

Running head: ACCELERATED MATH AND GRADE EQUIVALENCY SCORE

The Effects of Accelerated Math Utilization
On Grade Equivalency Score at a selected Elementary School

Patrick Kariuki

And

Christi Gentry

Milligan College

October, 2010

A paper presented at the Annual Conference of the Mid-South Educational Research
Association.

Mobile, Alabama, November 3-5, 2010

Abstract

The purpose of this study was to examine the effects of Accelerated Math utilization on student's grade equivalency scores. Twelve students for both experimental and control groups were randomly selected from 37 students enrolled in math in grades four through six. The experimental group consisted of the students who actively participated in Accelerated Math program. The control group consisted of the students who did not participate in Accelerated Math program. Data were collected from the reports generated from Accelerated Math program and from the STAR Math program. The STAR Math testing reports were used to determine the grade equivalency for each student in both experimental and control groups.

Data were analyzed using independent t-test using .05 level of significance. The results indicated a significant difference between experimental and control groups grade equivalency scores. The experimental group showed greater increase in grade equivalence score than the control group. No significant difference was found in number operation proficiency. The results suggest that the use of Accelerated Math program combined with regular classroom instruction increases the students' grade equivalency scores.

Review of the Literature

According to Wikipedia, Accelerated Math is a daily, progress-monitoring software tool that monitors and manages mathematics skills practice. Accelerated Math is a progress-monitoring software tool that is used to customize assignments and monitor progress in math students in grades 1-12. The software can be used to differentiate instruction and individualize assignments for all students regardless of ability levels. Accelerated Math can be used in addition to current mathematics curricula, and has a variety of reports that can be used to track and monitor student progress (U.S. Department of Education, 2008). Research has shown that technology use in the classroom has proven to be effective over the past decade as funding increased for technology implementation. Students with increased exposure to computer assisted instruction show higher achievement than those who are exposed to traditional instruction alone (Deubel, 2001).

Progress has been made in recent years with technology integration in classroom instruction. Barnett (2003) identified two major ways in which students use computers in school: (a) learning from computers, and (b) learning with computers. In the first, students use computers to assist them in the learning process by utilizing computer management and learning systems like Accelerated Math. The second type of students use computers mostly as word processors, and as research companions.

Nunnery and Ross (2007) investigated the results of progress monitoring systems on both reading and mathematics achievement. The Texas Assessment of Academic Skills (TAAS) assessment was used as the measure of student achievement in this study. It included 11 elementary and middle schools that utilized the progress monitoring systems Accelerated Reading and Accelerated Math as the treatment group. Those schools were matched

to control schools that didn't utilize either of these systems. The study investigated grades third through eighth and took into account repeated-measures analyses that were performed to estimate program effects on achievement and considered the impact of implementation integrity.

According to this study, progress monitoring systems contributed to higher achievement in both reading and math when compared to schools that did not utilize the progress-monitoring software system. There were statistically significant gains in math at both the elementary and the middle school levels after implementation of Accelerated Math. This study examined English Language Learners (ELL) students that were eligible for free or reduced lunches as a separate subgroup. The results reported gains in both reading and mathematics. Although the subgroups were too small to prove significance, these results still suggest that the computerized progress-monitoring systems were advantageous to these students as well (Nunnery & Ross, 2007).

Nunnery and Ross (2007) also examined the difference in results related to the extent of the implementation. The baseline for implementation comparison is set by the company's scientific research and best practices recommendation. Classrooms that were categorized as highly implemented resulted in students that experienced significantly higher achievements than students in the control groups. Lower level implementation still resulted in gains over the control groups, but these gains were not significantly higher than the control classrooms.

Nunnery and Ross' 2007 study was reexamined in the U.S. Department of Education, What Works Clearinghouse Intervention Report (2008). This report considered 40 similar schools to the treatment school and matched it to the most similar option that did not implement Accelerated Math. When the data were reexamined only grades 6-8 was considered relevant to the review. After reviewing the data, What Works Clearinghouse determined that the original

findings were neither statistically significant nor substantial according to their guidelines (U.S. Department of Education, 2008).

Fuchs and Fuchs (2001) described progress monitoring as when teachers systematically assess students' academic performance on a regular basis, like weekly or monthly. They use that information, to determine two things, first to determine what children profited from the typical instruction provided and second, to make decisions on improving the typical instruction to allow children who benefited inadequately from the typical instruction. Progress monitoring can be accomplished in various forms.

Mastery measurement is a common form. Mastery measurement methods assess and test for mastery of a certain skill, and continue to test that skill until the student proves it is mastered. Once that skill is considered mastered, and then the next skill in the sequence is assessed. With this method, different skills are tested at different times of the school year. The results of these tests cannot be compared at different times in the school year since the nature and difficulty of the assessments changed. This makes it impossible to quantify or describe the rates of progress, and also makes it impossible to provide information regarding the student's retention of previously learned material (Fuchs & Fuchs, 2001).

The second type of progress monitoring discussed is Curriculum-Based Measurement. Curriculum-Based Measurement assesses all of the different skills covered in the annual curriculum in each test. This allows scores received throughout the school year to be compared to determine student progress toward the year end goal. It also provided standardized formative assessment of various subjects and objectives throughout the school year. Curriculum-Based Measurement scores are appropriate to use to identify students that have a need in particular

areas, to monitor students' academic competence, and to improve instructional programs (Fuchs & Fuchs, 2001).

This study concentrated on the computerized curriculum-based management system, Accelerated Math. Accelerated Math appears to incorporate many of the effective instructional factors previously mentioned in research. Accelerated Math allows teachers to manage various mathematics objectives by matching those objectives to the students' skill levels, monitoring students' progress, and providing immediate feedback. This computerized curriculum-based management system automates the tasks of scoring, record keeping, and assigning practice (Spicuzza, Ysseldyke, Lemkuil, McGill, Boys, & Teelucksingh, 2001). Accelerated Math software can be used in conjunction with regular classroom instruction to add practice assignments, monitor progress of students and to differentiate instruction. The program allows the teacher to assign a beginning level for each student. This effectively individualizes the practice that the software assigns to that student. Student's record answers on special scan cards that are easily scanned and eliminate paperwork for the teacher. Future practice assignments are generated based on results of previous exercises. The software tracks mastery of preset objectives that are aligned with state and grade-level standards (U.S. Department of Education, 2008).

Technology has become especially important in the mathematics classroom. O'Dwyer, Russell, Bebell, & Seeley (2008) examined the relationship between standardized testing scores and computer usage in a sample of 986 fourth grade mathematics students across Massachusetts. Standardized testing has become the measure that we hold educators, schools, educational programs and even our laws and policies against in the past decade. During that same time period substantial investments have been made to increase computer technology and the

availability of that to all students. This study is based on the fact that students have traditionally developed stronger critical thinking skills and higher-order thinking skills in a technologically rich environment.

Therefore, computer based progress monitoring and instructional management systems, such as Accelerated Math, have been proven useful in helping differentiate and individualize instruction. Educators must focus an increasing amount of their effort into meeting the needs of all students in a diverse learning environment. By implementing curriculum- based instructional management systems in the mathematics classroom teachers were better able to provide meaningful instruction to all ability levels represented in their student population.

Ysseldyke and Tardrew (2007) found that when these programs are successfully implemented all grade levels increased greatly in grade equivalency scores and percentile gains. The gains were evident across all achievement areas, meaning that students that were in the low-, middle-, and high- achieving groups at the beginning of the study showed consistent gains in mastered objectives. Their research also showed that results were significantly influenced by the integrity of the program implementation in each classroom. Teachers in classrooms that utilized the progress monitoring and instructional management systems were able to spend more time engaged in individual instruction rather than whole group instruction. Those teachers felt better able to meet their students various needs.

This research also reported positive effects on the students' attitudes toward mathematics. Those students in the classrooms with the progress monitoring and instructional management systems reported that they liked math more than in previous academic years. They also reported that they felt that they helped other students in math more. This study showed that adding a progress monitoring and instructional management systems in the classroom positively

influenced the academic performance, teacher motivation and students' perception and performance (Ysseldyke & Tardrew, 2007).

On the other hand, the U.S. Department of Education's What Works Clearinghouse (2008) reviewed the Ysseldyke and Tardrew 2007 study. According to this report, the study was designed for school principals to randomly assign treatment and control classrooms, but the researchers had no control over this assignment and ultimately reported that they had no basis to claim random assignment. Ysseldyke and Tardrew reported a statistically significant positive effect of Accelerated Math for grade 6 according to the STAR Math test. They also reported a positive but not statistically significant result for grades 7-8. After adjusting the data for previous misalignments, What Works Clearinghouse determined that neither finding was statistically significant or large enough to be considered important according to their criteria.

Research regarding utilization of curriculum-based instructional management systems has been conducted and proven positive results in various school settings. Results have shown that students in large urban schools benefit from using curriculum-based instructional management systems in the classroom. Ysseldyke, Spicuzza, Kosciolk, and Boys (2003) studied a large urban school in the Midwest. The demographics of this study included 31% English Language Learners, 71% Free or reduced lunch recipients, 11% special education students, and 77% minorities. Students from four elementary schools were placed into one of two groups, the classrooms receiving the software and classrooms that will be monitored without the software. Teachers in the classrooms studied were trained to use the software appropriately and allowed to decide how to implement it into their classrooms.

The results of the study showed that students in the fully implemented classrooms received higher scores on standardized testing at the end of the treatment period, in this case the

school year. Students from all ability groups improved their standardized test scores after using the progress monitoring and instructional management system software in mathematics. This study showed that after one year of utilization, students from all ability groups surpassed national norms even when they started below national norms before the software utilization (Ysseldyke, Spicuzza, Kosciolk, & Boys, 2003).

Ysseldyke, Betts, Thill, and Hannigan (2004) studied the effect of instructional management systems to improve mathematics skills in 24 U.S. states. The study included 870 students in 47 schools Title I programs. The study was conducted to determine if the effects of the progress monitoring and instructional management system held true when Title I students were studied alone. The students studied were those receiving the software intervention and those that received traditional instruction alone. These students were a subgroup in a larger previous study conducted by Ysseldyke and Tardrew (2003).

The results of the previous study held true. They showed that students using the progress monitoring instructional management software intervention had a significant improvement over students that received traditional instruction alone. The treatment group showed an average gain of 7.9 normal curve equivalents (NCEs) over the comparison group (Ysseldyke, Betts, Thill, & Hannigan, 2004).

Additionally, Ysseldyke, Tardrew, Betts, Thill, & Hannigan (2004) studied students that qualified as gifted and talented separately from the general student population. The study concentrated on the mathematical performance of gifted and talented students as well as the differences in performance between gifted and talented and non-gifted students when utilizing a progress monitoring instructional software, Accelerated Math. The study was conducted from a number of states and using over 2,000 students. The teachers were trained in using the software

and utilized it in their classrooms for four months in addition to usual classroom instruction. The performance was assessed using a pre and post test method.

Accelerated Math utilization accounted for greater gains in all students that participated in the study, especially the gifted and talented students. Students in the treatment classrooms showed greater gains in achievement than other gifted and talented students who did not receive the software intervention. The fact that gifted and talented students obtained a higher percentage correct and attempted more items on the tests confirms that the great benefit to using the progress monitoring instructional software Accelerated Math is that these students can learn at their own pace. In today's diverse classroom, this type of differentiated instruction is invaluable (Ysseldyke, Tardrew, Betts, Thill, & Hannigan, 2004).

In summary, most of the available research strongly supports the use of the progress-monitoring software Accelerated Math as an effective way to increase students' mathematic achievement. However, questions do arise regarding the methodologies of some previous studies, and the measures of implementation integrity, since this has largely been left up to the classroom teacher. No Child Left Behind has imposed a new level of accountability in achievement gains on all levels of the educational system. With increasing importance being placed on standardized testing, administrators, principals and teachers must determine what technologies are effective and useful in differentiating and individualizing instructions for students of all ability levels.

Methodology and Procedures

The purpose of this study was to investigate the effects of the utilization of the mathematics software Accelerated Math by individual students on grade equivalency scores as reported by STAR Math testing at a rural Northeast Tennessee public elementary school.

The population for this study consisted of 100 students enrolled in kindergarten through sixth grade at a rural public elementary school. These students lived in an area where the median household income was \$30,447 annually. This was below the state average of \$42,389 annual income. Households in this population averaged 2.35 people living within each dwelling. The population also had 21.9% of the students' households under the federal poverty level as reported by the US Census Bureau. This was higher than Tennessee's average below poverty level of 15.8%. The elementary school studied reported a large majority (74%) of its students as economically disadvantaged.

Furthermore, the ethnic breakdown of the population of the rural public elementary school studied reflected Tennessee's overwhelmingly Caucasian population. The population of the school included 99% of students were of Caucasian decent, and the African- American population represented the remaining 1%. No other ethnicities were represented in the elementary schools. Female students made up the majority with 56%, and males comprised 44%.

The participants in this study were all students enrolled in fourth through sixth grades at the rural Northeast Tennessee elementary school where the research was conducted. The sample consisted of 37 students enrolled in fourth through sixth grades. Out of those 37, 12 students were selected to participate in the control group. The control group was comprised of 11 males and one female. These were students that did not participate in Accelerated Math, computer

progress monitoring system. Out of the 37 students, 12 were randomly selected to participate in the experimental group. The experimental group included seven males and five females who participated in Accelerated Math computer progress monitoring system.

Data were collected with a main focus on grade equivalency, but were also examined to determine an effect of Accelerated Math on number operation proficiency. The data for this study came from reports available in the Accelerated Math program and in the STAR Math program. One data source was the STAR Math program testing. STAR Math testing reports were used to determine the mathematic level of each student, and to measure individual and class growth over time. These reports were generated after each student completed the testing process which was usually completed in about 15 minutes and re-administered as often as necessary.

The final data source was the Test Record Report obtained from the STAR Math testing reports. This report provided the grade equivalency for each student at the beginning of the research period. This was used as the individual student's baseline. The Test Record Report was repeated at the end of the research period and used to determine changes in grade equivalency over the test period and number operation objective mastery.

Procedures

Prior to the researcher beginning this study, permission was requested from the principal of the elementary school and consent was sought from the parents of the students in the population. Once written approval was received from both, the sample was selected, including 12 students for the control group and 12 students for the experimental group. After the sample was selected, data were collected using STAR Math testing and Accelerated Math reports. Data were analyzed using T test for independent means.

Results

Research Questions

Two research questions were used to guide the analysis of data:

Research Question 1: Is there a difference in the grade equivalency score between the students who participated in Accelerated Math and those who did not?

Research Question 2: Is there a difference in number operation proficiency between the students that participated in Accelerated Math and the ones that did not?

Each research question was followed by a research hypothesis. Both research questions were analyzed using independent t-tests. The results for research question 1, yielded significant results ($t(22) = 2.543, P < .05$). Research question 2 did not yield significant results. Results for research question 1 are displayed in table 1.

Table 1

T-test for Independent means for Participation in Accelerated Math and Grade Equivalency

Group	Mean	SD	df	t-value	Sig. (2-tailed)
Experimental	6.275	2.614	22	2.543	0.019
Control	4.125	1.3219			

Note $p > .05$

Discussion

Research question 1 stated is there a difference in the grade equivalency score between the students who participated in Accelerated Math and those who did not? In regard to Research Question 1, an independent sample T-test was performed and mean scores for each group were calculated for both the experimental and control groups. The experimental group's grade equivalency mean was calculated to be 6.275. The control group grade equivalency mean was calculated to be 4.125. The results indicated that there was a significant difference in the grade equivalency scores between the control and experimental groups. These results were consistent with research from the literature review that indicated when programs such as Accelerated Math were successfully implemented all grade levels studied greatly increased grade equivalency scores and percentile gains (Ysseldyke & Tardrew, 2007). The experimental group consisted of students that chose to actively participate in the Accelerated Math computer software. The fact that these students chose to participate in the Accelerated Math computer software and work to master mathematics objectives showed that they were motivated to improve mathematic skills.

Research question 2 stated is there a difference in number operation proficiency between the students that participated in Accelerated Math and the ones that did not? In regard to Research Question 2 an independent samples T-test was performed and mean scores for number operation proficiency were calculated for both the experimental and control groups. The experimental group's number operation proficiency level mean was calculated to be 3.08, while the control group mean was calculated to be 2.25. Even though the mean for the experimental group is higher, the results indicated that there were no significant difference in number operation proficiency between the control and experimental groups. The research in this study indicated that students exposed to computer assisted instruction show higher achievement than

those exposed to traditional instruction alone (Deubel, 2001). The researcher believes the lack of significance in this instance could be attributed to the fact that data were collected after an extended holiday break in a school system that missed a high number of days due to winter weather. These students lost over 20 instructional days in addition to the scheduled vacation. This lost time may have affected skill retention as well as student motivation.

Conclusions

The purpose of this study was to determine if there was a significant difference between the grade equivalency scores of students that utilized the computer software Accelerated Math and those that did not use the product. The researcher also examined the effect Accelerated Math utilization had on number operation proficiency of the same students. Two independent T-tests were conducted. The results indicated that there was a significant difference in the grade equivalency score for the students that participated in the Accelerated Math computer software program and those that did not participate. The results showed that the students that participated in the Accelerated Math program earned a higher grade equivalency score. However, the results of the second T-test failed to show a significant difference in the number operation proficiency levels of the students studied.

References

- Accelerated Math (n). Wikipedia online encyclopedia. Retrieved from http://en.wikipedia.org/wiki/Accelerated_Math
- Barnett, H. (2003). *Investing in technology: The payoff in student learning*. Syracuse, NY: Retrieved from www.eric.ed.gov
- Deubel, P. (2001). The effectiveness of mathematics software for Ohio proficiency test preparation. *Journal of Research on Technology in Education*, 33, 75-85.
- Fuchs, L. & Fuchs, D. (2001). What is scientifically-based research on progress monitoring. Retrieved from: www.studentprogress.org
- Kosciolek, S. (2003). Instructional factors related to mathematics achievement: Evaluation of a mathematical intervention. Doctoral dissertation. Minneapolis, MN: University of Minnesota
- O'Dwyer, L.M., Russell, M., Bebell, D., & Seeley, K. (2008). Examining the Relationship between Students' Mathematics Test Scores and Computer Use at Home and at School. *Journal of Technology, Learning, and Assessment*, 6(5). Retrieved from <http://www.jtla.org>.
- Nunnery, J. A., & Ross, S. M. (2007). The effects of the School Renaissance program on student achievement in reading and mathematics. *Research in the Schools*, 14(1), 40-59.
- Spicuzza, R., Ysseldyke, J., Lemkuil, A., McGill, S., Boys, C., & Teelucksingh, E. (2001). Effects of curriculum-based monitoring on classroom instruction and math achievement. *Journal of School Psychology*, 39(6), 521-542.
- U.S. Department of Education, Institute of Education Sciences. (2008). *Accelerated Math*. Retrieved from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/3f/6f/57.pdf

- Ysseldyke, J.E., Spicuzza, R., Kosciulek, S., & Boys, C. (2003). *Effects of a learning information system on mathematics achievement and classroom structure.* *Journal of Educational Research*, 96(3), 163–173.
- Ysseldyke, J., Spicuzza, R., Kosciulek, S., Teelucksingh, E., Boys, C., & Lemkuil, A. (2003). Using a curriculum-based instructional management system to enhance math achievement in urban schools. *Journal of Education for Students Placed At Risk*, 8(2), 247–265.
- Ysseldyke, J. & Tardrew, St. (2007) Use of a progress monitoring system to enable teachers to differentiate mathematics instruction. *Journal of Applied school Psychology*, 24(1), 1-28.
- Ysseldyke, J., Tardrew, S., Betts, J., Thill, T., & Hannigan, E. (2004). Use of an instructional management system to enhance math instruction of gifted and talented students. *Journal for Education of the Gifted*, 27(4), 293–310.
- Ysseldyke, J.E., Tardrew, S., Betts, J., Thill, T., & Hannigan, E. (2004). *Use of an instructional management system to enhance math instruction of gifted and talented students.* *Journal for the Education of the Gifted*, 27(4), 293–310.
- Ysseldyke, J.E., Thill, T., & Hannigan, E. (2004). *Use of an instructional management system to improve mathematics skills for students in Title I programs.* *Preventing School Failure*, 48(4), 10–14.