The Effects of a Standards-Based Science Curriculum on High School Students At Risk of Failing the Science Washington Assessment of Student Learning

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The Effects of a Standards-Based Science Curriculum on High School Students At Risk of Failing the Science Washington Assessment of Student Learning

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ABSTRACT

This study conducted a dependent-*t*-test for variance using Northwest Evaluation Association's Science Measure of Academic Progress test administered to on sample group from a four A class high school in eastern Washington who were identified as at risk to not pass the tenth-grade Science Washington Assessment of Student Learning, and were enrolled in a two year standards-based science curriculum. This project was an attempt to provide the school and district with data pertaining to the amount of growth experienced by at risk students exposed to the standards-based curriculum, which had been lacking. The dependent-t-test strongly suggested that the standards-based curriculum had a strong significant positive impact on at risk student learning.

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CHAPTER 1

Introduction

Background for the Project

Eight years before the introduction of the federal No Child Left Behind Act in 2001, the Washington State Legislature began a state-wide education reform with the passage of House Bill 1209 in the year 1993. The bill called for the creation of common learning goals for all students, an assessment system to measure student progress towards mastery of the common learning goals, and an accountability system that would have insured continuous progress towards the improvement of education in Washington State (Bergeson, Kanikberg, & Butts, 2000, and Partnership for Learning, 2008). House Bill 1209 led to the development of Washington State Essential Learning Requirements outlining the learning standards for all students in the state. From 1993 to 1996, Essential Learning Requirements were developed and implemented as the new standards for learning. During this period, standards for reading, writing, and mathematics were developed and introduced as the Essential Learning Requirements in 1996. Science Essential Learning Requirements were finalized in 1997 (Office of the Superintendent of Public Instruction, 2008 and Partnership for Learning, 2008).

Once the standards were in place, the Washington Assessment of Student Learning was developed and implemented as the assessment tool to monitor student progress towards mastery of the Essential Learning Requirements. The first of the Washington Assessment of Student Learning tests was implemented at the fourth-grade level in 1997, with the Science Washington Assessment of Student Learning test implemented at grades five, eight and ten in 2003 (Office of the Superintendent of Public Instruction, 2008, and Partnership for Learning, 2008).

The stakes grew higher during the years 2000, and 2001. In 2000, the Washington State Board of Education determined that the graduating class of 2008 would be the first required to pass the Washington Assessment for Student Learning in reading and writing (Partnership for Learning, 2008). The Washington State Board of Education also determined that the class of 2010 would be the first class to meet the additional requirement of passing the mathematics and science portions of the Washington State Assessment of Student Learning examination.

The advent of the No Child Left Behind Act in 2001 required all states to assess student progress towards mastery of state-determined standards and implemented accountability measures to ensure each school was making Adequate Yearly Progress towards meeting the goal of one-hundred percent success rate for all students in the areas of math and reading (Partnership for Learning, 2008). However, in light of the poor pass rate for the mathematics and science portions of the Washington Assessment of Student Learning, the Washington State Legislature rescinded the mathematics and science Washington Assessment of Student Learning requirement for graduation until the year 2013 (Blankenship, 2008).

Due to the education reform movement in Washington State, and with the added pressures placed on schools to perform at high standards as each school's success rate on the Washington Assessment of Student Learning was posted for public viewing, the school at which the author worked as a science teacher developed and implemented numerous methods to identify students who were at risk of failing the tenth-grade Science

Washington Assessment of Student Learning examination. Science teachers designed curriculum focused on the science standards as described in the Essential Learning Requirements and subsequent Grade Level Expectations, and developed three different science courses in six years to help at risk students develop the skills necessary to pass the Science Washington Assessment of Student Learning. As the author understood at the time of this study, and as there was no documentation available to confirm otherwise from the school or the school district where the author was employed, the motivation for all curriculum changes made at the school and/or district level were intended to create a science course which was aligned to the Essential Learning Requirements and Grade Level Expectations for Science. In 2001, the school at which the author was employed developed the first course designed to help at risk students and was entitled Principles of Science. The curriculum of Principles of Science was developed with the science standards spelled out in the Essential Learning Requirements and Grade Level Expectations as the focus. The purpose of Principles of Science was to expose those students at risk of not passing the Science Washington State Assessment of Learning to the content areas described in the Grade Level Expectations for Science and develop the critical-thinking skills spelled out in the Science Essential Learning Requirements.

The first change to the science course offerings at the school where the author worked was motivated by the school's sharply declining scores on the 2005-2006 Science Washington Assessment of Student Learning examination (Washington State Report Card, 2008). Throughout the 2005-2006 school year, the science department designed the Integrated Science course to be implemented during the 2006-2007 school year. Integrated Science was intended for all ninth-graders and refocused the curriculum on the new Grade Level Expectations for the Science Essential Learning Requirements which were released in 2005 (Science K-10 Grade Level Expectations, 2005). During the 2006-2007 school year, the school district where the author was employed, in conjunction with the science departments of the two high schools in the district, collaborated to change the science course offerings again. This time, the district offered three science courses designed for ninth and tenth-grade students who were identified as at risk to fail the Science Washington Assessment of Student Learning examination. The track of courses included semester-long Earth Concepts and Physics Concepts for ninth-grade at risk students, and a year-long Chemistry-Biology Concepts class for tenth-grade at risk students.

At risk students were identified and placed into the Science Concepts track of courses based on three factors. One, the students' grade point averages for seventh and eighth grade was considered. Second, students were identified based on teacher and counselor recommendations. Third, students were placed in the Concepts Courses based on parent recommendations.

Statement of the Problem

At the time of this study, there had been no research or evidence regarding how the Science Concepts courses at the school where the author worked were impacting the learning of students identified as being at risk to not pass the tenth-grade Science Washington Assessment of Student Learning examination. Without clear evidence, the science teachers at the school, building administrators, and district-level staff could only guess regarding the effectiveness of the Science Concept courses.

Purpose of the Project

This study used the Northwest Evaluation Association's Science Measure of Academic Progress examination to measure the academic growth of students identified as at risk to not pass the tenth-grade Science Washington Assessment of Student Learning who were enrolled in the Science Concepts courses during their ninth and tenth-grade years. The goal of this project was to provide data pertaining to the level of growth achieved by students who required instruction focused on the standards outlined by the Washington State Essential Learning Requirements for Science to close the achievement gap between the students' prior performance to success on the Science Washington Assessment of Student Learning examination. The hope was this project would provide the data that was painfully absent in the decision-making processes that had two times in three years changed the science curriculum in the school where the author worked and throughout the school district where the author was employed. With this data, the school and school district would have concrete data to base further decisions regarding the fate of the Science Concepts track of courses.

Delimitations

Students selected for this study were sophomores, enrolled in a Four A high school from a middle to upper middle class socioeconomic community located in southeastern Washington State. The major employers of the region were a federal government science laboratory and a nuclear reservation as well as a large vinification industry. The 2007 enrollment at the school of focus was 1,569 students. Of the total student enrollment, 51.4% were male and 48.6% female, 85.7% of the students were white, with 6% Hispanic, 3% African-American, 4% Asian, and 0.5% Native American.

The school had 19% of the students on free and reduced lunch. Almost 10% of the students in the school were enrolled in special education programs (Washington State Report Card, 2008).

All students selected for study were enrolled in Science Concepts courses during ninth and tenth grade. The Science Concepts courses were designated for students identified as at risk to not pass the science portion of tenth-grade Washington Assessment of Student Learning. At risk students were identified as such by a combination of factors including students' middle school grades, teacher and counselor recommendations, and parent recommendations. The Science Concept courses were a track of three content-based classes taken across the students' ninth and tenth grade years. In the ninth grade, at risk students were enrolled in two individual semester-long classes of Earth Concepts and Physics Concepts. At the tenth-grade level, at risk students were enrolled in a year-long Chemistry-Biology Concepts course (Course Catalog, 2008). The curriculum of all Science Concepts courses was designed with Washington State Science Standards as outlined in the Essential Learning Requirements and Grade Level Expectations for Science as the focus.

Assumptions

The curriculum of all Science Concepts courses was focused on the Washington State science standards as expressed in the Science Essential Learning Requirements and Grade Level Expectations for Science. Also, all teachers who taught the Science Concepts courses were highly qualified.

Hypothesis

At risk students who were enrolled in Science Concepts courses during ninth and tenth grade would experience greater than expected growth at the 0.5% degree of significance or better as measured by the Science Measure of Academic Progress examination.

Null Hypothesis

At risk students who were enrolled in Science Concepts track of courses during ninth and tenth grade would not experience growth at the 0.5% degree of significance or better as measured by the Science Measure of Academic Progress examination.

Significance of the Project

At the time of this project, no quantitative data existed regarding the success of any of the programs or courses offered at the school where this project took place. Providing data as to the rate of growth of at risk students in the Science Concepts courses would have lent guidance to administrators and educators regarding the over-all effectiveness of the science programs in place. If the results of this project showed that the latest Science Concept courses offered to at risk students were favorable, then the district and school would be justified in their actions in moving towards and in maintaining the two year Science Concepts program of classes that focused on the science standards. If the results of this project were unfavorable, then the district and school should take a hard look at the resources devoted to the development of the Science Concepts courses. Also, the school and district would have needed to evaluate and decide if at risk students would fair better with either exacting changes to improve the curriculum and methods of the Science Concepts courses or if at risk students would have a better chance of success in regular content courses that were modified to better incorporate and focus on the science content, science as a process, and science in society -- standards spelled out in the Essential Learning Requirements.

Procedure

A random sample of 30 students was selected from a list of at risk students who were enrolled in all three of the Science Concepts courses; Earth Concepts and Physics concepts during the student's ninth-grade year, and Chemistry-Biology Concepts during sophomore year. All students selected were enrolled in the Science Concepts courses from the beginning of ninth-grade and at no point did any of the students transfer out of the school or Science Concepts courses before completion. Also, all students included in the study took the Science Measure of Academic Progress two times during the students' ninth and tenth-grade years; once in the fall and again in the spring. Once a list of students who met all the requirements of the study was compiled a random sample of thirty students was selected. The Science Measure of Academic Progress scores from the fall of the participants' ninth-grade and spring of tenth-grade. An independent-*t*-test of variance was conducted to determine if significant growth had occurred during the participants' ninth and tenth grade years.

Definition of Terms

advanced student. An advanced student scored well above the bar to pass a state's standards-based assessment.

at risk student. A student considered at risk had an academic history and prior scores on the Washington Assessment of Student Learning examination that suggested the likelihood of passing the tenth-grade science portion of the Washington Assessment of Student Learning to be low.

basic student. A basic student scored below the bar to pass a state's standards-based assessment.

cut score. A cut score was the raw score a student must receive on a state standardized test, including the Washington Assessment of Student Learning, in order to be determined proficient in the standards.

Essential Learning Requirements. The Essential Learning Requirements were standards defined by the Commission on Student Learning as requested by the Washington State Legislature in the years between 1994 and 1997. Each student of Washington State was required to meet the standards.

first-order change. A first-order change was any change in a school that was superficial in nature, changing only how a school functioned or worked. Such first-order changes ranged from changes in class sizes, to changing from standard schedule to block scheduling, or providing teacher collaboration time. These changes often did not make any deep fundamental philosophical changes in the workings of the school (Fouts, 2003).

Grade Level Expectations. The Grade Level Expectations was a document that provided a timeline as to when students should master the academic standards outlined by the Essential Learning Requirements.

high-performing school. High-performing schools in the State of Washington consistently outperformed other schools on the Washington Assessment of Student Learning examination in spite of their socioeconomic make up.

Measure of Academic Progress. The Measure of Academic Progress was a computer-based examination developed by the Northwest Evaluation Association used to determine the academic growth of individual students.

proficient student. A proficient student score on a state's standards based assessment suggested that the student met the educational standard of the state.

Science Concepts. Science Concepts were a series of courses that focused on the standards outlined in the Essential Learning Requirements and Grade Level Expectations with the objective of helping at risk students pass the tenth-grade Science Washington Assessment of Student Learning.

second-order change. A second-order change was a change in the fundamental philosophy within the people who were involved with the school. These changes were often a shift in the belief system by which a school operated and the actions of the administration, teachers, parents, students and community, which shifted the focus of the school on the standards, collaboration within the school and community, and a central belief that all students could learn (Fouts, 2003).

Washington Assessment of Student Learning. The Washington Assessment of Student Learning was a series of assessments used to measure students' mastery of the standards outlined by the Essential Learning Requirements. Assessments were given in grades three through eight and tenth-grade and included assessments in reading, writing, mathematics and science.

Acronyms

AYP. Annual Yearly Progress.

CSL. Commission on Student Learning

EALR. Essential Academic Learning Requirements.

ESEA. Elementary and Secondary Education Act

ESHB. Engrossed Substitute House Bill

GCERF. Governor's Council on Education Reform Funding

GLE. Grade Level Expectation.

MAP. Measure of Academic Progress.

NCLB. No Child Left Behind Act.

NWEA. Northwest Evaluation Association.

OSPI. Office of the Superintendent of Public Instruction.

SAC. Subject Advisory Committee.

SBE. State Board of Education.

WASL. Washington Assessment of Student Learning.

WSRC. Washington School Research Center.

Chapter 2

Review of Selected Literature

Introduction

The focus of the selected literature centered on the motivational factors most pertinent to the changes in the science curriculum and course offerings between the years 2001 and 2007 at the high school where the author of this project worked. In addition, the literature review focused on the assessment tools used to measure academic growth of at risk students placed in the Science Concepts track of courses.

First, the curricular and course offering changes implemented between the years 2001 and 2007 at the school in question were all fully or in part motivated by four factors. One, all three of the curricular changes were made in efforts to provide focused instruction that was aligned to the fluid science standards spelled out in the Essential Learning Requirements (EALR) and Grade Level Expectations (GLE), which were undergoing changes during the time of this study (Heil, Bybee, Pratt, & McCracken, 2008). Two, the final change to the science course offerings which created the Science Concepts set of courses for freshman and sophomore students were in part an effort to align the curriculum content across all grades and high schools within the school district where this study took place. Alignment of the curriculum to the EALRs and GLEs, alignment of the curriculum across grades within the school, and alignment of the curriculum district-wide were all strategies reinforced by two reports identifying the characteristics of high-performing schools released in 2003 by the Washington School Research Center and the Office of the Superintendent of Public Instruction (Fouts, 2003, and Shannon & Bylsma, 2003). Three, the school and district were, in part, reacting to the declining or insignificant improvements on the Washington Assessment of Student Learning (WASL) for science. Four, the advent of the 2001 No Child Left Behind Act (NCLB) created an urgent sense for schools to ensure the success of all students, especially students at risk (Fouts, 2003). Therefore, many changes observed in schools were in response to the growing accountability placed on each school's success at high-stakes testing (Cronin, 2003).

The second area of focus of this literature review centered on the assessment tools used by the school and district that were involved with this study. In addition to the WASL, the Measure of Academic Progress (MAP) computer-based examination created by the Northwest Evaluation Association (NWEA) was used by the school as the focus of this project as another means to measure student progress in science. The MAP test was also the measuring tool used by the author to determine the amount of growth at risk students made in the Science Concepts track of classes evaluated by this project.

<u>Washington Education Reform and the Movement to Performance-Based Education System</u>

Changes experienced at schools in Washington State, and the changes in curriculum and course offerings at the high school in this project, were in direct response to the educational reform legislation in the early 1990s. The compiled sources pertaining to educational reform centered on a historical review of the education reform in Washington as well as an evaluation of the standards and assessment systems that were a product of education reform in Washington State.

Momentum for education reform in Washington State was prompted in response to teachers' strikes and rallies in Olympia and a call for a clear vision and focus in education by educational and business groups alike. Then governor Booth Gardner created the Governor's Council on Education Reform Funding (GCERF) in the spring of 1991. The GCERF produced a set of recommendations that centered on moving Washington State from a time-centered education system where graduation requirements were based on student classroom hours, to a performance-based education system where graduation would be based on the students' ability to demonstrate mastery of set standards (Bergeson, 2000, and Plato, 1995). The GCERF also made recommendations that regulations be loosened in order to shift control of decision-making from the state to the local school districts.

On the heels of the GCERF report, the Washington State Legislature enacted Engrossed Substitute House Bill 5953 that created the Commission on Student Learning (CSL) which was charged with the task of identifying essential learning requirements, developing an assessment system to measure student mastery of the standards, and developing a school accountability system (Bergeson, Kanikberg, & Butts, 2000 and Plato, 1995). Engrossed House Bill 5953 also created the path to shift decision-making abilities on educational issues to the local school board level.

In 1993, the Washington State Legislature extended the statute of ESHB 5953 by enacting ESHB 1209, also know as the Washington Education Reform Act, which marked the beginning of education reform (Bergeson, Kanikberg, & Butts, 2000, Plato, 1995 and Stecher, Chun, Barron, & Ross, 2000). The ESHB 1209 set into statute the four educational goals of education reform in Washington. The goals outlined in ESHB 1209 centered on improving students' abilities to read, write, and communicate; improve student comprehension of core concepts and principles of mathematics, social sciences, physical sciences, and life sciences, history, geography, health and the arts; ensure that students were able to think critically, make judgments and solve problems; and finally, students were to understand the importance of work and effort towards opening doors of opportunity (Plato, 1995). Engrossed Substitute House Bill 1209 also went on to define Essential Learning Requirements as being “more specific academic and technical skills and knowledge, based on the student learning goals” (Plato, 1995, p. 5). With the learning goals and definition of what were to be the Essential Learning Requirements, and the charge of creating an assessment system to measure student mastery of the EALRs, the CSL began development of the state standards and what was to become the WASL (Plato, 1995 and Partnership for Learning, 2008). By 1994, Subject Advisory Committees (SACs) were developed by the CSL, to develop more specific EALRs for each content area. Between 1994 and 1996, standards for reading, writing, mathematics and science were developed and implemented. Between 1996 and 2001, the CSL developed the WASL for reading, writing, mathematics and science and the WASL tests for each subject were phased in, with the Science WASL being the last test to be piloted in 2002, and reported with other WASL tests in 2003 (OSPI, 2008).

Lastly, ESHB 1209 deregulated the educational system allowing greater flexibility for local school districts in decision-making on issues of how best to implement changes to move towards performance-based education systems. With the onus on individual districts, the need for an accountability system was required. The CSL was charged with developing such an accountability system to monitor the progress individual schools made towards reaching standards (Bergeson, 2000, and Plato 1995) but the advent of NCLB in 2001 implemented the standard that all schools meet Annual

Yearly Progress (AYP) towards the goal of all students' meeting proficiency by the 2013-2014 school year (Cronin, 2003).

Washington State phased in education reforms over the span of a decade between 1993 and 2003 through the development of standards and the phasing in of the WASL test for reading writing, mathematics and science (Fouts, 2003, and Stecher et al., 2000). Though the EALRs were originally developed and implemented during the 1990s, at the time of this project the science EALRs had been made over twice. The EALR standards were originally limited to three to five broadly stated performance standards with more specific benchmarks describing student skills that would demonstrate proficiency of the standard. By 2005, the standards benchmarks for science had been re-written to what was then defined as the Grade Level Expectations or GLEs (Science K-10 grade level expectations, 2005). In the year 2007, at the request of the Washington's State Board of Education (SBE), the Washington State science standards were reviewed by an independent research company, David Heil and Associates Incorporated. When compared to the science standards documents of four states and nations selected as benchmark comparisons, and the National Science Education Standards, the Washington State GLEs rated fairly well. One area of great strength was that standards were written to science as inquiry, or the process of science. The Washington State GLEs document outlined inquiry standards that matched the NSES standards for inquiry quite well when compared to other benchmark states (Heil et al., 2008).

However, the review of the science standards document for Washington State GLEs did find several areas needing improvement. The Washington Science GLEs lacked the rigor found in the NSES standards, the Science GLEs were difficult for educators to navigate, and the learning outcomes were not well-defined and actually focused too much on instructional strategies, not what the students should have learned (Heil et al., 2008). Based on the findings, Heil recommended that the Washington GLEs be rewritten to include eleven recommendations that suggested the GLE document increase the rigor to meet NSES standards, simplify the format of the GLE document, and improve the clarity and focus of both the standards to be met and the learning outcomes students should have been able to demonstrate. Under the recommendations of Heil and Associates Inc., OSPI released the first draft of the new *K-12 Science Education Standards for the State of Washington* in October of 2008. At the time of this report, the new science standards for Washington State received public input and were under revisions to develop a final draft to be released in 2009 (K-12 Science Education Standards, 2008).

As the science standards underwent changes, the Science WASL was expected to make changes to match the new K-12 Science Education Standards for the State of Washington (Blankenship, 2008). The Science WASL had been under scrutiny due to the fact that at the time of this report, only 40% of Washington students were able to pass the Science WASL (Washington State Report Card, 2008, and Blankenship, 2008). In spite of the public scrutiny and concern over the Science WASL examination, very little research had been compiled regarding the development of the Science WASL examination or the validity of the Science WASL. In fact, the only source suggesting the WASL exam contained validity was found in a letter to OSPI from the National Technical Advisory Committee stating that their research concluded that the WASL for mathematics, reading and writing were indeed valid (National Technical Advisory

Committee, 2004). No letter or research pertaining to the Science WASL was located at the time of this project. Any research relating to the WASL examination centered on how the reading, writing and/or mathematics WASL examination compared to the standards-based exams required for graduation in other states. The findings of these studies all concluded that the WASL for writing was a fair examination and that the mathematics and reading WASL were more than reasonable for tenth-graders to pass (How Do WASL Standards Measure Up, 2005). The only reference to the validity of the Science WASL was located in a training Power Point presentation that outlined the process of the development of Science WASL questions and scenarios. The presentation alluded to a built-in measure to ensure the Science WASL was valid and written to the standards. The built-in measure was that the Science WASL scenarios and questions were written by the Science Assessment Leadership Team (SALT) consisting of teachers, scientist, business and community members charged with writing the Science WASL. The questions and scenarios were then sent to an unidentified consultant contracted to revise the scenario and questions to ensure their validity (Beven, Parton, & Boyde, n.d.). Therefore, little or no research had been conducted to determine the validity or reliability of the Science WASL. The Science WASL was sure to undergo further revisions as new science standards were being implemented.

Characteristics of High-Performing Schools

Education reform initiated in 1993 was designed to restructure Washington State to a standards-based education system. The changes were to be implemented gradually over a decade with the development and implementation of the EALRs from 1994 to 1996 and the phasing in of the WASL examinations of reading, writing, mathematics, and science across seven years (Stecher & Chun, 2001 and Stecher et al., 2000). The transition to a standards-based education system, with the EALRs at the focus of the curriculum and achievement measured by the new WASL, proved to be slow and difficult for schools across Washington State. A survey study released in 1999 indicated that in the early years of reform only 10% of the schools across the state were exacting second-order changes in philosophy and operations of the schools. These second-order changes were intended to create environments of collaboration between teachers and school administrators with the clear goals of the EALRs at the focus of reform. Also noted was the degree by which school's scores improved on the California Test of Basic Skills (CTBS), which was used as an indicator for standards-based testing in the early years of the school reformation and was directly related to classroom environmental changes that shifted daily instruction towards more cooperative learning activities, intentional instruction to develop higher critical thinking skills, alternative assessment strategies and work that allowed students a chance to demonstrate skills and learning. Those schools with the highest degree of school-wide restructuring, and changed classroom instructional and assessment practices in accordance with higher standards and demonstration of student learning, saw a marked increase in CTBS scores that, on average, moved the reformed schools from the 50th to the 61st percentiles between 1993 and 1997 regardless of the school's socioeconomic status (Fouts, 1999).

The implementation of the WASL examination marked the beginning of accountability measures for all schools' success in meeting the standards outlined in the EALRs. Early test results were low, but were improving in the first three years of the WASL (Stecher et al., 2000). However, the greatest indicator of a school's success on the WASL was predetermined by that school's socioeconomic status as measured by the percentage of students receiving free and reduced lunch (Abbot, Joirman & Stroh, 2002, and Fouts, 2003). Nevertheless, there were schools with a high percentage of students who received free and reduced lunch that were outperforming all other schools in spite of their socioeconomic status. High-achieving schools with a low socioeconomic student base were identified as high-performing schools and became the focus of research in Washington State to find the common threads that led to greater success on the WASL (Shannon & Bylsma, 2003).

Through the research of high-performing schools in Washington State, and including other national research conducted over decades, nine characteristics of high-performing schools were identified. The nine characteristics of high-performing schools were described as needing the following: a clear and shared focus, high standards and expectations for all students, effective school leadership, high levels of collaboration and communication, and curriculum, instruction and assessment aligned with standards. In addition, high performing schools needed frequent monitoring of learning and teaching, focused professional development, a supportive environment, and high levels of family and community involvement (Shannon & Bylsma, 2003). These characteristics were meant to be integrated into school improvement planning for all schools in Washington State.

Characteristics of successful schools similar to those of high-performing schools in Washington State were also described in other states. Wisconsin defined characteristics of successful school districts to be used as an outline for districts to utilize during school improvement planning. Though only five characteristics were described, each character was divided into several standards (Burmaster, 2006). Within the characteristics and subsequent standards describing successful Wisconsin school districts were elements of Washington State's nine characteristics of high-performing schools. Notable similarities included characteristics explaining how successful districts and schools had clear and focused visions of educational goals, strong leadership, alignment of the curriculum to state standards, and collaboration between educators and staff. In California, a study, based on the appropriations of money and schools' success, led to the identification of five areas where successful schools showed improved learning. First, these schools dedicated more instructional time to students. Second, successful California schools used ongoing and frequent assessment to monitor student learning and adjust instruction. Third, schools which outperformed others receiving similar funding created an environment where parents and families acted as partners in their student's education. Fourth, professional development of educators was focused on improving student achievement. Finally, successful schools in California established an environment of collaboration and cooperation between teachers and administrators (Perez & Socias, 2008). The five characteristics listed did not alone guarantee a school's success. The separation of performance between average and high-performing schools in California was in the intensity, coherence, and the willingness to stay focused on the five characteristics of successful schools over time (Oberman, Arbiet, Praglin, & Goldstein, 2005 as found in Perez & Socias, 2008).

Though characteristics of successful schools were clearly identified and defined by not only Washington State but across the nation, many schools failed to implement the characteristics proven to lead to student success. Several reasons accounted for the failure of many schools to implement changes in the way the school operates. At the top of the list of barriers was lack of skilled leadership qualified to transition schools into new standards-based institutions. As Washington State education reform was progressing, the role of principals was changing from that of an administrator, bookkeeper and facility manager to one of educational leader. That transition was difficult for many principals to make. Also, standing in the way of school reform was lack of support of reformation changes in terms of funding, time for professional development and collaborative team-building for teachers. Many principals across Washington State recognized that the burden of reform fell on the shoulders of the teachers being asked to change the way teaching was done with little to no time allotted for professional development and collaboration. The fact that teachers were not provided with the professional support and time required to implement changes created what may have been one of the most difficult barriers to reform -- teacher buy-in. Reasons for teacher resistance ranged from fear of reaching outside the teacher's comfort zone to lack of knowledge regarding the standards and/or the goals of education reform, to a belief that the reform movement would pass in time as so many other educational fads. Regardless of the reason, teacher buy-in was a daunting task for principals to overcome and was essential if an entire building was to implement deep reforms in education (Fouts, Stuen, Anderson, & Parnell, 2000).

No Child Left Behind

The No Child Left Behind Act of 2001 was the United States Congress and President George W. Bush's expansion of the 1965 Elementary and Secondary Education Act signed into law by then President Lynden Johnson. The ESEA was a part of

Johnson's war on poverty. The ESEA ensured that schools and districts serving impoverished and minority groups were adequately funded to create equity in educational opportunities. In 1993, on the heels of President Reagan and George H. W. Bush's call to increasing standards in education, President Clinton signed an extension of the ESEA requiring all states to develop challenging standards (Ohio Education Association, 2007). The 1993 extension of the ESEA marked the national movement towards standardized education.

The 2001 NCLB extension expanded the ESEA in two key areas. First, NCLB required all states to assess students' achievement placing students in three levels; basic, proficient, and advanced (Kingsbury, Olson, Cronin, Hauser, & Hauser, n. d., and Cronin, Kingsbury, McCall, & Bowe, 2005). Second, schools were to create an accountability system that identified schools making Adequate Yearly Progress towards 100% of students meeting standards by the year 2014. Adequate Yearly Progress was measured by a comprehensive report that outlined the overall pass/fail rate of the state assessment system. Adequate Yearly Progress also included a disaggregated report outlining the performance of special education students, students of different socioeconomic levels, and students of different ethnicities. Finally, AYP provided a series of penalties for schools that did not meet improvement goals. Sanctions ranged from forced school improvement for schools not making AYP for two consecutive years to the possible replacement of the school's administration and staff after four years of AYP failure (Cronin, 2003).

The major outcome of NCLB was an accountability system that created incentives for states to identify schools in need of improvement towards meeting standards and to hold schools accountable for the education of all students. However, the overreaching goal of the accountability system was to create a system that helped close the achievement gap between those schools and students from high socioeconomic and predominantly white backgrounds and those struggling students with lower socioeconomic and minority backgrounds (Cronin et al., 2005).

At the time of this project, the question of what impact NCLB had on improving education was not yet answered. The public perception of NCLB was varied. A 2007 report suggested that 34% of Americans believed that NCLB had improved schools, while 26% stated that NCLB had actually made the educational system worse. Also, 45% of Americans expressed the belief that standardized testing was overemphasized. Also noteworthy, the report revealed a discrepancy of feelings between whites and African-Americans, with 40% whites believing that the federal influence on education as a result of NCLB was too great while 45% of blacks considered federal government's involvement to be too little (Pew Research Center, 2007). These findings suggested a realized achievement gap experienced by one of the most impacted minority groups in the nation NCLB was attempting to close and the perception that NCLB alone was not doing enough to help minorities gain ground.

Mixed public perceptions may have been validated by research data that also expressed a mixed bag of results regarding the NCLB effect on closing the achievement gap. Evidence showed as of 2005 that, even though reading and mathematics test scores improved overall, every minority ethnic group experienced a slight decline in achievement scores, thus increasing the achievement gap (Cronin et al., 2005).

NCLB also created a state by state accountability system with no real guidelines that aligned standards between states or across grade levels. The lack of alignment of standards, assessment strategies, and definitions of what was proficient created an environment across the nation where proficient in one state may have been considered basic (or failing) in another, even though the skill level of the student may have been the same. Within many states, the lack of consistency defining proficiency across grade levels may have allowed some student who made adequate growth between grades four and seven to fall from proficiency to basic in the same time frame. The assessment systems of many states allowed for too many variances between assessments across grade levels and from year to year that could mislead educators as to the actual academic growth achieved by students (Cronin, Dahlin, Adkins, & Kingsbury, 2007, and Kingsbury et al., n.d.).

Finally, the standards by which AYP was determined, though AYP standards were implemented with the best intentions to create incentives for districts, schools, and teachers to develop programs designed to help all students meet standards, proved to place all emphasis on growth that placed the student above the proficiency bar while disregarding any growth basic (or failing) students achieved from year to year. Coupled with the ensuing sanctions a school could face if AYP goals towards improvement in student achievement on track to ensure 100% of all students meeting state standards by the 2014, AYP's binary pass/fail reporting had two effects. First, the pass/fail reporting of student achievement forced districts, schools and teachers to focus educational efforts on students who were within striking distance of meeting the proficiency bar. Second, the AYP reporting process disregarded any student growth that did not raise the student's scores on the state's assessments above the proficiency bar (Cronin, 2003, and Hauser, 2003). For example, two seventh-grade students' assessment scores were 5 points and 40 points below the proficiency bar respectively. The first student may have achieved 5 point growth by the eighth-grade assessment, therefore boosting the school's AYP cut score. The second student may have made gains of up to 39 points on the eighth-grade assessment but would still not improve the school's AYP cut score. The lack of allowing reasonable student growth numbers to account for any AYP reporting called for some to suggest changes to AYP reporting to contain some measure of reasonable student growth to be a factor of a school's AYP standing (Hauser, 2003).

Measure of Academic Progress

The computer-based Measure of Academic Progress (MAP) examination was developed by the Northwest Evaluation Association (NWEA). The NWEA was created in 1977 as a non-profit organization dedicated to improving teaching and learning. Northwest Evaluation Association provided services and products to over 3,400 partner schools and districts across the nation (Northwest Evaluation Association, 2009).

The computer-based MAP test was designed to measure student growth and provided rapid feedback to educators. Measure of Academic Progress test scores were measured using the Rausch Unit, or RIT score. The RIT was an equal interval score designed to measure student growth in a subject area, regardless of the student's grade level. The RIT score was determined by adjusting the difficulty of the MAP exam questions based on how well the student had performed. The better the student's performance, the more challenging the questions on the MAP test became. This measure provided educators with data that identified at what grade level individual students were performing. Educators were also able to administer the MAP test to students up to four times in a school year, thus being able to compare RIT scores and measure actual student growth throughout the school year, or from year to year (NWEA, 2003).

The Science MAP examination was separated into two parts. The General Science portion of the MAP tested students' knowledge of scientific topics and content. The Science Concepts and Processes portion of the MAP provided insight into students' comprehension of investigative procedures (Northwest Evaluation Association, 2009).

The MAP tests' reliability, validity and alignment to the WASL were of special interest to the author as the MAP test was being used by the district where the author worked as a tool to predict students' potential for passing the states' standardized tenth-grade science examination.   Reliability was defined as the consistency of the examination when given to a student twice in a short time span. The validity of the examination was determined by comparing MAP test items to selected items from a state's standardized test to measure the variance between the two. Again, the Pearson coefficient measured the MAP RIT scores to the WASL cut scores for proficiency. In 2005, MAP reliability was found to have acceptable r values for reading, writing and mathematics. In 2004, MAP's validity to the tenth-grade Reading and Mathematics WASL examinations were a bit below the 0.80 acceptable range measuring 0.76 and 0.78 respectively. Unfortunately, at the time of this project, data pertaining to the reliability and validity of the Science MAP tests was not found (Reliability and Validity Estimates, n.d.) However, a 2007 study of the alignment of the MAP and WASL provided estimated General Science MAP RIT values that would predict students' passing the Science

WASL. A tenth-grader obtaining a RIT value of 213 on the General Science MAP would most likely be considered proficient for the Science WASL examination (Dahlin, 2007).

Summary

The school and district where the author was employed at the time of this project undertook science curricular changes in response to education reform in Washington State and AYP standards mandated by NCLB. Education reform in Washington state called for educational standards or EALRs which were developed in the mid 1990s while the WASL assessment tool was implemented between 1997 through 2002 to measure students' mastery of the state standards. No Child Left Behind increased the pressure placed on schools to improve student performance and success on the WASL by placing sanctions on those schools that did not meet goals to improve student achievement on the WASL to 100% by the year 2014. As Science WASL scores dropped, the school where the author worked developed and implemented changes in the course offerings to target and provide instruction focused on the EALRs for at risk students hoping to close the achievement gap. Curricular changes were made with the nine characteristics of high-performing schools as a backdrop. The school and district where the author worked attempted to create a collaborative environment to develop curriculum in the Science Concepts track of courses that was focused on the Science EALRs. However, curricular changes were made with no data pertaining to the success of the dismissed programs' success or failures at helping at risk students close the achievement gap. This project was an attempt to provide data relating to the level of academic growth at risk students had attained within the Science Concepts track of courses using the Science MAP test. The MAP test was a computer-based test that provided educators with rapid feedback of student performance and growth by providing RIT equal interval scores that could measure growth within and across grade levels.

CHAPTER 3

Methodology and Treatment of Data

Introduction

A pre/post test was used to measure the growth of tenth-grade at risk students placed in Science Concepts courses. The curriculum of the Science Concepts courses was focused on the state standards outlined by the EALRs. Pre/post test of student growth was measured using the Science MAP. Science MAP tests were taken by the participants in October of ninth-grade and again in March of the students' tenth-grade. A dependent-*t*-test of variance was conducted to determine if significant growth had occurred.

Methodology

A pre/post test of variance was used to measure the academic growth of students placed in a two year program. Students who were identified as at risk to fail the tenth grade Science WASL were placed in a two year Science Concepts track of courses focusing on the Science EALRs. A random sample of at risk students was selected and Science MAP tests were administered to the participant group in the fall of ninth- grade and again in the spring of tenth-grade. A dependent-*t*-test of variance of the MAP scores was conducted to determine if significant growth had occurred as a result of the Science Concepts courses.

Participants

Participants of this study were selected from students enrolled in a set of Science Concepts classes taken across the ninth and tenth-grades. All students placed in the Science Concepts courses track were identified as at risk to fail the tenth-grade Science

WASL. Determination of an at risk student was made by a combination of factors, which included students' middle school grades, teacher and counselor recommendations, and parent recommendations. All at risk students selected as participants of this study were enrolled in all three of the Science Concepts courses for the full duration of ninth and tenth-grade. The Science Concepts courses track included semester long Earth Concepts and Physics Concepts classes during ninth-grade and a year long Chemistry Biology Concepts course taken in tenth-grade. A list of 90 who had been enrolled in all three Science Concepts courses for the full duration of the ninth and tenth-grade was identified. A random sample of 30 students was selected from the 90 at risk students described by selecting every third name from the compiled list.

Instruments

Science Measure of Academic Progress was used to measure academic growth of at risk students enrolled in standards-based Science Concepts courses. The immediate access to results and the scoring system provided by the Science MAP test provided a useful tool to measure student growth within the curriculum of the Science Concept courses and across the grade levels. Measure of Academic Progress tests scores were measured using the Rausch Unit, or RIT score. The RIT was an equal interval score designed to measure student growth in a subject area, regardless of the student's grade level. The RIT score was determined by adjusting the difficulty of the MAP exam questions based on how well the student had performed. The better the student's performance, the more challenging the questions on the MAP test became. This measure provided educators with data that identified at what grade level individual students were performing. The MAP test was able to be administered to students up to four times in a school year, thus being able to compare RIT scores and measure actual student growth throughout the school year, or from year to year (NWEA, 2003).

The Science MAP examination was separated into two parts. The General Science portion of the MAP tested students' knowledge of scientific topics and content. The Science Concepts and Processes portion of the MAP provided insight into students' comprehension of investigative procedures (Northwest Evaluation Assosciation, 2009). To compile a single RIT value to be run through the dependent-*t*-test for variance, each student's General Science and Science Concepts and Processes RIT scores were summed to create a total Science MAP RIT value for each student. The total Science MAP RIT values of each participant's fall ninth-grade test were used as the pre-test values for the dependent-*t*-test for variance. The total Science MAP RIT values of each participant's tenth-grade spring test were used as the post-test values for the dependent-*t*-test for variance.

The MAP test's reliability, validity and alignment to the WASL were of special interest to the author as the MAP test was being used by the district where the author worked as a tool to predict students' potential for passing the state's standardized tenth-grade science examination. Reliability was defined as the consistency of the examination when given to a student twice in a short time span. The validity of the examination was determined by comparing MAP test items to selected items from a state's standardized test to measure the variance between the two. In 2005, MAP reliability was found to have acceptable r values for reading, writing and mathematics. In 2004, MAP's validity to the tenth-grade Reading and Mathematics WASL examinations were a bit below the 0.80 acceptable range measuring 0.76 and 0.78 respectively.

Unfortunately, at the time of this project, data pertaining to the reliability and validity of the Science MAP tests were not found (Reliability and Validity Estimates, n.d.) However, a 2007 study of the alignment of the MAP and WASL provided estimated General Science MAP RIT values that would predict students' passing the Science WASL. A tenth-grader obtaining a RIT value of 213 on the General Science MAP would most likely be considered proficient for the Science WASL examination (Dahlin, 2007).

Design

This project used a pre- and post test with 30 at risk students that were enrolled in the two year Science Concepts track of courses at the school where the author worked. Scores from the Science MAP test administered to the participants in October of ninth-grade were used as the pre-test. The participants then took the Science MAP test again in March of the tenth-grade. A dependent-*t*-test for variance of the total RIT scores for fall ninth-grade Science MAP and spring tenth-grade Science MAP test were calculated to determine if the standards-based Science Concepts track of courses had a significant impact in closing the achievement gap for students identified as at risk to fail the tenth-grade Science WASL examination.

Procedure

Participants in this project were selected from a list of students identified as at risk to fail the tenth-grade Science WASL examination. All participants were enrolled in all three standards-based Science Concepts courses; Earth Concepts and Physics concepts during ninth-grade and Chemistry-Biology Concepts during tenth-year, and at no time transferred into or out of the school or Science Concepts courses before completion. All students included in the study took the Science Measure of Academic Progress in early

October of ninth-grade. Ninety students met the requirements and were listed in alphabetical order by last name.

Of the 90 students who met the requirements of the project, every third name was selected as participants. The RIT scores of the October ninth-grade Science MAP test for both sections (the General Science and Science Concepts and Processes portions of the examination) were summed providing a total RIT value. Both portions of the Science MAP test were administered to the 30 participants in March of tenth-grade. Again, the RIT values for the tenth-grade Science MAP test were summed providing a total RIT value. Dependent-*t*-test of variance was calculated using the total RIT values of the October ninth-grade Science MAP test as a pre-test value and March tenth-grade Science MAP tests as a post-test value.

Treatment of the Data

A dependent-*t*-test of variance was used to provide statistical analysis of the academic growth of students identified as at risk to fail the tenth-grade Science WASL examination. Total RIT values were calculated by adding the separate RIT scores of the General Science and Science Concepts and Procedures portions of the Science MAP test. The Science MAP tests were administered in the fall of ninth-grade and again in March of tenth-grade. The variance of the total RIT values was calculated using Statpak Exe software.

Summary

A dependent-*t*-test of variance was used to analyze the academic growth of students identified as at risk to fail the tenth-grade Science WASL as measured by the Science MAP test. A random sample of 30 students was selected from the total number of students enrolled in a two year track of standards-based Science Concepts courses. The participants took the Science MAP test in October of ninth-grade and again in March of tenth-grade. Total RIT values were calculated from the addition of the RIT scores from both the General Science portion of the Science MAP test and the Science Concepts and Procedures portion of the Science MAP test. The total RIT values were used to calculate and measure the statistical growth attained by at risk students using Statpak EXE software program.

CHAPTER 4

Analysis of the Data

Introduction

At the time of this study, there had been no quantitative research evidence determining how successful the standards-based Science Concepts courses at the high school where the author worked were at impacting the learning of students at risk to not pass the tenth-grade Science WASL. Providing data as to the rate of growth of at risk students in the Science Concepts courses would have lent guidance to administrators and educators regarding the over-all effectiveness of the science programs in place. This study used the NWEA Science MAP test to measure the academic growth of at risk students to provide evidence to guide any further adjustments or changes to the standards-based Science Concepts courses for at risk students.

Description of the Environment

Students selected for this study were sophomores, enrolled in a Four A high school from a middle to upper middle class socioeconomic community located in southeastern Washington State. The major employers of the region were a federal government science laboratory, a nuclear reservation, and a large vinification industry. The 2007 enrollment at the school of focus was 1,569 students. Of the total student enrollment, 51.4% were male and 48.6% female, 85.7% of the students were white, with 6% Hispanic, 3% African-American, 4% Asian, and 0.5% Native American. The school had 19% of the students on free and reduced lunch. Almost 10% of the students in the school were enrolled in special education programs (Washington State Report Card, 2008).

Hypothesis

At risk students who were enrolled in Science Concepts courses during ninth and tenth grade would experience greater than expected growth at the 0.5% degree of significance or better as measured by the Science Measure of Academic Progress examination.

Null Hypothesis

At risk students who were enrolled in Science Concepts track of courses during ninth and tenth grade would not experience growth at the 0.5% degree of significance or better as measured by the Science Measure of Academic Progress examination.

Results of the Study

Thirty randomly selected at risk students were selected as participants in this study. Each participant's total Science MAP RIT values were obtained by adding together the General Science MAP RIT and Science Concepts and Processes RIT values and are shown in Table 1.

Table 1: MAP General Science, Science Concepts and Processes and Total RIT Scores

Participant	9th Grade General Science	9th Grade Science Concepts & Processes	**9th Grade RIT Total**	10th Grade General Science	10th Grade Science Concepts & Processes	**10th Grade RIT Total**
1	219	219	**438**	234	223	**457**
2	205	200	**405**	215	223	**438**
3	195	208	**403**	197	205	**402**
4	189	194	**383**	208	212	**420**
5	218	213	**431**	208	208	**416**
6	208	214	**422**	210	211	**421**
7	205	193	**398**	193	209	**402**
8	218	213	**431**	221	220	**441**
9	211	207	**418**	216	204	**420**
10	217	227	**444**	218	228	**446**
11	217	210	**427**	224	204	**428**
12	215	206	**421**	227	224	**451**
13	210	214	**424**	223	226	**449**
14	212	209	**421**	220	207	**427**
15	229	218	**447**	230	228	**458**
16	209	211	**420**	217	218	**435**
17	195	216	**411**	214	217	**431**
18	206	196	**402**	220	218	**438**
19	223	220	**443**	226	227	**453**
20	205	169	**374**	202	183	**385**
21	194	197	**391**	208	217	**425**
22	199	195	**394**	218	217	**435**
23	211	222	**433**	210	219	**429**
24	201	190	**391**	199	202	**401**
25	211	209	**420**	209	216	**425**
26	208	203	**411**	213	214	**427**
27	214	207	**421**	211	217	**428**
28	172	173	**345**	175	178	**353**
29	217	195	**412**	242	221	**463**
30	219	218	**437**	232	220	**452**

The participant's ninth-grade and tenth-grade total RIT values were analyzed using the dependent-*t*-test for variance. The *t* score was equal to 5.2 with 29 degrees of freedom and equated to a p value less than 0.5%; thus suggesting the participants had experienced significant growth and are shown in table 2.

Table 2: Dependent-t-Test for Variance Results.

	Number	Mean	Standard Deviaiton
X	30	413.93	22.63
Y	30	428.53	23.36

t= 5.2 Degrees of Freedom = 29 $p < 0.05$

Findings

The null hypothesis that at risk students enrolled in the standards-based Science Concepts track of courses would not experience significant growth at 0.05% as measured by the Science MAP test was rejected. The *t* value of 5.2 and 29 degrees of freedom related to a *p* value of 0.001 which was much less than the 0.05 benchmark for significance. Thus, the original hypothesis that at risk students enrolled in the standards-based Science Concept courses would experience significant growth was indeed supported.

Discussion

The results of this project did correspond with the tenants of the nine characteristics of successful schools that curriculum, instruction and assessment focused on the standards relates to student success (Shannon & Bylsma, 2003). The goals of the Science Concepts courses were to focus the instruction of at risk students on the science standards spelled out in the EALRs in order to close the at risk students' tenth-grade Science WASL achievement gap.

Secondly, in order to develop the Science Concepts courses, teachers were required to collaborate and share information not only within the science department but across the school district as well. The fostered collaborative environment may have been another of the nine characteristics of high-performing schools to have an impact on the results of this project. With a focus on the standards, teachers were required to develop and/or share instructional techniques, laboratory activities and to streamline their instruction to the core concepts that would have best benefited the at risk students towards the goal of passing the Science WASL.

<u>Summary</u>

The dependent-*t*-test for variance of the fall ninth-grade and spring tenth-grade Science MAP test of 30 randomly selected students showed significant growth. These students at risk of failing the tenth-grade Science WASL, who were enrolled in a standards-based Science Concepts set of courses at a four A class high school in eastern Washington state, proved to have experienced significant growth with a p value less than the 0.05 statistical benchmark. In fact, the statistical values expressed 29 degrees of freedom and a t value equal to 5.2. The t value and the degrees of freedom translated to a p score of less than 0.001 suggesting a less than 1% chance the student growth was a random event. Therefore, the growth of at risk students was indeed positively affected by the instruction students received throughout the Science Concepts track of courses. Thus, the original hypothesis that the Science Concept courses would cause at risk students to experience significant growth was supported.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

This study used the NWEA's Science MAP examination to measure the academic growth of students identified as at risk to not pass the tenth-grade Science WASL, all of whom were enrolled in the standards-based Science Concepts courses during their ninth and tenth-grade years. The goal of this project was to provide data pertaining to the level of growth achieved by students who required instruction focused on the standards outlined by the science EALRs. The intent of the instruction was to close the achievement gap between the students' prior performance and ability to succeed on the Science WASL examination. The hope was this project would provide the data that was painfully absent in the decision-making processes that had two times in three years changed the science curriculum in the school where the author worked and throughout the school district where the author was employed. With this data, the school and school district would have concrete evidence to base further decisions regarding the fate of the Science Concepts track of courses.

Summary

Due to the education reform movement in Washington State, the added pressures placed on schools to perform a high level by NCLB, and in response to previous Science WASL test data, the science department at the high school at the center of this project exacted two changes in three years to the course offerings and to the science curriculum. Each overhaul was intended to improve student achievement on tenth-grade Science WASL. At the time of this study, there was no concrete quantitative data providing insight to the success or failure of the program's goal to improve student learning as measured by the Science WASL or any other standards-based test. This project was an attempt to collect data that would provide the needed insight to determine if the latest curricular change was having a positive impact on student learning. To a greater extent, this project set out to determine if the curricular change to a Science Concept set of courses designed around the EALRs helped at risk students succeed on the WASL. The growth of at risk students enrolled in the Science Concepts set of courses was measured by the NWEA Science MAP examination.

The changes that developed the Science Concepts courses were in line with several of the nine characteristics of high-performing schools outlined by OSPI in 2003. In particular, the characteristics pertaining to high levels of collaboration between teachers and alignment of curriculum, instruction and assessment to the state standards were two of the nine characteristics of high-performing schools that played crucial roles in student success on the WASL (Shannon & Bylsma, 2003, and Fouts, 2003). The Science Concept courses were developed with cooperation between science department teachers at the high school at the focus of this project and across the school district where collaboration between the science departments of all high schools within the district took place. The curricular move was also intended to align the individual schools' and the entire district's curriculum, instruction, and assessments to the state science standards.

The NWEA Science MAP test was chosen as the tool to measure the growth of at risk students enrolled in the two year Science Concepts program for several reasons. One, the MAP test provides immediate data to administrators and teachers. Two, the ability to administer the MAP test numerous times throughout the school year provided the ability to gather pre and post test data. Three, the RIT scores were placed on a continuum that allowed administrators and teachers the ability to measure student growth within and across grade levels. Finally, the Science MAP test was written to the Washington State Science Standards (Northwest Evaluation Association, 2003). Although the validity and reliability between the Science WASL and the Science MAP were in doubt, the MAP test did provide the ability to measure student growth on a standards-based test (Reliability and Validity Estimates, n.d.).

A dependent-t-test for variance was conducted on the ninth-grade fall and tenth-grade spring Science MAP total RIT values for thirty randomly selected at risk students enrolled in all of the Science Concepts courses across the freshman and sophomore school years. The study concluded that significant growth had been experienced by the at risk students.

Conclusions

The null hypothesis that at risk students enrolled in the standards-based Science Concepts track of courses would not experience significant growth at 0.05% as measured by the Science MAP test was rejected. The *t* value of 5.2 and 29 degrees of freedom related to a *p* value of 0.001 which was much less than the 0.05 benchmark for significance. Thus, the original hypothesis that at risk students enrolled in the standards-based Science Concept courses would experience significant growth was indeed supported.

Based on such significant positive growth, the district and school is justified in their actions in developing the two year standards-based Science Concept courses and the results of this project did correspond with the tenants of the nine characteristics of successful schools that a curriculum, instruction and assessment focused on the standards relates to student success (Shannon & Bylsma, 2003). The goals of the Science Concepts courses at the center of this project were to focus the instruction of at risk students on the science standards spelled out in the EALRs in order to close the tenth-grade Science WASL achievement gap. In order to develop the Science Concepts courses, teachers were required to collaborate and share information not only within the science department but across the school district as well. The fostered collaborative environment may have been another of the nine characteristics of high-performing schools to have an impact on the results of this project. With a focus on the standards, teachers were required to develop and/or share instructional techniques, laboratory activities and to streamline their instruction to the core concepts that would have best benefited the at risk students towards the goal of passing the Science WASL.

Recommendations

The positive results suggest that the high school and district at the focus of this project should have maintained the standards-based Science Concept track of courses offered to at risk students. The level of growth shown by at risk students suggests that the Science Concept courses did indeed help struggling students close the gap towards success on the Science WASL. The school and district would have been justified in exploring the possibility of making the Science Concepts ninth-grade semester-long Earth Concepts and Physics Concepts required for all freshmen, provided advanced students retained the option to take chemistry in preparation for an advanced placement track of courses. At risk sophomores would then be encouraged to take the Chemistry-Biology

Concepts course as tenth-graders. The rest of the tenth-graders would have the option to take any science course they desired.

A move towards making the Science Concept courses required for all ninth-graders would have been beneficial to all students. First, the change would have lessened the stigma that was imposed on at risk students who were enrolled in less rigorous science courses and raise the expectations for all students. Second, the behavioral issues that accompany a group of twenty to thirty at risk students, all having struggled in the school system at some level, would be decreased as at risk students would be dispersed amongst potential peer role models. Finally, all students would have benefited from a department collaborating to develop common lessons, laboratory activities, and assessments aligned to science standards outlined in the EALRs.

The school and district would also have been wise to conduct analysis of Science MAP test scores, in the same manner as this project, annually in order to monitor the progress all students made towards mastery of the science standards in all classes. The RIT scores provided by the Science MAP was an excellent tool to measure how students grew from year to year. Conducting a dependent-*t*-test for variance for a sample across all Science Concept courses and within individual Science Concepts courses annually would have quickly identified any divergences between the curriculum, instruction and assessment, from the targeted standards. The school and the district would then be able to quickly respond and make any required curricular changes with the appropriate data at hand.

Finally, the school and district should have allowed for and created increased opportunities of collaboration between teachers in order to continue development of curriculum, lessons, activities and assessments that kept up with the changing Washington state science standards. At the time of this project, Washington State was re-writing the science standards to a new format that changed the emphasis of much of the content and increased the rigor students were expected to master. The science department would have benefited greatly from more administrative support and commitment. More time and resources would have allowed teachers to review the new Science EALRs, design new lessons, develop laboratory activities, and create assessments that focused instruction and student learning towards mastery of the new standards. In addition, more time would have allowed teachers to implement, properly monitor, and collect data measuring the success or failures of the adjusted curriculum before any seeping changes to the course offerings were entertained. The environment of education, especially science education, was extremely fluid and in great flux at the time of this report. The science teachers not only required appropriate time and resources to adapt to the changing standards, but earned and deserved the commitment of time and support from the district and administration to improve science education in a difficult and ever-changing period.

REFERENCES

Abbot, M. L., Joirman, J., & Stroh, H. R. (2002). *The influence of district size, school size and socioeconomic status on student achievement in Washington: A replication study using hierarchical linear modeling.* Lynnwood, WA: Washington School Research Center.

Bergeson, T., Kanickberg, K., & Butts, R. (2000). *State laws regarding education reform, assessment, and accountability in Washington State*. United States Department of Education. Office of Educational Instruction Improvement Educational Resources Center.

Beven, R., Parton, C., & Boyde, A. (n.d). *Powerful classroom assessments for elementary science.* A presentation from the Science Assessment Leadership Team. Olympia, WA: Office of Superintendent of Public Instruction.

Blankenship, D. G. (2008). Washington begins to revise science education standards: Outrage that came with math change isn't surfacing. *Seattle Post-Intelligencer*. Retrieved November 18, 2008, from http://www.seattlepi.com/local/357065_science31.html

Burmaster, E. (2006). *Characteristics of successful districts.* Madison, WI: Wisconsin Department of Public Instruction. Retrieved November 18, 2008, from http://dpi.wi.gov/ssos/pdf/characteristics.pdf

Course Catalog. (2008). Richland, WA: Richland School District.

Cronin, J. (2003). *How strong is the incentive for educators to gain the adequate yearly progress requirements of the No Child Left Behind Act?* Lake Oswego, OR: Northwest Evaluation Association.

Cronin, J., Dahlin, M., Adkins, D., & Kingsbury, G. G. (2007). *The proficiency illusion*. Lake Oswego, OR: Northwest Education Association.

Cronin, J., Kingsbury, G. G., McCall, M. S., & Bowe, B. (2005). *The impact of the no child left behind act on student achievement and growth: 2005 edition.* Lake Oswego, OR: Northwest Education Association.

Dahlin, M. P. (2007). *A study of the NWEA RIT scale with the Washington assessment system*. Lake Oswego, OR: Northwest Evaluation Association.

Fouts, J. T. (1999). *School restructuring and student achievement in Washington State: Research findings on the effects of House Bill 1209 and school restructuring on western Washington schools.* Seattle, WA: Seattle Pacific University. School of Education.

Fouts, J. T. (2003). *A decade of reform: A summary of research findings on classroom, school, and district effectiveness in Washington State.* Lynnwood, WA: Washington School Research Center.

Fouts, J. T., Stuen, C., Anderson, M. A., & Parnell, T. (2000). *The reality of reform: Factors limiting the reform of Washington schools.* Seattle, WA: Washington School Research Center. Seattle Pacific University. Retrieved October 28, 2008, from http://www.spu.edu/orgs/research/Reality%20of%20Reform%20-%20CompleteFINAL.pdf

Hauser, C. (2003). *So, what d'ya expect? Pursuing reasonable individual student growth targets to improve accountability systems.* Lake Oswego, OR: Northwest Evaluation Association. Retrieved October 28, 2008, from http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/31/e7.pdf

Heil, D., Bybee, R. W., Pratt, H. A., & McCracken, K. (2008). *Washington State science standards: An independent study. Final review.* Olympia, WA: Washington State Board of Education. David Heil Associates. Retrieved October 28, 2008, from http://www.sbe.wa.gov/documents/ScienceStandards Review050708.pdf

How do WASL standards measure up. A comparison of the 2003 10th grade Washington Assessment of Student Learning with high school graduation exams from other states. (2005). Washington, DC: Achieve Inc. Retrieved November 18, 2008, from http://www.k12.wa.us/research/pubdocs/pdf/achieve-WA_final.pdf

K-12 science education standards for the State of Washington. First public draft. (2008). Olympia, WA: Office of Superintendent of Public Instruction.

Kingsbury, G. G., Olson, A., Cronin, J., Hauser, C., & Hauser, R. (n.d.). *The state of the standards: Research investigating proficiency levels in fourteen states*. Lake Oswego, OR: Northwest Evaluation Association. Retrieved October 28, 2008, from http://www.ecs.org/html/offsite.asp?document=http%3A%2F%2Fwww%2Enwea%2Eorg%2Fassets%2Fresearch%2Fnational%2FState%2520of%2520State%2520standards%2520%2D%2520complete%2520report%2Epdf

National Technical Advisory Committee. (2004). *Letter to Terry Bergeson, Superintendent of Public Instruction, Review of the quality of the Washington Assessment of Student Learning.* Olympia, WA: Office of Superintendent of Public Instruction.

Oberman, I. C., Arbeit, C., Praglin, & Goldstein, S. (2005). *Challenged schools,* *remarkable results: Three lessons from California's highest achieving high schools.* San Francisco: Springboard Schools.

Office of Superintendent of Public Instruction. (2008). *Washington State Report Card.* Olympia, WA: Office of Superintendent of Public Instruction. Retrieved November 18, 2008, from http://reportcard.ospi.k12wa.us/summary.aspx?.Year=2007-2008

Ohio Education Association. (2007). *The elementary and secondary education act of 1965: From the war on poverty to no child left behind.* Retrieved January 10, 2009, from http://www.ohea.org/GD/Templates/Pages/OEADetail.aspx?page=3&TopicRelationID=170&Content=8038

Overview: Assessments should make a difference. (2009). Lake Oswego, OR: Northwest Evaluation Association. Retrieved February 12, 2009, from www.nwea.org/assessments/map.asp

Partnership for Learning. (2008). *Education reform timeline.* (2008) Seattle, WA: Partnership for Learning. Retrieved October 28, 2008, from http://www.partnership4learning.org/reform/education_reform_timelinem

Perez, M., & Socias, M. (2008). *Highly successful schools: What they do differently and at what cost.* Palo Alto, CA: Stanford University. Institute for Research on Education Policy and Practice.

Pew Research Center. (2007). *'No Child Left Behind' gets mixed grades.* Retrieved January 12, 2009, from http://people-press.org/report/337/no-child-left-behind-gets-mixed-grades

Plato, K. C. (1995). *History of education reform in Washington State: The transition to performance-based, student learning education system.* Olympia, WA: Office of Superintendent of Public Instruction.

Reliability and validity estimates: Achievement level tests and measures of academic progress. (n. d.). Northwest Evaluation Associaiton. Retrieved November 10, 2008, from http://dcsd.k12.nv.us/pdf/Board%20Minutes/Reliability%20and%20Validity%20as%20of%202005%20(2).pdf

Science K-10 grade level expectations: A new level of specificity. Washington State's essential learning requirements. (2005). Olympia, WA: Office of Superintendent of Public Instruction.

Shannon, G. S., & Bylsma, P. (2003). *Nine characteristics of high-performing schools. A research-based resource for school leadership teams to assist with the school improvement process.* Olympia, WA: Office of Superintendent of Public Instruction.

Stecher, B. M., & Chun, T. (2001). *School and classroom practices during two years of education reform in Washington State.* Los Angeles: University of California Los Angeles. National Center for Research on Evaluation, Standards, and Student Teaching.

Stecher, B. M., Chun, T., Barron, S., & Ross, K. (2000). *The effects of the Washington State education reform on schools and classrooms: Initial findings.* Documented Briefing. Santa Monica, CA: RAND Education.

Teacher's handbook for Measure of Academic Progress. (2003). Lake Oswego, OR: Northwest Evaluation Association. Retrieved November 22, 2008, from

http://www.montgomeryschoolsmd.org/departments/helpdesk/docs/Map-

R/Teacher_Handbook.pdf

APPENDIX

Nine Characteristics of High-Performing Schools in Washington State

1. Clear and Shared Focus. Everybody knows where they are going and why. The focus is on achieving a shared vision, and all understand their role in achieving the vision. The focus and vision are developed from common beliefs and values, creating a consistent direction for all involved.

2. High Standards and Expectations for All Students. Teachers and staff believe that all students can learn and meet high standards. While recognizing that some students must overcome significant barriers, these obstacles are not seen as insurmountable. Students are offered an ambitious and rigorous course of study.

3. Effective School Leadership. Effective instructional and administrative leadership is required to implement change processes. Effective leaders are proactive and seek help that is needed. They also nurture an instructional program and school culture conducive to learning and professional growth. Effective leaders can have different styles and roles—teachers and other staff, including those in the district office, often have a leadership role.

4. High Levels of Collaboration and Communication. There is strong teamwork among teachers across all grades and with other staff. Everybody is involved and connected to each other, including parents and members of the community, to identify problems and work on solutions.

5. Curriculum, Instruction and Assessment Aligned with Standards. The planned and actual curriculum are aligned with the essential academic learning requirements (EALRs). Research-based teaching strategies and materials are used. Staff understand the role of classroom and state assessments, what the assessments measure, and how student work is evaluated.

6. Frequent Monitoring of Learning and Teaching. A steady cycle of different assessments identify students who need help. More support and instructional time is provided, either during the school day or outside normal school hours, to students who need more help. Teaching is adjusted based on frequent monitoring of student progress and needs. Assessment results are used to focus and improve instructional programs.

7. Focused Professional Development. A strong emphasis is placed on training staff in areas of most need. Feedback from learning and teaching focuses extensive and ongoing professional development. The support is also aligned with the school or district vision and objectives.

8. Supportive Learning Environment. The school has a safe, civil, healthy and intellectually stimulating learning environment. Students feel respected and connected with the staff and are engaged in learning. Instruction is personalized and small learning environments increase student contact with teachers.

9. High Levels of Family and Community Involvement. There is a sense that all have a responsibility to educate students, not just the teachers and

staff in schools. Families, businesses, social service agencies, and community colleges/universities all play a vital role in this effort. (Shannon & Bylsma, 2003 p. 3).