARY TEACHER QUESTIONNAIRE
(PLEASE RETURN TO FORT FRASER ELEMENTARY SCHOOL)

I. GENERAL QUESTIONS

1. How many years have you taught in School District #91 (or #56)? _____
2. Which grade/s have you taught? _____
3. Please list all the schools within the original School District #56 in which you have taught: _____

II. READING PROGRAMS

With what types of reading programs have you taught? Please check all that apply. As well, please indicate (to the best of your memory!) the years during which you taught the program/s:

Basal reading series

Please indicate which series:

| | | |
|---------------|-----------------|--------------------|
| Years taught: | _____ pre-1990 | _____ 1990-1992 |
| | _____ 1993-1995 | _____ 1996-present |

Literature-based reading series

Please indicate which series:

| | | |
|---------------|-----------|--------------|
| Years taught: | pre-1990 | 1990-1992 |
| | 1993-1995 | 1996-present |

Phonics-based program

Please indicate which program:

| | | |
|---------------|-----------------|--------------------|
| Years taught: | _____ pre-1990 | _____ 1990-1992 |
| | _____ 1993-1995 | _____ 1996-present |

Novel studies

Years taught: _____ pre-1990 _____ 1990-1992
 _____ 1993-1995 _____ 1996-present

“Teacher-made” reading units or program

Please describe:

| | | |
|---------------|-----------|--------------|
| Years taught: | pre-1990 | 1990-1992 |
| | 1993-1995 | 1996-present |

Other

Please describe:

| | | |
|---------------|-----------------|--------------------|
| Years taught: | _____ pre-1990 | _____ 1990-1992 |
| | _____ 1993-1995 | _____ 1996-present |

Has your use of reading programs changed over the past few years? _____ Yes _____ No

If yes, please indicate how it has changed, in general: _____

III. READING STRATEGIES / TEACHING STYLES

What types of strategies and styles have you used to teach reading? Please check all that apply. As well, please indicate (to the best of your memory!) the years during which you taught using these strategies and styles:

| | | | |
|--|------------------------------------|---------------------------------------|--|
| <input type="checkbox"/> Small groups | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> Whole class | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> Same-ability grouping | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> Mixed-ability grouping | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> "Traditional", structured style | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> "Holistic", less-structured style | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> Combination of the "traditional" and "holistic" styles mentioned above | | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |
| <input type="checkbox"/> Other | | | |
| Please describe: | _____ | | |
| Years taught: | <input type="checkbox"/> pre-1990 | <input type="checkbox"/> 1990-1992 | |
| | <input type="checkbox"/> 1993-1995 | <input type="checkbox"/> 1996-present | |

Has your teaching style and/or use of strategies in teaching reading changed over the past few years? ☐ Yes ☐ No

If yes, please indicate how it has changed, in general: _____

Appendix C
School Board Approval

P.O. Box 129
Vanderhoof, B.C.
V0J 3A0
Telephone: (604) 567-2284
Fax: (604) 567-4639



Serving
Fort Fraser
Fort St. James
Fraser Lake
Vanderhoof

October 30, 1996

Ms. Tammi Rothenbusch
Box 1046
Fraser Lake, B.C.
V0J 1S0

Dear Tammi:

On behalf of the Board of School Trustees, School District No. 56 (Nechako), I am writing a letter in support of your research for your Master's degree. Improving the quality of education is important to all of us and we would be very interested in the results of your research. Anonymity of students and score results are essential in maintaining the confidentiality of the students.

Your desire to further your education is to be commended and it demonstrates a commitment on your part to continually improve oneself.

We wish you luck on your Master's program and look forward to your sharing the results.

Yours truly,

Louise Burgart
Superintendent of Schools

LB/cp

cc: J. Six, Principal

Appendix D**Letter of Intent to Principals**

November 15, 1996

Greetings!

(This message applies to all schools in our district except for Fort St. James Secondary and NVSS.)

For those of you who don't know me, I am currently teaching grade 7 at Fort Fraser Elem. and this is the sixth year that I've taught in the district. I began my Master's program at UNBC a year ago, and I am beginning to plan for my thesis topic. I am interested in evaluating the Reading Mastery program combined with the teaching components of the Morningside Academy model (fluency, charting, Direct Instruction, etc.) which our school implemented in 1994. I have received permission from the School Board to use available CTBS data with which to conduct such an evaluation, and I will be following strict confidentiality and anonymity guidelines (no names of students or schools will be used, etc.). I hope to use as many schools as is possible for comparison groups. Here's where you come in (!)...

I would like to find out whether your school administers the CTBS to all grades or only to those required (grades 3, 6, 9)? For my research, the more grades' results I have, the better (altho I do realize that administering the CTBS to all grades costs \$).

I would greatly appreciate your answering this question at your convenience (but as soon as possible, please?!). Also, please feel free to contact me with any questions or comments you may have regarding my potential research study.

Thanks,
Tammi Rothenbusch

Appendix E**Letter to Aboriginal Band Councils****Research Study Permission Form**

December 10, 1997

To Whom it May Concern:

I am a teacher at Fort Fraser Elementary School and I am working on my Master's thesis through the University of Northern British Columbia. My research study involves examining the effects of an experimental reading program on students' reading abilities as measured by the Canadian Tests of Basic Skills. The experimental reading program was implemented in our school in 1994 in response to a growing concern regarding the reading ability of its students.

The Canadian Tests of Basic Skills have been regularly administered in our school district for many years. Test results are normally retained by the district as part of an ongoing evaluation program and according to its ethical guidelines and procedures. Previously collected data from this standardized measure will be analyzed to determine the effects of the reading program's implementation. The vocabulary and reading scores of the experimental school will be compared to the vocabulary and reading scores of four control schools in the district.

Permission has been obtained from the School Board to use the Canadian Tests of Basic Skills data from all schools and years deemed necessary. Throughout the study, confidentiality and anonymity of schools will be maintained and ethical guidelines concerning the policies of the school district and the University of Northern British Columbia will be strictly followed.

As there is a high percentage of Aboriginal students in our district, I am interested in analyzing the scores of Aboriginal students and non-Aboriginal students separately to determine whether the two groups of students respond in the same manner to the new program. Investigating the effectiveness of the experimental reading program for both groups could result in important implications regarding the future education for all our students. As well, the results of this study will enable us to address the needs of our students in order for them to learn more effectively.

I am therefore requesting the permission of Aboriginal Band Councils represented by students in the original School District No. 56 (Nechako) to analyze the results of Aboriginal students as a separate group for my research study. Confidentiality and anonymity of all schools and students will be maintained. As well, I will gladly share the results of my research with you when it has been completed.

I would appreciate your signing the attached permission form. Please feel free as well to contact me with any questions, concerns, or comments you may have regarding this research study. I thank you for your consideration of this request.

Sincerely,
Tammi Rothenbusch

RESEARCH STUDY PERMISSION FORM

I, _____ (name),
from the _____ (Band),
do give my permission for Tammi Rothenbusch to analyze the Canadian Tests of Basic
Skills scores of Aboriginal students in School District No. 56 as a separate group for a
Master's thesis research study at the University of Northern British Columbia. I
understand that confidentiality and anonymity of all Bands, schools, and students will be
maintained and that ethical guidelines concerning the policies of the school district and the
university will be strictly followed.

Signed: _____ Date: _____