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Will Standards-Based Instruction Improve Student Achievement in the Areas of Mathematics?

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WILL STANDARDS-BASED INSTRUCTION IMPROVE STUDENT ACHIEVEMENT IN THE AREAS OF MATHEMATICS?

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DEDICATED
To
Kim, Megan, and Michael

Without your support this work could not have been accomplished.

ABSTRACT

The author conducted this longitudinal study to gain an objective view of the instructional practices on student achievement. The author, an elementary principal, facilitated a change in philosophy and practice, especially in the area of mathematics.

This study confirmed that there is a statistically significant impact on student achievement when a standards-based instructional program is implemented. The data in the study also indicated that a significant number of students improved their achievement score based on CTB-McGraw Hill Terra Nova Assessments.

This study also indicated a significant demographic factor that will need to be further researched. Fifty percent of the students will change between first grade and sixth grade due to an extremely transient population. This school has a twenty-seven percent Free and Reduced lunch population. Are the two factors related? That will be for another study. However, it is noteworthy that student scores from the sample group indicated a two grade level increase in one year. Does standards-based instruction have an impact on student achievement in mathematics?

Finally, the study explored other areas of the instructional process and makes specific recommendations for the school and school district to apply the results of the study. The goal for every level of the educational institution is to improve student achievement. It is the author's hope that the information

presented in this study will further that goal.

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CHAPTER 1

INTRODUCTION AND RATIONALE

The motivation for this research study comes from personal desire to improve student achievement in the area of Mathematics. The author, currently an elementary administrator, incorporated standards-based activities into his special education classroom for several years. As an administrator charged with improving student achievement, the author began to analyze current instructional practices and curriculum. Several questions emerged: How do we implement performance-based instruction with our current curriculum? What tasks are appropriate for each grade level? What does a good performance-based task look like and how do we develop this task? Should this be the only method of assessing students now? Finally, and most importantly, does standards-based instruction improve student achievement in the area of mathematics?

Interest in this subject was prompted by the author's experience designing mathematics curriculum for his school district. The school district is currently in the process of adopting a new mathematics curriculum and part of this curriculum development is to correlate mathematical tasks to the Show-Me Standards. Demands on teachers to present a standards-based instruction and assessment program that correlates to a district curriculum is essential. The author is

currently serving as the curriculum facilitator for mathematics. Our charge is to develop and implement a standards-based mathematics curriculum. The author's duties serve as a source of motivation to conduct this research project.

This research study looked specifically at performance-based instruction, tasks, and assessments in the area of mathematics. A question that immediately comes to mind is, "Why are research standards-based instruction and assessment together?" According to the National Council of Teachers of Mathematics, (NCTM):

> In the NCTM Standards Document, the phrase mathematical power has been used to capture the shift in expectations for all students. The shift is toward understanding concepts and skills; drawing on mathematical concepts and skills when confronted with both routine and non-routine problems; communicating effectively about the strategies, reasoning, and results of mathematical investigations; and becoming confident in using mathematics to make sense of real-life situations. It is away from mastering a large collection of concepts and skills in particular order. (NCTM Assessment Standards, 1996, p.2).

Once schools and teachers evaluate the way they teach they need to correlate instruction with assessment:

> As schools and teachers change their practices, they face the dilemma that the result of their efforts to meet new goals may not be supported by traditional assessment practices because such practices are inconsistent with these new views of mathematics and how learning progresses. (NCTM Assessment Standards, 1996, p.3)

The 1993 Outstanding School Act, now law in Missouri, put into force challenging academic standards for all students. The Outstanding Schools Act established the Show-Me Standards, defining what students should know and be

able to do. Therefore it established the purpose of researching what materials or types of tasks should be considered in reforming what we teach.

The real challenge with the Outstanding Schools Act is that it relates a standards-based curriculum with instruction and assessment. This signifies changes in the way teachers have been teaching. It also changes the way curriculum is designed, but most importantly, it changes the way students are assessed. The Outstanding Schools Act recognized the need for professional development by establishing professional standards for all educators. The act also mandated that one percent of the local school district's basic state aid and one percent of the educational budget be set aside to support professional development for educators.

The area of mathematics was first to be addressed because of the efforts of The National Council of Teachers of Mathematics. The NCTM established documents regarding assessment, curriculum and standards-based instruction in the early 1990's. The work of the NCTM created the foundation for reforming mathematics education. The NCTM was first to establish the link between assessment, instruction, and curriculum. Research supporting NCTM is plentiful. Coates (1995) states that student learning, teacher instruction and assessment should not be separate entities, but support each other. Other educators continue to relate assessment, instruction and curriculum design.

Change is slow to happen. Though mandated by law, many classroom teachers still have not adopted a standards-based approach to their teaching. While in pursuit of new directions in writing research, Sara Lundsteen (1976) indicated that change in school practices stalls because sufficient data to support change is not usually available. Consequently, teachers are slow to move, change, or adjust their teaching simply because there is not a method or framework to go by. The author found a very limited number of studies that compared student performance receiving traditional mathematics instruction with those students receiving a standards-based instructional program. Therefore, the author firmly believes this research will add significantly to the body of knowledge about the effects of standards-based instruction and perhaps provide
A foundation on which the author could develop a framework for standards-based instruction, assessment, and curriculum design.

Statement of the Problem

Will standards-based instruction improve student achievement in the area of mathematics?

Hypothesis

Teachers who provide mathematics instruction using a standard-based methodology will improve student achievement.

Definitions of Key Terms

This study uses several terms that need defining. These terms include ***standards, performance assessment, task, prompt, rubric, analytical trait scoring, criterion-referenced assessment, benchmark, holistic scoring guide, standards-based instruction, and Missouri Frameworks.*** Arter and Blum (1996, p. x-1: 1) refers to ***standards*** as statements of what students should know and be able to do when they complete school. ***Performance assessment*** is referred to as the process of quantifying, describing, or gathering information about performance (p. x-1: 1). The NCTM (1995, p. 91) describes task as an assigned, purposeful, contextualized activity. ***Missouri's Frameworks*** for ***Curriculum Development*** provides a discussion of how districts might begin to explore the advantages of curriculum integration (D.E.S.E. 1996).

Task is an activity, exercise, or problem given to the students to perform (Archer and Blum, 1996). Before the student can begin to work on their task, the student will need to know what he or she is expected to do. A ***prompt*** is an assignment or directions asking the students to undertake a task or series of task (Arter and Blum, 1996). A ***rubric*** is an established set of criteria for scoring or rating student's performance on task (Arter and Blum, 1996). The NCTM (1995) describes a ***rubric*** as the following:

> A set of authoritative rules to give direction to the scoring of assessment tasks or activities. To be useful, a scoring rubric must be derived from careful analysis of existing performances of varying quality. A task-specific rubric

> describes levels of performance for a particular complex performance task and guides the scoring of that task consistent with relevant performance standards. (A task-specific rubric is more specific than a performance standard and can apply a performance standard to a particular context found in a performance task.) A general rubric is an outline for creating task specific rubrics, or for guiding expert judgment, where task specific scoring rules are internal to the scorer. (p. 90)

The author has described standards and rubrics, which a teacher employs to construct instructional tasks. Curriculum frameworks have also been discussed.

Research produced the following assessment models and definitions:

> ***Analytical Trait Scoring*** is a scoring procedure in which performances are evaluated for selected dimensions or traits with each trait receiving a separate score. For example, a piece of writing may be evaluated according to organization, use of details, attention to audience, and language usage/mechanics. Trait scores may be weighted and /or totaled (p. x-1: 1).
> ***Criterion-Referenced Assessment*** compares a student's performance according to a description of the desired performance. For example, she typed 55 words per minute without errors (p.x-1: 2).
> ***Benchmark*** is an interpretation of a performance standard according to age, grade, or developmental levels (p. x-1: 2).
> ***Holistic Scoring*** refers to assigning one overall score to a performance (p. x-1: 3).

Finally, ***standards-based instruction*** is defined as an established level of achievement where the instruction, provided by the teacher, results in observation of student performance or work in content areas. This observation meets the stated criteria of what the students should know and be able to do at the end of the instructional period.

Research Problems

Several questions surfaced during the course of this research. These foreshadowed problems may provide direction and offer significant implications for analysis of the finding from this study.

1. Will student achievement in mathematics be affected by the student's ability to express their knowledge in writing?

2. Are teacher training programs in place to present new standards-based instructional methods?

3. Will assessment change to match instruction?

4. What effect will standards-based instruction have on the growth of mathematical skills for regular education students and those receiving special services (Learning disabled and behavior disordered)?

5. Will there be changes in attitudes of students and teachers towards mathematics?

CHAPTER II

LITERATURE REVIEW

The research literature compiled for this study falls into three distinct categories. The categories are listed below to provide an overview.

Instruction

Curriculum

Assessment

Instruction

For the purposes of this study, the instructional literature review focused on instruction at the elementary level. Since the NCTM released its Professional Standards for Teaching Mathematics in 1991, research was slow to develop in the area of instructional strategies. As states began to implement new educational mandates, such a Missouri's 1993 Outstanding School Acts, requiring school districts to allocate a percentage of state aid for professional development, research started to develop in the area of performance-based instruction.

Jay McTighe (1996) suggested seven performance-based instructional principles that instructors should follow in order to implement an effective performance-based curriculum. McTighe applied his principles in classrooms and gathered from this experience to give validity to them. This research study will

be focused on McTighe's seven principles of performance-based instruction as a foundation for developing performance-based tasks in mathematics.

The first principle is to establish clear performance targets. The following excerpt established the connection between assessment, curriculum and instruction.

> The principle of establishing clear performance targets and the goal of teaching for understanding fit together as a powerful means of linking curriculum, instruction, and assessment. A performance-based orientation requires that we think about curriculum not simply as content to be covered but in terms of desired performances of understanding (McTighe, p.7).

McTighe is supported in this first principle by Missouri's Frameworks for Curriculum Development which established a link between instruction, assessment, and curriculum. Setting clear targets for students should be the primary goal when establishing a performance-based instructional format. These performance standards should reflect curriculum performance goals. (MO DESE, 1996)

McTighe's second principle tells us to strive for authenticity in products and performance. McTighe stated educators need to design activities that reflect real-world activities. This leads into the third principle, to publicize criteria and performance standards. Give students the rubric or scoring guide that states how their performance will be judged.

McTighe's seven principles are interconnected. In the fourth principle, instructors are to provide models of excellence. McTighe states that students may need more than a rubric or scoring guide to immediately understand the criteria. The following excerpt provides the reader with a clear understanding of this fourth principle.

> In this way, students learn the criteria of quality through tangible models and concrete examples. In some classrooms, students actually help to construct the scoring tools (rubric, rating scale, or performance list), based on their growing knowledge of the topic and the criteria they have identified in the examples. (The potential benefits of providing students with tangible examples underscore the value of saving examples of student work form performance tasks for use as models in future years!)(p. 10)

The fifth principle has teachers teach strategies explicitly. If you want a student to summarize, teach them to summarize. If you want a student to solve problems in mathematics, teach them the problem-solving method you want them to use – teach students the "process they are to follow in completing their task. Use ongoing assessment for feedback and adjustment is the sixth principle. This approach simply states for teachers to assess at various points in the process and not wait for the final product. The seventh and final principle explains the importance of documentation. Celebrate student achievement!

An article by Richard Stiggins (1996) also related performance-based instruction to curriculum and assessment. Stiggins suggested a blueprint in which to design a performance-based lesson. Stiggin's blueprint design consists of three parts: clarifying performance; developing exercises; and scoring and

recording results. Stiggins stated that these three parts of a task blueprint can be presented in reverse order (p. v-8: 1 – v-8: 9). Stiggin's research suggested that the elements of a task blueprint could be presented in reverse order. This presented a different way of approaching instruction. The research uncovered recommendations made by Grant Wiggins (1992), a recognized authority on performance-based instruction and assessment.

> All real world performers know the target and standards, not just their task, in advance; such knowledge guides their training and rehearsals. Students should never have to wonder "Is this right?" "Am I finished?" "How am I doing?" "Is this what you want?" (Wiggins, p. 29).

Wiggins made a case for presenting students with the scoring guide, or rubric, before they begin a performance assessment. William Lazzaro published research which put Wiggins' recommendation to the test. Lazzaro (1996) initiated a plan using scoring rubrics extensively during the 1992-1993 school year at Damascus Elementary School. Students were given the rubric prior to beginning work on a performance-based task. The result of this instruction was seen in 1993 at a Maryland School. The students at Damascus Elementary School had substantially higher scores when compared with students throughout the state of Maryland. Lazzaro made this closing statement regarding performance-based instruction and assessment.

> In light of Wiggins' suggestions, and the classroom experiences of teachers using rubrics, we are convinced that students should be given the rubric for performance assessment before they begin the task. If performance assessments are to measure what students can do, it is essential that

students understand the scoring criteria so they can produce their best work. The challenge to teachers is to instructionally use rubrics to help students understand and apply the criteria to improve their performance (p. VI–3:1 – VI-3: 9).

Curriculum

Organizing the research on standards-based curriculum was a little more difficult. There are few studies with statistical results that can document that a particular curricular design will be successful for students. However, there are many articles that make suggestions on what and how to make decisions regarding learner goals. The Frameworks for Curriculum Development in Mathematics have been compiled by the Missouri Department of Secondary and Elementary Education. (Mo. DESE, 1996)

Robert Blum (1996) prepared an article for the Handbook for Student Performance Assessment. In this article Blum stated that learner goals should be developed locally. These learner goals should be connected to standards for instruction, especially when making a curriculum. Blum also indicated that school districts have an obligation to the community to gather information about the community's needs and develop a curriculum that is focused on meeting the community's needs.

"Assessment is fundamental to the improvement of education; it provides measures of success for student learning" (Paris et al, October 1992 p.88).

Research revealed a framework for authentic, performance-based literacy assessment. Though the focus of this research was on mathematics, this framework certainly could be adapted to fit a mathematics program. This research also introduced a framework for assessment that contains five phases of decision making that policy makers should consider when they revise their assessment practices or design their curriculum.

Phase one deals with identifying the dimensions; what are the standards that students should be performing at? What is the criteria? How are the students to be assessed? Phase two asks the decision-makers to identify the attributes of the dimensions students are expected to perform within. What is the exact process for which the student is to work? Methods for collecting evidence is phase three. What tasks are expected of the students? Phase four is scoring students' work samples. Phase three and four go hand in hand. This third and fourth phase can be reversed, by presenting the scoring guide the way Wiggins described first. So, phase four can be the scoring guide and phase three can be the task description. The fifth phase involves interpreting and using the data obtained from student performances.

Diane Coates (1995) presented arguments for curriculum reform in an article entitled, ***"Alternative Assessments to Reflect a Changing***

Mathematics Curriculum." Coates focused on the move to reform assessment in mathematics, and in order to do so mathematics curriculum needs to be revamped.

Missouri's Frameworks for Curriculum Development is designed to be a resource for teachers. A Curriculum is not required by law. However, curriculum sets the standards by which student performance and achievement can be measured. The Missouri Frameworks for Curriculum Development are resources:

- To assist districts in developing curriculum consistent with the Show-Me Standards.
- To indicate what students should know and be able to do by the end of grades 4, 8, and 12.
- To support teachers in providing high-quality learning experiences for all students.
- To suggest examples of hands-on, real-world activities and classroom performance assessments.
- To suggest effective learning and teaching strategies supported by research and practice.
- To initiate discussions concerning curriculum integration within and across classrooms.
- To provide examples of quality student work requiring knowledge and application of that knowledge (MO. DESE, 1996).

Assessment

The final key to this research study is assessment. How well did students perform based on the criteria, or standards, that have been established for instructional delivery and assessing what we are teaching students is a key element in measuring student achievement. Arter emphasizes:

> Clear criteria for performance are essential in a performance assessment if we are to be consistent in judging student work. However, performance criteria can be more than just a means for making consistent judgements about students. They can also be indispensable tools for learning in the classroom (1996, p.VI-2: 2).

Grant Wiggins (1993), President and Director of the Center on Learning Assessment, in his article entitled ***"Assessment: Authenticity, Context, and Validity",*** described performance as a "means to execute a task or process and to bring it to completion" (p.204). The focus of Wiggins' research was to make sure assessment design is authentic and is directly related to the task. In this article, Wiggins presented a set of criteria for judging the authenticity of a test. Authentic tests of intellectual performance involve the following factors.

- Engaging and worthy problems or questions of importance, in which students must use knowledge to fashion performance effectively and creatively.
- Faithful representation of the contexts encountered in a field of study or in real-life "test" of adult life.
- Non routine and multistage tasks – real problems.
- Tasks that require the students to produce a quality product and/or performance.
- Response-contingent challenges in which the effect of both process and product/performance determines the quality of the result.
- Trained assessor judgment (p.206-206).

Test validity is of great concern for assessors. During performance-based instruction it is important to assess what we are asking the students to perform in a task. If we want students to perform a task that requires the students to identify

and describe mathematical patterns and to describe their relationship, it is only appropriate to assess the mathematics portion of this assessment. It would not be appropriate to assess language elements of describing the mathematical patterns. This brings to light one of the foreshadowed problems dealing with teacher training. Educators must be trained to write tasks that specify the tasks students are to perform and the assessment tool is an accurate measure of the criteria. Assessors must be able to assess a task in mathematics, identify the performance criteria and not assess other elements of the task not related to the assessment. Wiggins continued:

> The bottom line is that validators have an obligation to review whether a practice has appropriate consequences for individuals and institutions, and especially to guard against adverse consequences. You ... may prefer to exclude reflection on consequences from meanings of the word validation, but you cannot deny the obligation." But we would prefer a somewhat stronger phrasing, because the meaning of validation should not be considered a preference" (p.212).

The goal of assessment, according to Hibbard (1996), is to coach students to become independent learners (p. VI-6: 3). Assessment tools that students have been using to complete tasks need to be weaned away from students by the completion of high school. This excerpt from Hibbard explains the relationship between instruction and assessment. "If you walk into a classroom where students are using assessment lists and models of excellence to shape and assess their work and you ask whether you're watching activity or the assessment activity, the answer is absolutely" (p. VI-6: 3).

The most basic tool in performance assessment is the rubric. The rubric needs to be correlated to the performance criteria in order to validate the assessment. This process of applying standards and criteria in a rubric to student performance is known as anchoring. There are several steps that need to be taken in order to accomplish this process of validating and anchoring. Stephen Hess (1996) concluded, "that regardless of the actual plan, it is critical that each district or school attempting to design performance assessments have an agreed upon method to validate and anchor student performance" (p. V-9: 2).

Most of the research concerning assessment has referred to formal methods of assessment. Recently, there has been a great deal of research regarding the use of portfolio assessment. Portfolio assessment can be very practical for the classroom teacher, however, reliability from one teacher to the next is suspect. Portfolios can be an excellent method for informal evaluation to use with students and parents. (Wiggins, 1996)

Summary of Literature

Mathematics instruction has not changed a great deal until recently. Since the NCTM Standards appeared on the scene in the Spring of 1989, mathematics instruction and assessment has focused more on the process that it has on getting the right answer. Grant Wiggins (1993) emphasized scoring rubrics be aligned to the task criteria. This process provides validity to the assessment. Stephen Hess (1996) went a little further in identifying this process of validation as anchoring. Research continues to emphasize teacher training as an intricate part of reforming assessment strategies. The research, explored by the author for

this proposal, emphasized the correlation between instruction, curriculum design, and assessment.

Based on the research reviewed, the best way to develop mathematical tasks and assessments that validate the instructional task will be to continue with staff development and new teacher training in the areas of standards-based instruction and assessment. Curriculum must also become standards-based with an emphasis on what the student knows and should be able to do, based on established criteria.

CHAPTER III

METHODOLOGY AND PROCEDURE

Introduction

This causal-comparative research study attempted to determine if standards-based instruction improves student achievement in the areas of mathematics. This study followed a group of sixth grade students over a period of two years. This study compared instructional practices in mathematics to determine if there is a significant improvement in student achievement. This study group was compared with a national average to determine if there is a significant gain in student achievement when compared with the national norm group. This chapter discusses the research design, instrumentation, participants, reliability, validity, data collection, and results of this study.

Subjects

The student participants in this current study were 59 sixth grade students from three classrooms. The students all attend South Point Elementary School. South Point is located in Washington, Missouri. Ten of these students were resource students whose data is included in this study. The resource students were made up of ten boys and two girls. Overall, thirty-one boys and twenty-eight girls participated in this study. Fifty-eight of these students were white and one student was African-American.

Sample Procedure

This current study of sixth grade students were exposed to the same treatment of

standards-based instruction. The group was an even split of boys versus girls. The group of the students fell within the accepted guidelines of the district. No student was older than twelve years of age and not younger than eleven years of age. The students used in this study were chosen simply by their enrollment at South Point Elementary.

Research Setting

This study took place in a suburban setting, outside of St. Louis, Missouri. The sixth grade students who participated in this study came from two classrooms of twenty students and one classroom of nineteen students. The student data was collected in each classroom during the spring of each year.

Research Design

The research design for this study included two parts. One part consisted of a pre and post-test for each member of the study group. The pre / post test allowed for comparison of the study group so that the significance of the independent variable could be measured statistically. In this study the independent variable was the application of standards-based instruction to the study group. The hypothesis studied stated that the average of the post-test must be equal to or greater than the average of the pretest. The statistical measure used to determine if the hypothesis can be accepted was a Dependent "T" test. Table 3.1 provides information on the group that was studied and the relationship between the independent and dependent variables in this study.

Table 3.1

GROUP	INDEPENDENT VARIABLE	DEPENDENT VARIABLE
6th Grade Students	Standards-Based Instruction	Terra Nova Mathematics Assessment

The second portion of this research was designed to compared the study group's average score to the average score of the national norm group in the area of mathematics.

Table 3.2

GROUP	INDEPENDENT VARIABLE	DEPENDENT VARIABLE
I - Sample Study Group	Standards-Based Instruction To 6th Grade Students in Sample Group	CTBS – Terra Nova Mathematics Scaled Scores Average
MEAN – 684.4 **STANDARD DEVIATION – 32.2** **STUDENT SAMPLES - 59**		
II- National Norm Group	National Instructional Practices	CTBS – Terra Nova Mathematics Scaled Scores Average
MEAN – 659		
P value – 5.53 **T value – 2.019**		

The average scaled score of the sample group was significantly greater than the average scaled score for the national norm group. A "One-Sample T Test" was the statistical measurement used to determine the significance of the data.

Research Procedure

CTBS-McGraw Hill Terra Nova assessments were administered to the sample group

in the spring of 2001 and 2002. The assessments, when completed, were then shipped back to CTBS-McGraw Hill for scoring. CTBS-McGraw Hill also provided the national averages needed for comparisons. The Terra Nova Mathematics Assessments were administered by two different teachers. The first teacher administered the assessments to the entire study group in 2001. The second teacher administered the assessment to the entire study group in 2002. The study group was provided standards-based instruction in the area of mathematics during the 2001 – 2002 school year. The purpose was to use this study to determine if the method of standards-based instruction significantly increases student achievement. Standards-based instruction was defined in chapter one as an established level of achievement where the instruction, provided by the teacher, results in observation of student performance or work in content areas. This observation met the stated criteria of what the students should know and be able to at the end of the instructional period.

Instrumentation

Data obtained from the CTBS-McGraw Hill Terra Nova Mathematics Assessment was used to conduct this study. This is a standardized achievement test. There was one teacher that provided standards-based instruction to the study group. The teacher has extensive training in the area of standards-based instructional practices and has over twenty years of teaching experience.

Validity and Reliability

With any causal-comparative study there are two weaknesses. The weaknesses are a

lack of randomization and inability to manipulate an independent variable. One means to eliminate internal validity is to conduct a matching of subjects. This study did a matching of subjects and eliminated nine students that did not pretest. An additional eight students were dropped from this study since they did not complete the posttest.

Further evaluation of specific threats to validity is necessary. The first area to analyze was in the area of subject characteristics. The socioeconomic level, gender, ethnicity, and marketable job skills are all factors that contribute to students staying in school. The matching of students conducted during this study eliminated these factors from having an adverse affect on the validity of this study. Mortality, location, and instrumentation were not factors threatening validity during this study. Instrument decay can be a threat to validity in casual-comparative studies, however, for this study the data was gathered during a single setting of approximately forty-five minutes. Fatigue was not a factor. Data collection was not a concern since the assessment tool used has a standardized method for administrating the assessment. Data collection was not a factor for this current study. Student data is analyzed by CTBS-McGraw Hill. The data collector was the teacher. The teacher did not score any of the student assessments and therefore did not have any impact on the student data. Dropout rates were not assessed in this study. Finally, other threats such as implementation, history, maturation, attitudinal, and regression threats did not affect this kind of casual comparative study.With these various validity threats having been addressed, the reliability that the results of this study could be replicated were high.

Statistical Treatment of Data and Rationale

The data collected from the pre/post assessment were compared using a dependent "T" test. The "T" test determined if a significant improvement in student achievement actually occurred by making a statistical comparison from student scores on the pretest when compared with the same students and their scores on the post-test.

A one-tailed "T" test was used to compare the sample group mean with the mean of the national norm group. This data reinforced the statistical significance of this study and the importance of standards-based instruction.

Explanation of Data Treatment for Variables

This current study focused on data collection for the dependent variable, which was student achievement. There was no data collection or treatment for the independent variable of teacher instructional practices. The only control was placed on the independent variable where the teacher provided instruction to the sample group.

Summary

This chapter identified the participants, both students and teachers, who participated in this study. The CTBS McGraw Hill Terra Nova was identified as the assessment instrument that was used in this causal-comparative study. Validity and reliability issues were discussed along with the procedure for collecting data and the type of student data to be collected. This chapter finally identified the hypothesis, which will either support findings of a significant increase in student achievement or statistically prove there is not a statistically significant impact on student achievement using standards-based

instruction.

CHAPTER IV

RESULTS

Introduction

This study reports two sets of data. The first set of student data established a baseline score. Students were then exposed to the independent variable, standards-based instruction in the area of mathematics. A post assessment was given to measure the level of student achievement. The results were analyzed using a dependent "T" test. The results of this data are reported in this chapter.

Additionally, results form the second set of student data used a one-sample "T" test to analyze data for comparison between the study group and the national norm group is also reported in this chapter.

Results

The data reported on the pre/post test, grade equivalent, portion of this study indicated a pretest mean of 6.85. The mean for the post-test was 8.87. This data was obtained using a dependent "T" test.

The Terra Nova Mean Scale Score results were provided by CTBS-McGraw Hill. The sample mean scale score for this study was 684.4. The national mean scale score was 659. The standard deviation was 32.2. This data compared the scores of 59 student samples to the national norm group.

Analysis of Data

During the pre/post test the students participating in the sample group were compared to themselves. The application of standards-based mathematics instruction was presented as the independent variable. The students had a grade equivalent mean score of 6.85. The post test grade equivalent mean score was 8.87. This is a two-year gain in student achievement based on the grade equivalent mean score. However, was this a significant gain statistically? After completing the t-test, the t-critical score for measuring the statistical significance of this gain was 2.019. The P-Value for the sample group was 5.53. Since 5.53 is greater than 2.019, it can be concluded that standards-based instruction had a significant impact on student achievement.

A one-sample "T" test was conducted to compare the sample group's mean scaled score to the national norm group's mean scaled score. The mean scaled score for the sample group was 684.4. The mean scaled score for the national norm group was 659. The standard deviation provided by CTBS-McGraw Hill was 32.2. The t-score for this data set was obtained by subtracting the mean scale score of the national group from the sample group. This number was divided by the quotient of the standard deviation divided by the square root of the sample size. The t-critical score was obtained from a table of critical values of t-ratios provided by McGraw Hill. The critical value for this test was 2.390. The t-score obtained from this set of data is 4.657. Since 4.657 was greater than 2.390 then the hypothesis can be accepted that states standards-based instruction had a statistically significant impact on student achievement with the sample group when compared with the national norm group.

Teacher Variable

There was one teacher involved in providing standards-based instruction to the sample group for this study. The pre and post test were given according to the assessment guidelines and the student data were scored by the assessment company outside the school setting eliminating any potential for teacher bias.

Conclusion

Based on the information obtained from both sets of data, this study concluded that standards-based instruction improved student achievement in the area of mathematics significantly.

Summary

When teachers provide a standards-based instructional approach, student achievement increases significantly in the area of mathematics according to this study. The result of this study provided the author with statistically significant data to focus teacher instruction. The data supported further discussion on instructional methodology and the impact the instructor has on curriculum and assessment. This will be discussed in greater detail in the final chapter. Though there was student matching during this study for reliability and validity reasons, it is worth mentioning again that fifty percent of the students change every five years at this elementary site. This becomes a significant factor as instructional methods, curriculum, and assessment strategies are considered. Additionally, application of these findings should be considered for all grade levels and content areas.

CHAPTER V

DISCUSSION

Introduction

The possible impact of this study in the areas of curriculum development and assessment is explored. Furthermore, the implications for effective schools and recommendations based on the data obtained from this study is also discussed.

Implications for Effective Schools

What are the implications of this research for effective schools? First, the data from this research indicated that instructional practices, specifically standards-based instruction, had an enormous impact on improved student achievement in mathematics. The next question to be discussed is, "How do we implement standards-based instruction with our current curriculum?" A recommendation would be to re-write the mathematics curriculum for this district. The essential skills that identify what students should know and be able to do at a particular grade level need to be identified. Once the essential skills can be identified it becomes easy to determine what standards-based tasks are appropriate for students at each grade level. Teachers will want to know what a good instructional task looks like and how to develop the task.

Recommendations

Based on the data from this research, standards-based instructional practices can have a significant impact on student achievement in mathematics. The school district should develop a comprehensive school improvement plan that is student focused. As part of the school improvement plan, a goal is needed to provide professional development to teachers in the area of standards based instruction and assessment. This provides an opportunity to model good performance tasks and instruct teachers on how to develop these types of standards-based performance tasks. An excellent model was produced by the Pattonville School District (1997) based on work by Jay McTighe and identified the key elements of a performance assessment. It also provided a template to guide teachers in the development of a standards-based performance task.

The implication on instructional practices and its relation to curriculum and Assessment was previously mentioned. It is vital that curriculum and assessment be designed to support standards-based instructional practices. This can be accomplished through collaboration with teachers, administrators, and parents. However, depending on the district, this could mean a major overhaul to an educational system such as re-writing the entire mathematics curriculum for the school district. The curriculum will need to identify the essential skills and be able to define what the students should know and be able to do. This allows for instruction to be assessed so that it can clearly be determined that the student

has mastered the essential skills. Another recommendation is to consider a change the way grades are reported. Perhaps a change in the format of the district's report card is needed.

Summary

The findings of this study suggest that the standards-based instructional practices implemented by the two teachers have a significant impact on student achievement. How much did the student's ability to write have an impact on their achievement is a question this study is not able to answer in a definitive manner. However, it can be inferred that the students ability to express him or herself in written language can have a positive impact on the learning process.

Recommendations for a comprehensive school improvement plan that has a professional development component that focuses on standards-based instruction and assessment is essential to student achievement. Furthermore, having alignment amongst curriculum, assessment, and instruction is also critical to student achievement.

What effect does standards-based instruction have on the growth of mathematical skills for those receiving special education? This study did not focus on this group of students, however, this is an area that could be addressed through future research. Students, regardless of ability, should be working toward mastery of the essential skills that must be outlined in a district's curriculum.

It is vital to use the information learned from this study and apply it to all applicable areas to improve student learning. Will the results of this study change attitudes toward mathematics? There is no way to definitively answer this question through the results of this study. However, teachers and students who are obtaining positive results are more likely to develop a positive attitude toward mathematics. Whatever the method or approach, the focus must always be on student achievement.

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