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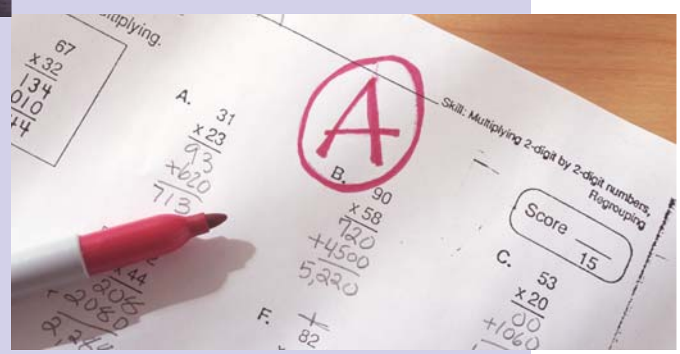
Classroom-Based Assessment Project

Enhancing the Learning of English Language Learners: Consultation and a Curriculum Based Monitoring System



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MINNEAPOLIS PUBLIC SCHOOLS
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The College of Education & Human Development
UNIVERSITY OF MINNESOTA

Enhancing the Learning of English Language Learners: Consultation and a Curriculum Based Monitoring System

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Executive Summary

This study examines an implementation of Accelerated Math (AM), a math intervention intended to enhance math outcomes for English Language Learning (ELL) students. Consultation procedures that were necessary to make the intervention work are also examined. The math performance of ELL students using the intervention was compared to a control group of students who did not receive the intervention. Two achievement measures were used to measure growth in math performance over time. Overall, ELL students participating in classrooms using AM in conjunction with Math curriculum outperformed ELL students from the control group. There is strong evidence to suggest that Accelerated Math is an effective math intervention for English Language Learning students in urban school districts.

Consultation

Several researchers have demonstrated that consultation in the schools positively affects the outcomes and conditions of children, teachers, and families with regards to school-related needs (Curtis & Meyers, 1988). For example, consultation has a positive effect on teacher development of professional skills (Gutkin, 1980; Zins, 1981), teacher attitudes regarding the "seriousness" of children's problems (Gutkin, Singer, & Brown, 1980), improved teacher information and understanding of children's problems (Curtis & Watson, 1980), generalization of consultation benefits to other children in the same classroom (Jason & Ferone, 1978), and improved long-term academic student performance (Jackson, Cleveland, & Merenda, 1975). As trained consultants, school psychologists have the opportunity to play an important role in addressing some of these school related concerns (Curtis & Meyers, 1988).

Behavioral consultation is one model of consultation that allows for an indirect service delivery approach where consultation is intended to have a broader impact on the system than other types of direct service delivery (Kratochwill & Bergan, 1990). School psychologists often use an indirect service delivery model with teachers and other staff members in order to provide these individuals with an opportunity to enhance their own skills and deliver better instructional services to their students. Using the problem solving approach to behavioral consultation, a consultant and consultee attempt to define the problem of concern (e.g., academic, behavioral), directly measure the problem, develop an intervention, implement the intervention, and evaluate the intervention (Tilly & Flugum, 1995). The consultation process enables school psychologists not only to support teachers in their intervention efforts with students, but also to help ensure the treatment integrity of interventions.

Math Performance of Students in the U.S.

Academic interventions are typically developed and implemented when there are concerns about student's performance. Most would agree that the academic achievement and performance of students in the United States has been an issue of national concern in past years (National Commission on Excellence in Education, 1983). Since 1983, there have been major academic and school reform strategies that have been enacted in order to address these issues. Fortunately, there have been some recent improvements in the math performance and achievement of students nationwide. Reports issued on student performance on the National Assessment of Educational Progress (NAEP) include data showing that the percentage of students scoring at or above the basic level on the 1996 mathematics assessments increased in all three grades: grade 4 (14%), grade 8 (10%), and grade 12 (11%) compared to the 1990 assessment results (Resse, Miller, Mazzeo & Dossey, 1997). Although there have been some improvements in students' math performance at a national level, students in the U. S. have plenty of room for improvement at a more global level. In the Third International Mathematics and Science Study (TIMSS) in 1995, U. S. eighth graders scored below the 41-nation international average in math with eighth graders in 20 countries outperforming 8th grade U. S. students. Eighth graders in the U. S. scored higher than their international peers in only 7 countries (U. S. Department of Education, 1998). These results clearly indicate that there continues to be an increasing need for students in this country to improve their math performance and achievement.

Math Performance of ELL Students

In the United States, there has been a consistent trend of poor math performance and achievement for many language minority students attending schools (Goldenberg, 1996). Unfortunately, the math performance and achievement of many English Language Learning (ELL) students in the United States has not been documented very well (Liu & Thrulow, 1999). One major reason for limited data on the academic performance of ELL students is because these students have often been excluded from participating in large-scale assessments (Abedi, Lord, & Hofstetter, 1998; National Academy of Education, 1993).

Further, a quick review of state accountability reports collected and analyzed by the National Center on Educational Outcomes (Ysseldyke, Thurlow, Langenfeld, Nelson, Teelucksingh, & Seyfarth, 1998) indicated that only seven states reported on the performance of ELL students in state assessments and only six states reported on the participation of ELL students on those assessments (see Liu & Thurlow, 1999). Moreover, the data that are available on the math performance of ELL students does not look too promising. In Minnesota, for example, roughly 75-80% of 8th grade Limited English Proficiency (LEP) students in a given year *did not pass* the Minnesota Basic Standards Math test (MBST), whereas 70-80% of *all* 8th graders taking the test between 1996 and 1998 did pass (Liu & Thurlow, 1999).

Because ELL students can be considered an at-risk population, there is an increasing need to ensure that these students are improving their performance in math. It is especially important that these students are provided with appropriate and effective math supports and services in school. It is extremely critical that these students' math performance is monitored frequently in order to document progress over time. One area that schools can focus on in order to enhance the performance of ELL students is math instruction. By improving math instruction and continually evaluating its effectiveness, opportunity to learn and benefit from instruction will be maximized for all students.

Components of Effective Instruction

Provision of math instruction in any classroom, and especially for students who are English

Language Learners, involves more than teaching. Effective instruction is multifaceted and involves application of empirically demonstrated effective principles of planning, managing, delivering, and evaluating instruction (Algozzine, Ysseldyke, & Elliott, 1997). There has been extensive research supporting the notion that learning difficulties and delays that language-minorities experience may be due to inadequate instruction (Baca & Cervantes, 1989; Campos & Keatinge, 1988; Fradd & Correa, 1989; Garcia, 1994; Gay, 1993; Ortiz & Ramirez, 1989), making instructional techniques an even more critical component of teaching. Specifically, it has been documented that ELL students often have less *opportunity to learn*, (Arreaga-Mayer & Greenwood, 1986, Oakes, 1985; Ortiz, Yates, & Garcia, 1990), are less *actively engaged in academic tasks* (i.e., passive learning role) (Arreaga-Mayer, Carta, & Tapia, 1994), experience *expressive and receptive communication difficulties* within the classroom (Ortiz & Garcia, 1989), and have lower *success rates*, which potentially delay their academic and linguistic development (Benavides, 1989; Miramontes, 1993).

One of the most challenging tasks for teachers instructing students in any classroom, including English Language Learners, is managing the complex nature of instructional tasks and student behaviors that are present in every classroom (Algozzine et al., 1997). Teachers must decide what to teach, what practice exercises to assign, provide students with opportunities for practice, score student's work, provide them with feedback, and test them. In short, they must manage and monitor student performance and progress. This can be challenging and often overwhelming.

Curriculum-Based Monitoring Systems

An empirically based technology, curriculum-based monitoring, already exists for monitoring student performance in schools. A curriculum-based monitoring system (CBM) is a "standardized methodology that specifies procedures for selecting test stimuli from student's curriculum, administering and scoring tests, summarizing the assessment information, and using the information to formulate instructional decisions in the basic skills areas" (Fuchs & Fuchs, 1988). More specifically, CBM can be defined as one form of the curriculum based assessment process whereby assessment results are used to monitor student progress and improve instructional programs for students (Deno, 1985, 1986).

When teachers use CBM systems to measure student growth and performance and to assist with the development of instructional programs in the classroom, student achievement and quality of instruction have been shown to increase in both general and special education settings (Fuchs, Deno, & Mirkin, 1984; Christenson, Ysseldyke, & Thurlow, 1989). There is also evidence to support the effectiveness of CBM systems when consultants are available to help with the implementation and monitoring of such programs (Fuchs, Fuchs, Hamlett, & Stecker, 1991). Furthermore, CBM systems have been shown also to be effective when implemented classwide and when used with students who have mild to moderate academic difficulties (Fuchs, 1992). As mentioned earlier, English Language Learning students often demonstrate academic difficulties, generally do not do well in U. S. schools, and are at high risk for educational failure (Arreaga-Mayer & Perdomo-Rivera, 1996; Goldenberg, 1996).

In an educational setting, the use of curriculum based measurement systems easily can be tied to consultation and the problem-solving model approach in that data can be used to guide the decision making process (Shinn, 1995). Most CBM data can be collected by both regular and special education teachers, which allows for the reduction of the special education eligibility testing load for school psychologists (Shinn, 1995). Essentially, consultation and supervision can then be easily provided by a school psychologist to teachers and other staff using curriculum-based monitoring systems.

Computer Management Systems

During the 1960's and 1970's, a movement began whereby computer systems were being designed to either supplement the instructional system in place in a classroom (computer-managed instructions or CMI) or to provide all the mainline instruction, testing, and record keeping necessary in a classroom (computer-assisted instruction or CAI) (Szabo & Montgomerie, 1992). Computer-assisted instruction was first introduced in 1968 by IBM when IBM 1500 was developed (Szabo & Montgomerie, 1992). The primary purpose of this computer-assisted instruction system (CAI) was for the computer to perform many of the instructional functions required by a teacher, allowing the teacher to serve more as a tutor or direct interventionist when remedial instruction or skill-based evaluation was necessary (Szabo & Montgomerie, 1992).

Computer-managed instruction (CMI), which was extensively researched by Hansen in 1970, is a "highly specialized application of the computer to assist in the process of managing an individualized instructional plan for students" (Szabo & Montgomerie, 1992). CMI is different from CAI in that computer-assisted instruction places an emphasis on direct instruction through tutorials, drill-and-practice, computer based interactive instructional simulations, and includes an extensive amount of interaction time between the learner and the computer (Szabo & Montgomerie, 1992).

It is important to mention the role that CMI can play in individualized instruction and the learning process. Bloom has identified six important variables that can affect student achievement including reinforcement, corrective feedback, cues and explanations, classroom participation, study time on task, and improved reading/study skills (Bloom, 1984). Most of these aforementioned variables can be incorporated into CMI in order to create a system that could successfully impact student learning and achievement (Szabo & Montgomerie, 1992).

Learning Information Systems

As technology has become more advanced over the past few decades, computer managed instruction has evolved and taken on different forms and ultimately different names. One example of a computer management system that has been developed in recent years is a learning information systems (LIS), designed to provide information about student learning most often by using computers (Advantage Learning Systems, 1998). While CMI provides actual instruction to students via computers, learning information systems are not intended to supplement or replace instruction. Instead, learning information systems, like Accelerated Reader or Accelerated Math™ (developed by Advantage Learning Systems) promise to take away the logistics of managing and monitoring instruction, freeing teachers up to teach and provide corrective feedback to students (Advantage Learning Systems, 1998).

Studies conducted by researchers at the Institute of Academic Excellence in the Tennessee and Texas Public Schools have demonstrated increasing evidence that using Accelerated Reader, a reading LIS, does lead to higher performance gains across all grades and subject areas (Paul, Swanson, Zhang, & Hehenberger, 1997).

Accelerated Math

Accelerated Math (AM) is a task-level learning information system that was developed by the Institute for Academic Excellence. AM is intended to accelerate the learning of mathematics while used in conjunction with the existing instructional practices and curriculum already in place in the classroom (Advantage Learning Systems, 1998).

Accelerated Math was also designed to:

- keep track of individual students' daily activities (prints and scores personalized practice assignments and tests for each student),
- provide immediate feedback to students and teachers through information generated from individual or class diagnostic reports,
- alert teachers when students are having difficulty with certain math objectives, and
- monitor student achievement (Advantage Learning Systems, 1998).

Accelerated Math helps both teachers and students ensure that students are working at an appropriate level, mastering new objectives, and reviewing skills already mastered. With the information provided by the Accelerated Math program, teachers have the opportunity to make informed instructional decisions and tailor math interventions to meet the needs of individual students. The Accelerated Math program can be considered a *curriculum-based monitoring system* in a sense because it possesses many of the same characteristics of this type of a system.

Spicuzza and Ysseldyke, independent researchers from the University of Minnesota, have been studying the effects of Accelerated Math in the Minneapolis Public Schools. In one study, they found that overall, students participating in a six week summer school program and using the Accelerated Math intervention showed higher performance gains during the summer than they did in the preceding nine-month academic year when Accelerated Math was not implemented as an intervention (Spicuzza & Ysseldyke, 1999).

Purpose

The purpose of the current study is to determine the extent to which English Language Learning students who were in a Title I classroom that used the Accelerated Math computer management instructional program performed better than or similar to a control group of ELL students who were not using the AM program. Specifically, I explored the differences in the Northwest Achievement Levels Test (NALT) scores and the STAR Math test scores for Accelerated Math participants and a control group of non-Accelerated Math participants during the 1998-99 academic school year. Further, I examined the role of consultation in the process of implementing the Accelerated Math intervention in a classroom.

Method

Participants

A pilot study intended to evaluate the effectiveness of the Accelerated Math program was conducted in an urban district during the 1998-99 academic year at four different sites. Although results will be presented for participants across the four sites, the focus of this study is on 26 students who were all receiving math instruction through Title I services at one of these sites and were included in the pilot study.

These 26 students were enrolled in a Spanish Immersion School (K-8). At this site, students had been receiving math instruction only in Spanish from Kindergarten through third grade. Students who participated in this study during the 1998-99 academic school year were either fourth graders (N=12) or fifth graders (N=14). Demographic information was obtained for all of these students (see Table 1). There were considerably more male than female participants, most students were Hispanic (N=17), most were eligible for free or reduced lunch (N=22), and a handful of the participants were receiving ELL services (N=7).

Table 1. Demographic Information of AM Participants at Target Site

English Language Learning (ELL) Status		Home Language Status		Ethnicity		Lunch Indicator		Gender	
ELL	7	English	18	American Indian	1	Free/Reduced	22	Males	17
Non-ELL	19	Spanish	8	African American	6	Not Eligible	4	Females	9
				Asian	0				
				Hispanic	17				
				White	2				
Total	26	Total	26	Total	26			Total	26

(N=26)

The control group (N=74) was comprised of fourth and fifth grade students who were not participating in the Accelerated Math intervention at the target site during the 1998-99 academic year. Demographic information was also obtained for all of these students (see Table 2). In this group there were about the same number of males and females, most of the students were either Hispanic American or White, a little more than half of the participants were receiving free or reduced lunch (N=41), and about a quarter of these students were ELL (N=18).

The Accelerated Math participants and the control group were pre-tested on the Northwest Achievement Levels Test (NALT) in Spring 1998 and on the STAR Math test in January, 1999. These students were then post-tested on these two measures at a later time. The NALT post-test was administered in Spring 1999 and the STAR Math post-test was also given in May, 1999. The participants in the control group did not participate in the Accelerated Math program, however these students were pre- and post-tested on the NALT test and the STAR Math test at the same time the Accelerated Math participants were tested.

Table 2. Demographic Information of Control Group Subjects at Target Site

English Language Learning (ELL) Status		Home Language Status		Ethnicity		Lunch Indicator		Gender	
ELL	18	English	54	American Indian	0	Free/Reduced	41	Males	39
Non-ELL	56	Spanish	20	African American	12	Not Eligible	33	Females	35
				Asian	1				
				Hispanic	32				
				White	29				
Total	74	Total	74	Total	74	Total	74	Total	74

(N=74)

Measures

Northwest Achievement Levels Test (NALT)

Each year, all students in this urban district in grades 2-7 are tested on the math portion of the NALT test. This test is an achievement test that increases in difficulty from one level to the next. The actual NALTs are un-timed; however, usually 50-60 minutes is sufficient time for students to complete one test. Level testing allows students to be given tests that are appropriate for their individual achievement levels. Another advantage of level testing is that growth in math performance can be tracked and measured systematically from year to year.

NALTs are developed at the local level and possess characteristics representative of individual districts. For example, the NALT test is often aligned with the curriculum standards as well as with grade level expectations already in place in a district. Further, NALTs are calibrated to the curriculum, meaning that a difficulty value is assigned to each test item. These tests focus on specific achievement levels of individual students and on student progress and growth over time. Information obtained from the NALT can often assist districts with determining the effectiveness of instructional programs.

STAR Math Test

Students in this study were also tested on the STAR Math exam (Advantage Learning Systems, 1998), a computer-adaptive test of math skills. This test was designed for use with students in grades 3 through 12 and measures skills in numeric concepts, computation, and math application. The test consists of 24 multiple choice questions and takes approximately 15 minutes to administer. Tests are all individualized and authentic in nature, making every test a unique measure.

The STAR Math test is used for several purposes. This test provides information related to individual student performance in math and assists in appropriately placing students at their current level of achievement in the Accelerated Math program. This test also provides information related to student growth in math performance via administration of a post-test. Another feature of this computer-adaptive test is that it allows for continual monitoring of progress throughout an academic year if multiple tests are administered to students (e.g., up to six tests can be administered to students in a year).

The adaptive branching technology used with this system continuously adjusts each test to the abilities of the individual. Students who answer questions correctly are then presented with a more difficult item, while those who answer questions incorrectly are given an easier item. Essentially, the test is designed to focus in on a student’s individual instructional level. The

STAR Math test provides grade equivalents, percentile ranks, and normal curve equivalent scores.

Normal Curve Equivalents (NCE) are a method for equalizing performance across a range of test scores allowing direct comparison of student performance at any point on the test performance continuum, as well as across time. If students perform at a consistent level of performance relative to their peers (45th percentile Time 1 and the 45th percentile Time 2), the students' NCE growth would be zero. In effect, students are considered to be gaining new skills (absolute knowledge), but not at an accelerated rate so as to increase their overall standing in comparison to same-grade peers (relative performance). Thus, when an NCE gain is above zero, the outcome is considered to be an acceleration in a student's rate of achievement.

Instructional Consultation

Ethnographic data related to instructional consultation procedures used throughout the intervention were collected throughout the study. Notes were taken in a journal each time the consultant conducted a site visit at the school. Instructional consultation procedures included instructional planning and the development of math interventions for participants, trouble-shooting when technological problems arose with either the AM software or hardware, and developing interpersonal relationships with classroom teachers and other school professionals who were unfamiliar with the AM intervention.

Procedures

Students both in the treatment group and the control group at this site were pre-tested on STAR Math during the first two weeks of January, 1999. The Accelerated Math program was then implemented with the participants in this study (N=26) at the end of January, 1999 after STAR Math scores had been obtained.

All of the participants were receiving math instruction through Title I services. The Title I teacher at this site implemented AM with all of her students on an itinerant model. The fourth and fifth grade classes met in the cafeteria or the media center four days a week for an hour at a time. The Title I teacher was actively involved in teaching and providing feedback to all of her students. She used AM consistently and closely monitored students using the intervention.

In the spring, all students at this site were administered the NALT district test. The AM intervention was implemented through May, 1999 which is also the time that the STAR Math post-test was administered to students again.

Results

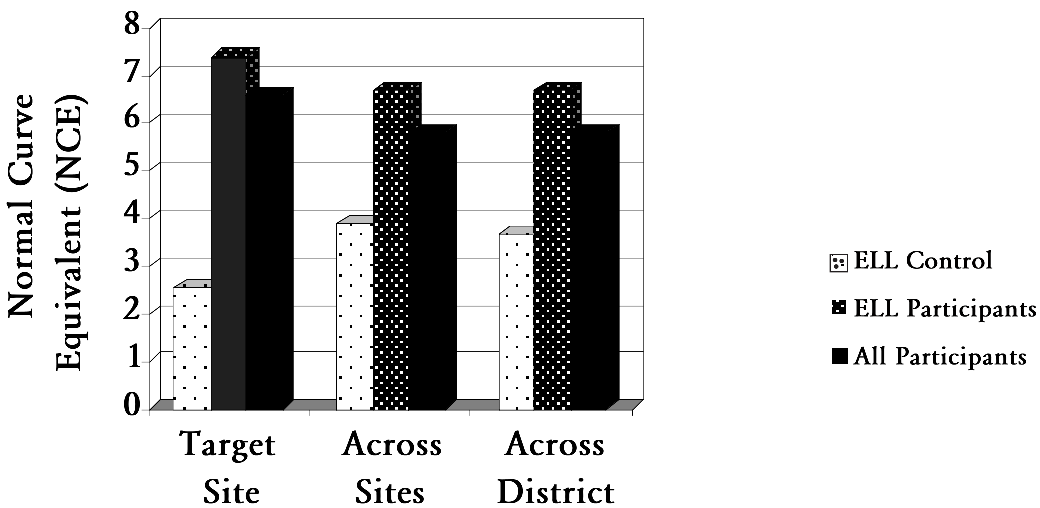
Both quantitative and qualitative data were collected. Quantitative data include results from both the NALT and STAR Math tests for AM participants and the control group.

NALT Test Performance

NALT data were obtained for 25 of the AM participants in this study. Overall, AM participants gained an average of 6.57 NCE units between the Spring 1998 and Spring 1999 administrations. For those participants in the control group (N=70) the average gain was only 2.79 NCEs between the same time period.

When examining ELL students who participated in AM at the target site (N=6), they demonstrated gains of 7.40 NCE units between the two NALT administrations compared to a 2.53 NCE gain of the ELL students in the control group (N=15) (see Figure 1).

Figure 1. Normal Curve Equivalent (NCE) gains on the Northwest Achievement Levels Test (NALT) between Spring 1998 and Spring 1999 for ELL participants, ELL control subjects, and all participants across settings



Across the four pilot sites in this urban school district, control group ELL students (N=151) enrolled in fourth and fifth grade gained an average of 3.87 NCEs between the Spring 1998 and Spring 1999. This is comparable to the English Language Learning students enrolled in the fourth and fifth grade who did not participate in the Accelerated Math program in the entire district (N=2665). They gained an average of 3.66 NCEs between the Spring 1998 and Spring 1999 administration. However, ELL students who *did* participate in AM across the district (N=50) gained an average of 6.67 NCE units, nearly twice the amount of growth of those who did not participate (see Figure 1).

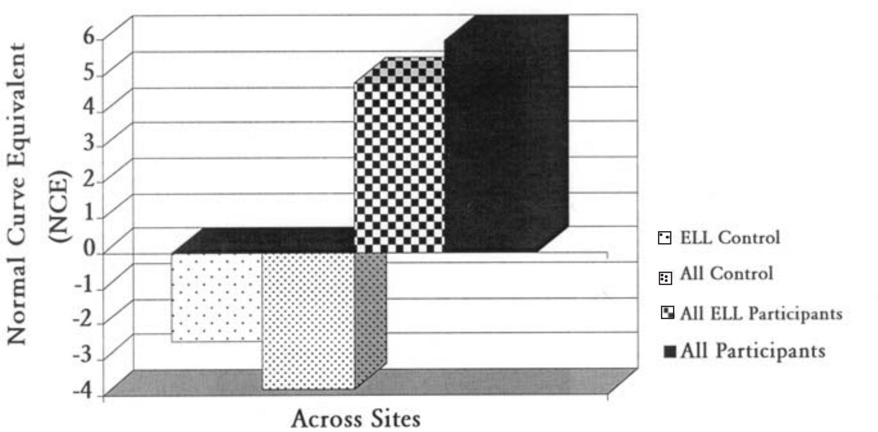
STAR Math Performance

STAR Math data were obtained for 20 of the AM participants in this study. Overall, AM participants gained an average of 3.62 NCE units between the January, 1999 and May, 1999 administrations. ELL participants (N=5) gained an average of 3.68 NCEs on STAR Math. STAR Math results were not obtained for the ELL students in the control group at the target site.

However, across the four pilot sites, ELL participants in the fourth and fifth grades (N=49) gained an average of 4.79 NCE units on STAR Math. The ELL students in the control group (N=15) lost an average of –2.55 NCE units. These results are similar to the 5.96 NCE unit gain made by all of the AM participants across the four sites in fourth and fifth grade (N=118). All of the participants in the control group (N=51) lost an average of -3.85 NCE units on the same measure (see Figure 2).

Qualitative data were also obtained during this study. The results from the ethnographic data collected on instructional consultation procedures are summarized below.

Figure 2. Normal Curve Equivalent (NCE) gains on the STAR Math test between January, 1999 and May, 1999 for ELL participants, ELL control subjects, and all participants across settings



Instructional Consultation

Data were collected on different types of instructional planning tactics and strategies and individual/group interventions that were developed through the consultation process. Based on information on individual math performance that was received from reports generated by AM, it was easy to identify areas of concern for students. For example, when students had difficulty mastering particular AM objectives, the Title I teacher and the consultant often worked together to develop ideas for individual or group interventions intended to assist students with learning the necessary skills to master the objectives. These interventions varied in nature. At times, "math notes" were used (see Appendix A) which helped students define, give examples, and practice specific objectives. Because unfamiliar math terminology and vocabulary can often serve as barriers to learning for ELL students, instructional strategies like Math Notes are good ways to help these students overcome barriers. By creating a student glossary of common math terms, students can begin to expand and understand math problems like never before.

Other times, group interventions (e.g., mini-lessons) were implemented with several students who were having difficulty mastering similar objectives. At any time teachers can easily access a Status of the Class Report (see Appendix B), a report that can be generated by the Accelerated Math program. This report would assist teachers in knowing the objectives or skills students are struggling with and can use this information to develop lesson plans. This is another type of instructional strategy that can be extremely effective for ELL students.

Data were also collected on consultation procedures related to technological problems that arose throughout the duration of the computer-based AM intervention. The consultant most often served as the communication link between the person at the site experiencing technological difficulties and personnel at Advantage Learning Systems (ALS), the company who developed the AM program. The most common technological problems that were addressed included AM management system lock up, scanner lock up, crashing of the main server, accessing the data location on the server, and installation of upgraded versions of AM. Consultation related to technological issues occurred frequently with the Title I teacher, ALS technology support, and with other staff members on the AM project.

Because the participants in this study were receiving AM through Title I services, it was important to try to develop interpersonal relationships with homeroom teachers in order to form a more collaborative approach to instructional planning for these students. Furthermore, the majority of the staff members at this site were unfamiliar with the AM program and how it related to classroom curriculum. This is a common issue in schools that arises when students are served in the general education classroom and also receive other support services.

Therefore, consultation focused on establishing rapport with staff, building working relationships on an informal basis with teachers who had students from their homeroom using AM, and helping staff become more familiar with AM and how it can be used to supplement math curriculum (e.g., brief conversations in the hall about AM, asking for assistance with proctoring STAR Math testing, etc.). Although the consultant did not engage in formal instructional planning or development of math interventions with homeroom teachers, information related to student performance and progress in AM was disseminated to classroom teachers on a weekly basis. Maintaining consistent contact with homeroom teachers and continually providing them with information related to Accelerated Math as well as how their students were progressing with AM was a significant part of the consultation process.

One of the goals of consultation is to help facilitate communication among staff that are serving students in different settings (e.g., Title I, regular classroom). It is important to note that data were not collected on the extent to which teachers used this information to help inform instructional planning and the development of math interventions for students in their classrooms. Further studies might examine this critical area related to the number of instructional changes made based on data provided throughout the intervention.

Discussion

This study examined the extent to which a math intervention, Accelerated Math, enhanced the math performance of English Language Learning students compared to ELL students in a control group. Specifically, fourth and fifth grade ELL students receiving Title I services in a Spanish immersion school in an urban school district were the focus of this study. The expected difference between the two groups was supported by this study and findings were consistent across two dependent measures, NALT and STAR Math achievement measures. ELL students participating in AM made higher math gains on both measures compared to the ELL students who did not participate in the intervention. These results were also consistent for ELL participants across the four pilot sites and the district when compared to an ELL control group.

While these results are extremely powerful, there are some issues to consider when interpreting them. First, the sample size of ELL students participating in AM and in the control group at the target site was small, thus it is difficult to determine whether or not the results accurately represent the larger population of ELL students. On the other hand, in this urban district results are not reported for groups of students when N<5. For all of the results reported in this study, the number of participants always exceeded this number.

While the sample size in this study could have been selected more systematically and in larger numbers, the ELL selection criteria in the state confounds this issue. For example, in Minnesota when attempting to identify students for placement in a language program, the criteria are extremely vague (see Appendix C), making it difficult to not only identify students for programming, but to appropriately meet the unique needs of language minority students. Because there is not a systematic way to determine which students will receive language services, we must seriously consider whether or not this system allows us to appropriately identify ELL students. To this end, advocating for state and federal guidelines that are clearly implemented is strongly encouraged.

Nonetheless, even if we are not fully capable of accurately identifying ELL students in our schools, we still need interventions in place that will optimize the academic performance of students with diverse needs. Specifically, it is important to have interventions and programs in place that allow students to work at their current instructional level in order to effectively begin meeting the instructional needs of our students. This study yielded strong evidence to support that Accelerated Math is an effective math intervention for ELL students. Further research in this area is recommended in order to corroborate the results of this pilot study.

It is also important to consider the role of instructional consultation in this study. The consultant played a significant role in the implementation and maintenance of the Accelerated Math program. Assisting with the development of instructional interventions for individual students, helping to problem solve when technological problems arose, and fostering working relationships with other staff members in the school were all roles of the consultant. Similar to the support that school psychologists often provide to teachers when implementing academic or behavioral interventions in schools, consultation procedures were also an integral part of this AM intervention. Furthermore, the treatment integrity of the AM intervention could be monitored and ensured more easily with the assistance and support of a consultant.

One direction that future research in this area could take would be to evaluate the AM program with and without consultation in order to better determine the role that consultation plays in the implementation of this intervention. It would be important to examine the extent to which ELL participants using AM make math performance gains when consultation is provided to teachers compared to when consultation is not provided to teachers.

Another important issue to consider in this study is the type of classroom model used to deliver the intervention. The Title I teacher at the Spanish Immersion site did not have her own classroom and provided Title I services to her students on an “itinerant” model. For example, classes were often held either in the cafeteria or in the media center. These classroom “arrangements” were less than optimal for both the instructor and students. In the future, it would also be important to examine the extent to which ELL students improve their math performance when the AM intervention is delivered in a more traditional classroom setting.

One suggestion for evaluating the AM program more comprehensively in the future might be to use a specific model of evaluation. Evaluation research is the systematic application of social research procedures for assessing the conceptualization, design, implementation, and utility of social intervention programs (Rossi & Freeman, 1993). It is a way for researchers to assist in the development, improvement, and implementation of programs already in place or in the process of being designed. Informal and formal methods of evaluation can be conducted in the educational evaluation process. Informal evaluation can be characterized by its dependence on causal observation, implicit goals, intuitive norms, and subjective judgment in the educational setting (Stake, 1967). On the other hand, formal evaluation of education incorporates checklists, structured observation systems, controlled comparisons, and standardized testing of students (Stake, 1967).

Stake's model of evaluation is a model that might be considered in further evaluating the Accelerated Math program. Stake purported that "an evaluation of a school program should portray the merit and fault perceived by well-identified groups, systematically gathered and processed" (Stake, 1967). Furthermore, he states that it is important to distinguish between *antecedent*, *transaction*, and *outcome* data when examining such an evaluation process. An antecedent can be defined as any condition existing prior to teaching and learning that may relate to outcomes. Transactions are considered the numerous interactions of students with teacher, student with students, author with reader, parent with counselor, or the different types of encounters that may negatively or positively affect the educational process. Transactions are primarily dynamic, whereas antecedents and outcomes are static in nature.

If Stake's model had been used in the current study to evaluate the AM program, antecedents, transactions, and outcomes would have been identified. An example of an antecedent could have been that the majority of teachers at this site were unfamiliar with the AM program and were not using the program in their classrooms. A possible transaction would have been that consultation procedures were implemented in order to foster working relationships with teachers and staff not using AM and provide them with information related to AM on a regular basis in order to form a more collaborative approach for academic instruction and intervention with ELL students. Finally, an example of an outcome would have been that three new teachers at this site decided to use the AM program as a math intervention for student in their classrooms during Summer School, 1999, which interestingly enough, was a real outcome.

Although there are many facets to the evaluation process, there are specific uses of the process that are directly useful for future research and can be adapted to address the issues of concern in the present study. Most importantly, future research should focus on expanding the current study on how to identify methods that can further enhance the use of tools such as AM to best meet the instructional challenges of ELL students. To date, AM appears to be a promising and useful tool to assist teachers in meeting the challenge.

References

Abedi, J., Lord, C., & Hofstetter, C. (1998). *Impact of selected background variables on students' NAEP math performance*. CSE Technical Report 478. Los Angeles, CA: University of California at Los Angeles, National Center for Research on Evaluation, Standards, and Student Testing.

Advantage Learning Systems, Inc. (1998). Accelerated Math (Computer Program). Wisconsin Rapids, WI: ALS. (http://www.advlearn.com).

Algozzine, B., Ysseldyke, J., & Elliott, J. (1997). *Strategies and tactics for effective instruction.* Sopris West: Longmont, CO.

Arreaga-Mayer, C., Carta, J. J., & Tapia, Y. (1994). Ecobehavioral assessment of bilingual special education settings: The opportunity to respond. In R. Gardner III, D. M. Sainato, J. O. Cooper, T. E. Heron, W. L. Heward, J. E. Eshelman, & T. A. Grossi (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (pp. 226-239). Pacific Grove, CA: Brooks/Cole.

Arreaga-Mayer, C., & Greenwood, C. R. (1986). Environmental variables affecting the school achievement of culturally and linguistically different learners: An instructional perspective. *Journal of the National Association for Bilingual Education, 10*, 113-135.

Arreaga-Mayer, C. & Perdomo-Rivera, C. (1996). Ecobheavioral Analysis of Instruction for At-Risk Language Minority Students. *The Elementary School Journal, 96* (3), 245-258.

Baca, L. M., & Cervantes, H. (1989). *The bilingual special education interface.* Columbus, OH: Merrill.

Benavides, A. (1989). High risk predictors and pre-referral screening for language minority students. In A. A. Ortiz & B. A. Ramirez (Eds.), *Schools and the culturally diverse exceptional student* (pp. 19-31). Reston, VA: Council for Exceptional Children.

Bloom, G. S. (1984). The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher, 13(4),* 4-16.

Campos, J., & Keatinge, R. (1988). The carpinteria language minority student experience: From theory, to practice, to success. In T. Skutnabb-Kangas & J. Cummins (Eds.), *Minority education: From shame to struggle* (pp. 299-307). Clevedon: Multilingual Matters.

Christenson, S. L., Ysseldyke, J. E., & Thurlow, M. L. (1989). Critical instructional factors for students with mild handicaps: An integrative review. *Remedial and Special Education, 10(5)*, 21-31.

Curtis, M. J., & Meyers, J. (1998). Consultation: A foundation for alternative services in the schools. In J. Graden, J. Zins, & M. Curtis (Eds.), *Alternative educational delivery systems: Enhancing instructional options for all students*. (pp.35-48). Washington DC: National Association of School Psychologists.

Curtis, M. J., & Watson, K. (1980). Changes in consultee problem clarification skills following consultation. *Journal of School Psychology, 18,* 210-221.

Deno, S. L. (1985). Curriculum-based measurement: The emerging alternative. *Exceptional Children, 52,* 219-232.

Deno, S. L. (1986). Formative evaluation of individual student programs: A new role for school psychologists. *School Psychology Review, 15,* 358-374.

Fradd, S. H., & Correa, V. I. (1989). Hispanic students at risk: Do we abdicate or advocate? *Exceptional Children, 56,* 105-110.

Fuchs, L. S. (1992). Classwide decision-making with computerized curriculum-based measurement. *Preventing School Failure, 36 (2),* 30-33.

Fuchs, L. A., Deno, S. L., & Mirkin, P. K. (1984). The effects of frequent curriculum-based measurement and evaluation on pedagogy, student achievement, and student awareness of learning. *American Educational Research Journal, 21,* 449-460.

Fuchs, L. S., & Fuchs, D. (1988). Curriculum-Based Measurement: A Methodology for Evaluating and Improving Student Programs. *Diagnostique, 14 (1),* 3-13.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., & Stecker, P. M. (1991). Effects of curriculum-based measurement and consultation on teaching planning and student achievement in mathematics operations. *American Educational Research Journal, 28,* 617-641.

Garcia, E. E. (1994). *Understanding and meeting the challenge of student cultural diversity.* Princeton, NJ: Houghton Mifflin.

Gay, G. (1993). Ethnic minorities and educational equity. In J. A. Banks & C. A. McGee Banks (Eds.), *Multicultural education: Issues and perspectives* (pp. 171-192). Boston: Allyn & Bacon.

Gutikin, T. B. (1980). Teacher perceptions of consultation services provided by school psychologists. *Professional Psychology, 11*, 637-642.

Gutkin, T. B., Singer, J. H., & Brown, R. (1980). Teacher reactions to school based consultation services: A multivariate analysis. *Journal of School Psychology, 18,* 126-134.

Goldenberg, C. (1996). The education of language minority students: Where are we, and where do we need to go? *Elementary School Journal, 96* (3), 353-361.

Jackson, R. M., Cleveland, J. C., & Merenda, P. F. (1975). The longitudinal effects of early identification and counseling of underachievers. *Journal of School Psychology, 13*, 119-128.

Jason, L. A., & Ferone, L. (1978). Behavioral versus process consultation interventions in school settings. *American Journal of Community Psychology, 6*, 531-543.

Kratochwill, T. R., & Bergan, J. R. (1990). Behavioral Consultation in Applied Settings. Plenum Press: New York, NY.

Liu, K., & Thurlow, M. (1999). *Limited English Proficient Students' Participation and Performance on Statewide Assessments: Minnesota Basic Standards Reading and Math, 1996-1998* (Minnesota Report 24). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.

Miramontes, D. B. (1993). ESL policies and school restructuring: Risks and opportunities for language minority students. *Journal of Educational Issues of Language Minority Students, 12*, 77-96.

National Academy of Education. (1993). *The trial state assessment: Prospects and realities. The third report of the National Academy of Education Panel on the Evaluation of the NAEP Trial State Assessment: 1992 trial state assessment.* Stanford, CA: Stanford University, The National Academy of Education.

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform.* Washington, DC: US Government Printing Office.

Oakes, J. (1985). *Keeping track: How schools structure inequality.* New Haven, CT: Yale University Press.

Ortiz, A. A., & Garcia, S. B. (1989). A prereferral process for preventing inappropriate referrals of Hispanic students to special education. In A. A. Ortiz & B. A. Ramirez (Eds.), *Schools and the culturally diverse exceptional student* (pp. 6-18). Reston, VA: Council for Exceptional Children.

Ortiz, A. A., & Ramirez, B. A. (1989). *Schools and the culturally diverse exceptional student: Promising practices and future directions.* Reston, VA: Council for Exceptional Children.

Ortiz, A. A., Yates, J. R., & Garcia, S. B. (1990). Competencies associated with serving exceptional language minority students. *Bilingual Special Education Perspective, 9*, 1-5.

Paul, T., Swanson, S., Zhang, W., & Hehenberger, L. (1997). *Learning information system effects on reading, language arts, math, science, and social studies.* Madison, WI: The Institute for Academic Excellence.

Reese, C. M., Miller, K. E., Mazzeo, J., & Dossey, J. A. (1997). *NAEP 1996 mathematics report card for the nation and the states.* Washington, DC: National Center for Education Statistics.

Rossi, P. H. & Freeman, H. E. (1993). *Evaluation: A systematic approach 5.* Newbury Park, CA: Sage Publications.

Shinn, M. R. (1995). Best practices in curriculum-based measurement and its use in a problem-solving model. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology III* (pp. 547-565).

Spicuzza, R., & Ysseldyke, J. (1999). *Using Accelerated Math™ to enhance instruction in a mandated summer school program.* Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.

Stake, R. E. (1967). The countenance of educational evaluation. *Current Research on Instruction*. Prentice-Hall, Inc.: Englewood Cliffs, N. J.

Szabo, M. & Montgomerie, T. C. (1992). Two decades of research on computer-managed instruction. *Journal of Research on Computing in Education, 25* (1), 113-133.

Tilly, W. D., & Flugum, K. R. (1995). Best practices in ensuring quality interventions. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology III* (pp.485-500).

U. S. Department of Education. (1998). *Linking the National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS): Eighth-grade results*. Washington, DC: National Center for Education Statistics.

Ysseldyke, J., Thurlow, M., Langenfeld, K., Nelson, J., Teelucksingh, E., & Seyfarth, A. (1998). *Educational results for students with disabilities: What do the data tell us?* (Technical Report 23). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.

Zins, J. E. (1981). Using data-based evaluation in developing school consultation services. In M. J. Curtis & J. E. Zins (Eds.), *The theory and practice of school consultation.* Springfield, IL: Charles C. Thomas.

Appendix A

Math Notebook

My Math Notebook

Terms and Definitions	Example
Expanded Form -	
Standard From –	
Odd Numbers -	
Even Numbers –	
Greater than {>} –	
Less than {<} –	

Appendix B

Status of the Class Report

Status of the Class Report

Accelerated Math: Tuesday, 11/24/98, 4:15 PM

Ms. Powell
5th Grade
Lincoln Elementary School

Page 1

Use these to monitor time.

Students Ready To Score: 20 of 20	Practice Form	Practice Problems	Practice Date	Exercise Form	Exercise Problems	Exercise Date	Test Form	Test Problems	Test Date
Aguilar, Karen	118	15-28	11/23/98						
Albrecht, Byron	125	43-56	11/24/98				85	16-30	11/24/98
Brown, Michael	131	1-14	11/23/98	41	15-35	11/24/98			
Cohen, Susan	127	15-28	11/24/98						
Cross, Carrie	119	71-84	11/24/98				74	1-15	11/24/98
Edades, Marvin	122	43-56	11/23/98						
Eubanks, Cindy	126	57-70	11/23/98	56	22-42	11/24/98			
Gilbert, Sherri	128	29-42	11/24/98	58	36-56	11/24/98			
Ginter, David	115	1-14	11/24/98						
Hetzel, Laurie	132	15-38	11/24/98	47	15-35	11/24/98			
Huang, Jane	117	29-42	11/23/98	43	29-49	11/24/98			
Miller, Ashley	120	43-56	11/23/98	51	22-42	11/24/98			
Olivera, Juan	129	71-84	11/24/98				87	46-60	11/24/98
Ramirez, Linda	116	15-28	11/24/98						
Salazar, Francesca	130	57-70	11/23/98				83	46-60	11/24/98
Saunders, Tanya	124	1-14	11/24/98				77	16-30	11/24/98
Scott, Cordell	112	71-84	11/20/98						
Watson, Patrick	121	43-56	11/23/98						
Wickersham, Mark	109	29-42	11/20/98						
Wright, Sue	123	71-84	11/24/98						

Students Ready To Test: 12 of 20	Number of Test-able Objectives
Aguilar, Karen	3
Brown, Michael	2
Cohen, Susan	1
Edades, Marvin	2
Gilbert, Sherri	4
Ginter, David	2
Hetzel, Laurie	3
Huang, Jane	3
Olivera, Juan	4
Ramirez, Linda	4
Saunders, Tanya	2
Wright, Sue	4

These students can take a test.

Accelerated Math Basics 19

Status of the Class Report

Accelerated Math: Tuesday, 11/24/98, 4:15 PM

Ms. Powell
5th Grade
Lincoln Elementary School

Page 2

Students Not Ready To Test: 8 of 20

Albrecht, Byron
Cross, Carrie
Eubanks, Cindy
Miller, Ashley
Salazar, Francesca
Scott, Cordell
Watson, Patrick
Wickersham, Mark

These students do not have any testable objectives.

These students need your help.

Students With Intervene Objectives: 3 of 20	Objectives	Library
Cross, Carrie	55. Classify fractions as proper or improper.	Grade 5
Scott, Cordell	52. Simplify fractions.	Grade 5
Wickersham, Mark	58. Compare and order fractions.	Grade 5

These students haven't scanned any work recently.

Students With No Recent Activity: 2 of 20	Last Activity	Date of Last Activity
Scott, Cordell	Printed Practice	11/20/98
Wickersham, Mark	Printed Practice	11/20/98

Intervene: Scott is having difficulty with objective #52.

Objective Groupings	Library	Students	Status	Poses	Accuracy
52. Simplify fractions.	Grade 5	Susan Cohen	Working	4	100%
		Scott Cordell	Intervene	21	61%
		Juan Olivera	Working	7	71%
		Sue Wright	Assigned	0	0%
53. Find equivalent fractions using models.	Grade 5	Susan Cohen	Working	4	100%
		Cindy Eubanks	Assigned	0	0%
		Jane Huang	Assigned	0	0%
		Juan Olivera	Working	4	75%
		Patrick Watson	Working	4	100%
		Sue Wright	Assigned	0	0%

Use the objective groupings to plan small-group mini-lessons.

Assigned: Sue is one or two objectives away from objective #53.

Working: Patrick is working on objective #53 in a practice assignment.

20 Accelerated Math Basics

Appendix C

Minnesota Criteria for Defining Limited English Proficiency (LEP)

Minnesota Criteria for Defining Limited English Proficiency (LEP)

Minnesota defines LEP as "a pupil in any of the grades of kindergarten through 12 who meets the following requirements:

a) The pupil, as declared by parent or guardian

1) first learned language other than English,

2) comes from a home where the language usually spoken is other than English, or

3) usually speaks a language other than English;

b) The pupil's score is significantly below the average district score for pupils of the same age on a nationally normed English reading or English language arts achievement test. A pupil's scores shall be considered significantly below the average district score for pupils of the same age if it is one-third of a standard deviation below that average score."

(Minnesota Statutes 126.262)

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