Researching if Aquaculture or Horticulture Helps Improve the Measure of Academic Progress Scores More Significantly

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Researching if Aquaculture or Horticulture Helps Improve the Measure of Academic Progress Scores More Significantly

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ABSTRACT

The author of Researching if Aquaculture or Horticulture Helps Improve the Measure of Academic Progress Scores More Significantly was interested in how to better serve the Science students in a small rural high school in Washington. Forty-nine students were used as test subjects. The students' Science Measure of Academic Progress Test scores from the fall of 2008 and winter of 2009 were used in a non-independent *t*-test to see which class improved most significantly. The author then used that data to help advise the ninth-grade students as to which Science class they should take to best prepare for the Washington Assessment of Student Learning.

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Joshua P Golob, Author

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Introduction

Background for the Project

The graduation requirements for Washington State had changed. Prior to the year 2013 the Science Washington Assessment of Student Learning had not been a requirement for graduation. Only Reading, Writing and Mathematics were required. Students who graduated in 2013 or after would be required to pass the Science Washington Assessment of Student Learning in order to receive a Certificate of Academic Achievement which was not required before the year 2013. For the 2007-8 school year, 48.2% of Washington State eighth graders passed the Science Washington Assessment of Student Learning and 40.0% of Washington State tenth graders passed the Science Washington Assessment of Student Learning (Office of Superintendant of Public Instruction, 2008).

The implications of having to pass the Science Washington Assessment of Student Learning in order to graduate were clear. If a student passed all classes and met the school's graduation requirements and did not pass the Science Washington Assessment of Student Learning, then the student would not earn a diploma from a Washington State high school. Since 40.0% of Washington State tenth graders passed the Science Washington Assessment of Student Learning in 2007-8, the other 60.0% would not qualify to receive a high school diploma in the year 2013. Thus, Washington's graduation rates would have dropped as would the earning power of the students not graduating from high school.

Statement of the Problem

The researcher posed a question related to the Science Washington Assessment of Student Learning scores. The question: "What could be done to increase the Science Washington Assessment of Student Learning scores even more significantly than what was currently being done?" An important note was that the researcher taught Horticulture and Aquaculture as Science classes prior to and concurrent with conducting the research. As stated above, for the 2007-8 school year, 48.2% of Washington State eighth graders passed the Science Washington Assessment of Student Learning and 40.0% of Washington State tenth graders passed the Science Washington Assessment of Student Learning. In the studied school only 12.5% of eighth graders pass the Science Washington Assessment of Student Learning and only 16.2% of tenth graders passed the Science Washington Assessment of Student Learning in that same year (Office of Superintendant of Public Instruction, 2008).

Passing the Washington Assessment of Student Learning in Reading, Writing, and Mathematics were already state requirements for Washington students to graduate from high school. Moreover, as of 2013, passing the Science Washington Assessment of Student Learning was also going to be required for Washington students to earn a high school diploma. Knowing that the state regulations were going to become more stringent for high school graduation, the researcher decided that the passing rate of the Science Washington Assessment of Student Learning must be increased before passing the Science Washington Assessment of Student Learning became a state graduation requirement.

Purpose of the Project

The purpose of the project was to study whether or not Horticulture or Aquaculture would better prepare students to meet benchmark on the 10th grade Science Washington Assessment of Student Learning. To test if Horticulture or Aquaculture would prepare students to meet benchmark in the Science Washington Assessment of Student Learning the researcher used a norm referenced test, the Measure of Academic Progress science assessment, to predict Science Washington Assessment of Student Learning scores. The Measure of Academic Progress science assessment was administered in the fall and winter at the studied school and the scores were compared to see if significant gains had been made. An independent *t*-test with $p<.05$ level of significance was used to compare the scores. The class that showed greater score gains would be seen as the better class for ninth graders to take in order to better prepare the students for the Science Washington Assessment of Student Learning.

Delimitations

The small rural school observed had the following demographic data according to the Office of the Superintendant of Public Instruction's Report Card for the 2007-8 school year. The school had a student population of 7.4% Native American, 0.3% Black, 86.1% Hispanic, and 6.1% White. The free and reduced lunch rate was 92.1% with a 16.3% migrant population and a 90% extended graduation rate. The school measured had a high school population of 425 students (Office of the Superintendant of Public Instruction Report Card).

The rural school ran a seven-period alternating block schedule that included an advisory period four days a week. The schedule had students taking four classes per day with an advisory class on Monday, Tuesday, Thursday and Friday. The same students and teachers looped together in Advisory from the students' ninth-grade through twelfth-grade year. Students earned ½ credits per semester for each class taken and students took the same class for two semesters each year. The school had three science teachers teaching Integrated Science, Aquaculture, Horticulture, Biology, Chemistry and Physics. Two science classes were required to meet the high school's graduation requirements.

The school in question was in an agricultural based community which grew hops, grapes, alfalfa, corn, apples, pears, cherries, prunes, apricots, mint, raspberries and other assorted crops. Beef cattle and dairy operations were also found in the community. The town had three gas stations with mini-marts, two small grocery stores, a bank, post office, liquor store and lamp factory.

Assumptions

The project was conducted under the assumption that since the researcher had obtained a Bachelor of Science in Agriculture Education, had been teaching for eight years and the researcher was competent to teach the Aquaculture and Horticulture curriculums. The State of Washington had declared the teacher Highly Qualified. Also assumed was that all students in the Aquaculture and Horticulture classes were attempting to earn the best grades the students possibly could.

Hypothesis

Ninth and tenth grade Horticulture classes will make greater improvement in science than ninth and tenth grade Aquaculture classes as measured by the Measure of Academic Progress scores from winter of the 2008-9 school year.

Null Hypothesis

Ninth and Tenth grade Horticulture classes will not show greater growth in Science than ninth and tenth grade Aquaculture classes as measured by the Measure of Academic Progress scores from Fall to Winter in the 2008-9 school year using a non-independent *t*-test with $p<.05$ level of significance.

Significance of the Project

As stated earlier, as of 2013 all students would be required to pass the Science Washington Assessment of Student Learning in order to graduate from a Washington State high school. The researcher assumed students graduating from high school would make one million dollars more, over an earning lifetime, than high school students who did not graduate from high school (EarnMyDegree.com, 2003).

The pertinence of whether the Aquaculture or Horticulture class improved the scores for the Measure of Academic Progress and Washington Assessment of Student Learning was valuable to the small rural school. Many students were told to take Aquaculture or Horticulture because Aquaculture and Horticulture were lower level science classes. The students who had lower reading scores were generally put into lower level science classes first and then moved into harder science classes after completion of either the Aquaculture or Horticulture classes. If the school was able to put students into the class that would increase students' science achievement the most, then the school's Measure of Academic Progress and Washington Assessment of Student Learning scores would have improved and the students would have had more success, thus increasing the number of students who passed the Science Washington Assessment of Student Learning and thus graduated from high school.

Procedure

In the 2—8-9 school year the researcher taught two classes of Aquaculture which included 55 students and three classes of Horticulture that included 75 students. The books used were *Introductory Horticulture 5th Edition* from the Delmar Publishing Company (1997) and a second edition *An Introduction to Aquaculture* book from Interstate Publishing Company(1997). The classes were also supplemented with common science assessments between all three of the high school teachers along with experiments that were student-made throughout the school year. The common assessments were all related to the scientific method.

The students ranged from ninth- through twelfth-graders with about 20% of the students were eleventh- and twelfth-graders. Most of the upper classmen were using the classes as vocational credits, instead of science credits, to count towards graduation from high school. The researcher gathered the information from the Measure of Academic Progress scores from a random selection of twenty-five 9th and 10th grade students (combined) from each Aquaculture and Horticulture class from the 2008-9 school year. The researcher simply assigned a number to each student and had a computer randomly select twenty-five numbers from each class. The Measure of Academic Progress Test was taken both in the fall and in the winter. The researcher inferred that the class that had the most pre-to-posttest growth on the Measure of Academic Progress assessment was the class that would better prepare students for the Washington Assessment of Student Learning assessment.

All students took the Measure of Academic Progress assessment in the fall of 2008 and winter of 2009. A non-independent *t*-test was used to compare scores and determine if significance was reached at the .05 level of significance. If a student left the class for more than two weeks the student was dropped from the test group. Students were told to work hard on the Measure of Academic Progress Test but were not told that the test results were being used for a comparative analysis.

Definitions

A/B Alternating Block Schedule. The schedule for the school researched was called an A/B Alternating Block Schedule. Six classes were 90 minutes long and met every other day for an entire year. Thus, one week a class met on Monday, Wednesday, and Friday and the next week the class met on Tuesday and Thursday.

3 A/B This was the name of the class period which met for 45 minutes every day, on both A and B days. This was an Aquaculture class.

Advisory. This class met for 30 minutes every Monday, Tuesday, Thursday and Friday during the research period. The students and the teacher stayed the same for all four years of the students' years in high school. Advisory was similar to a home-room class. School portfolios were made and the advisory teacher checked to make sure the students had kept "best works" from all classes. The advisory teacher also met with the advisory students' parents a minimum of twice a year.

Acronyms

AYP.	Adequate Yearly Progress.
EALR.	Essential Academic Learning Requirements.
ELL.	English Language Learner.
GLE.	Grade Level Expectation.
OSPI.	Office of Superintendent of Public Instruction.
MAP.	Measure of Academic Progress.
NWEA.	Northwest Evaluation Association.
PISA.	Programme for International Student Assessment.
RIT.	Rasch Unit.
TAC.	Technical Advisory Committee.
WASL.	Washington Assessment of Student Learning.

CHAPTER 2

Review of Selected Literature

Introduction

The gap between the rich and poor was widening in the United States between 1990 and 2009 (United States Census Bureau, 2008). When looking at this wide gap of income earned, a person had to look no further than the education people had received and completed. People from low income homes were less likely to graduate from high school, attain fewer postsecondary degrees and were thus subject to lower limits of income for an entire lifetime (National Center for Education Statistics 2004).

Aquaculture An Introduction 2nd Edition by Jasper S. Lee and Michael E. Newman (1997) and the EALRs that were focused on in the 2008-9 school year.

The researcher decided that the major difference between the Aquaculture and Horticulture classes was the content of the classroom books. Thus, the researcher wanted to document the content of the Aquaculture and Horticulture books because if there was significance found in the pre-to-posttest MAP assessment scores, then the class content would have been seen as the reason for the Science MAP gains. One aquaculture class met for 90 minutes every other day while the other was a 3AB class which met for 45 minutes every day. Both classes had one entry task for every 90 minutes of class time. For each chapter the class received 10 terms. The book had more than 10, but the teacher picked the 10 most important words to know and the students wrote the terms down, defined the words and then drew pictures that showed the definition graphically. The students read the chapter over two to three weeks.

The students created tree maps of the information that was important and the class discussed what was learned at the end of every class period. A tree map was a graphical thinking organizer that had a title and three to five branches that were labeled with the main ideas of the chapter. Within each branch the main points of that section were also explained by the students. The post chapter questions were done as the students read each section. The teacher handed out a teacher-generated crossword for students to answer as a form of studying for the chapter test. The students also made a crossword puzzle for each chapter. The students worked in pairs to create 15 clues of important information. The crossword that the students created acted as a study guide for the test. The crosswords the teacher deemed of good enough quality were given as extra credit after students finished the test. The classes also fed the fish every class period and cleaned the water bi-weekly. If the students saw a problem such as the fish sucking for air at the top of the water or not eating feed, the students had to figure out what the problem was and then fix it.

For the research study the researcher listed what chapters were taught from the Aquaculture book, what was in the chapter and which EALRs were met before the students took the second MAP assessment in the winter. Chapter 1, *Aquaculture Industry,* discussed the different types of aquaculture areas such as food, bait, recreation, ornamental and feed. Science EALR 1.2 was met. Chapter 2, *The Importance of Aquaculture,* was about how aquaculture was beneficial for people as a food and to make money. Omega-3 fatty acids were discussed along with farming, consuming, educational agencies and the national trade deficit. Science EALR 1.3 was met.

Chapter 3, *Fundamentals of Aquaculture Biology,* discussed the scientific classification system, the importance of different species, body systems, habitat considerations and reproduction. Science EALR 1.2 was met. Chapter 4, *Water Environments,* discussed water supplies, the water cycle, different types of water facilities and the suitability of water. Science EALR 1.2 was met.

Chapter 5, *Water Quality and Environment,* discussed water quality, chemical and physical characteristics, management of water, oxygenation, weeds, calculating volume and disposing of water without polluting the environment. Science EALR 1.2 was met. Chapter 6, *Disease and Pest Management,* discussed what a healthy environment was, how diseases were harbored, losses, signs of disease, disease control and prevention, parasites and control along with regulations in pest control. Science EALR 1.3 was met.

Chapter 7, *Aquaculture Marketing,* was about marketing, functions, marketing channels, economy of scale, marketing planning and food processing. The students also learned how to fillet fish, vacuum seal the fish and cook them. Science EALR 1.2 was met. Chapter 10, *Raising Freshwater Aquacrops: Warm Water Species,* discussed the general requirements needed for catfish, crawfish, tilapia and striped bass. The class actually had been raising Tilapia for the entire school year. Science EALR 1.3 was met.

Additions that were added to supplement the book were "Science Entry Tasks" which were provided every Thursday and Friday. One of the studied school's three science teachers would make the entry tasks for the entire month and each of the three science teachers gave the entry tasks to every science class that was taught in the high school under study. All entry tasks dealt with Science EALRs 2 and 3.

The researcher also had the Aquaculture students work on experiments in groups of three that were later presented to the class. The science experiments were done with the students setting-up experiments that the teacher had prearranged. The students were also allowed to pick science experiments to conduct and present to the class. The culmination of the science experiments was in March when the Aquaculture class held a science fair for the public. The Science Fair met Science EALR 2.

Introductory Horticulture Fifth Edition by H. Edward Reiley and Carroll Shry, Jr. (1997) and the EALRs that were focused on in the 2008-9 school year.

Unit 1, *Exploring the Horticulture Field,* dealt with scientific horticulture names, jobs in horticulture and the requirements of those jobs. Science EALR 1.1 was met. Unit 2, *Plant Taxonomy,* discussed how plants were named and different plant families. Science EALR 1.2 was met. Unit 3, *Parts of the Plant and Their Functions,* discussed the importance of plants, parts of a plant, flowers, fruits and seeds. Science EALR 1.2 was met.

Unit 4, *Environmental Requirements for Good Plant Growth,* discussed the underground environment, types of soil, soil improvement as well as the soil layers. Science EALR 1.1 and 1.2 were met. Unit 5, *Growth Stimulants, Retardants, and Rooting Hormones,* was about apical dominance, stimulants, chemical retardants, rooting hormones and biostimulants. Science EALR 1.2 was met. Unit 6, *Seeds,* discussed propagation of plants from seeds, seed germination, monocotyledons and dicotyledons, indirect seeding and direct seeding. Students also were in the greenhouse practicing the techniques from the Horticulture book from January through May. Working in the greenhouse met Science EALR 1.3.

Unit 7, *Softwood and Semi-softwood Cuttings; and Micropropagation,* discussed how to take a cutting, use hormone treatment, label and control the atmosphere for plants. Science EALR 1.2 and 1.3 were met. Unit 16, *Integrated Pest Management and the Biological Control of Pests and Diseases,* discussed how there are many different ways to lower pest populations and that some amount of pests were tolerable. Science EALR 1.2 and 1.3 were met. Unit 17, *The Safe Use of Pesticides,* discussed the different types of pesticides, how to select the proper pesticide, toxicity, label information, safety precautions and how to treat a person if poisoned. Science EALR 1.2 and 1.3 were met.

Just as for the aquaculture class, the horticulture class had the same entry tasks every Thursday and Friday that were added to supplement scientific inquiry. The researcher also had the students work on experiments in groups of three that were later presented to the class. The science experiments were done with the students setting-up experiments that the teacher had prearranged. The students were also allowed to pick science experiments to conduct and present to the class. The culmination of the science experiments was in March when the Aquaculture class held a science fair for the public. The Science Fair met Science EALR 2.

The three horticulture classes met for 90 minutes every other day. All three classes had one entry task every class period. The students read the assigned chapter over two to three weeks. The students created tree maps of the information that was important and the class discussed what was learned at the end of every class period. The post chapter questions were done throughout the chapter as the Horticulture students read each section. The teacher handed out a teacher-generated crossword for students to answer as a form of studying for the chapter test. The students also made a crossword puzzle for each chapter. The students worked in pairs to create 15 clues of important information. This student-made crossword puzzle acted as a study guide for the chapter test. The crosswords that the teacher deemed of good enough quality were given as extra credit after the students finished the test. The Horticulture classes started to plant seeds in January and receive shipments of plugs to transplant in February and March. The students took care of the plants and kept a daily journal of watering the plants, pinching the plants and observations about whether the plants were thriving or dying. The Horticulture class culminated the project with a plant sale on May 8th and 9th, 2009.

A Study of the Alignment of the NWEA RIT Scale with the Washington Assessment System

Dr. Dahlin (2007) completed a project that connected the tests used for the Washington mathematics and reading WASL with the NWEA MAP assessment. The information from the WASL was used in a study to correlate RIT scale scores with passing scores on the WASL. The WASL was administered in the spring and the MAPs RIT score was determined based on the percentage of the population within the selected study group that performed at each level on the WASL. The RIT scores were then calculated. An example was that if 40% of the study group in grade three mathematics performed below the proficient level on the WASL, the RIT score would have been equivalent to the 40th percentile for the study population. The RIT score was the estimated point on the NWEA RIT scale that would be equivalent to the minimum score for proficiency on the state test. The categories that were established were: well below standard, below standard, meets standard and above standard (Dahlin, 2007).

Why Science is Important to Students and What the 10th Grade WASL Looks Like

The National Science Teachers Association reported in 2008 that U.S. students scored below the average of the educational systems tested. American students scored an average 489 points which was 11 points below the 500 point average. The United States ranked 21st out of the 30 countries that were tested. The science Programme for International Student Assessment (PISA) measured how well students could extrapolate from what had already been learned and apply that knowledge and skills to new settings.

So, why was the PISA important to the study of Science MAP and WASL assessments? The PISA scores helped to define where American students ranked relative to peers in the expanding global economy. With the economy turning more global every year, the National Science Teacher's Association surmised that students from other countries would be better prepared for more jobs and that the United States would see lower wages and a reduced standard of living within the next 15 years. The U.S. was competing with a world economy that saw trade barriers go down and an increase in technology. If the United States lost the ability to supply skilled workers to generate economic growth, increased productivity and technological innovation in the decades ahead, it depended on student performance now (National Science Teachers Association, 2008).

The United States understood that Americans were falling behind other countries in science, so the State of Washington decided to increase science awareness in students through the WASL. The following WASL information was provided by Lund, Stickel and Yergen (2006).

Science WASL Scenario Test Map. This was point-balanced in Physical, Earth/Space and Living Systems. The seven sections were:

1. Investigating a Physical System (Inquiry in Science)
2. Investigating an Earth/Space System (Inquiry in Science)
3. Investigating a Living System (Inquiry in Science)
4. Designing a Solution (Application of Science)
5. Analyzing a System (Systems of Science)
6. Analyzing a System (Systems of Science)
7. Pilot Scenario (5 items).

(For 9th and 10th grade Science EALRS see Appendices Table 1)

History of the WASL.

In 1993 Education Reform Laws (HB 1209) mandated the creation of a state achievement test. The WASL was then created to measure how well students were meeting Washington State's EALR's and GLE's. Under state and federal law the WASL met all requirements for standardized testing (Office of the Superintendent of Public Instruction, 2004).

The federal *No Child Left Behind Act of 2001* also required every state to test all students in grades 3-8 and grade 10 in reading and mathematics annually. Writing and science were to be tested at selected grade levels. The WASL was approved by the U.S. Department of Education for use in the state of Washington. The WASL was administered every spring in grades 3-8 and 10. Students were tested in reading and mathematics in grades 3-8; in writing in grades 4,7 and 10; and in science in grades 5,8 and 10 (Partnership 4 learning, 2009).

The Science WASL was first administered on a voluntary basis in 2003. The test was administered to grades 8 and 10 with 95% of Washington State's schools participating at the middle school level and 81% at the high school level. In the year 2004 the Science WASL was required in grades 8 and 10. In the year 2005 and after, the Science WASL was also given to fifth graders (Roberts, 2003).

OSPI Information about the WASL.

Tenth graders were expected to examine scientific theories and master investigative skills in experiments. Students were also expected to develop physical, conceptual and mathematics models to represent and investigate systems and processes. Students were also expected to infer and make predictions based on scientific evidence and then the students were supposed to be able to apply the skills and knowledge that had been learned previously to new situations.

The Technical Advisory Committee (TAC) used the Standards for Educational and Psychological Testing, American Psychological Association and National Council on Measurement in Education as a basis for having made professional judgments about the reliability and validity of scores from the WASL. The TAC had reviewed the technical reports from 1999 through 2002. The reports provided evidence regarding the validity of inferences made from WASL scores about the level of student achievement on the EALRs. Reports included test development methods, item content review, item analysis, methods for setting performance standards, evidence for validity of scores, and annual descriptive data regarding statewide performance on the WASL assessment (OSPI, 2008).

The TAC concluded that the WASL met the relevant standards of validity as prescribed by the National Standards for Educational and Psychological Testing. The test design was shown to adequately test the EALRs for the State of Washington. The level of validity and reliability was acceptable for reading, writing and mathematics. Given that the opportunity for retakes was present, the Grade 10 WASL scores were sufficiently reliable and valid to award the Certificate of Mastery (OSPI, 2008).

<u>Measures of Academic Progress.</u>

The NWEA MAP assessment has been proven to be exceptionally stable and valid over time. The scale was based on the same modern test theory that made up the Scholastic Aptitude Test (SAT). The benefit of the MAP assessment was that the MAP assessment was based on the RIT scale which was divided into equal parts like centimeters on a ruler. Whether a person scored high or low, the next test would have shown if there was improvement from the previous test or not. Because the tests were adaptive and the test items displayed were based on student performance and not on age or grade, identical scores across grades meant the same thing. For example, a third grader who received a score of 210 and a fourth grader who received a score of 210 were learning at the same level. The RIT score allowed growth to be measured independent of grade level. A distance between 240 and 252 was the same as the distance between 170 and 182. The RIT scale then allowed educators to apply simple mathematical equations to the scores in order to find out mean and median scores across a class or grade.

The test design for the MAP was based on more than 15,000 items for mathematics, reading, language usage and science. Each year hundreds of new items were added to the test item bank. Test items were developed by teachers who received thorough training in the NWEA item-writing process. Each potential item had to pass a rigorous bias and content review which was followed by field-testing with a minimum of 300 students. Only items that passed review became part of the item test bank.

The reliability of the MAP assessment was described as test-retest reliability or temporal stability. "To what extent does the test administered to the same students twice yield the same results from one administration to the next?" (Northwest Evaluation Association, 1999). The question of whether or not test results were reliable between different administrations was answered in terms of a Pearson product-moment correlation coefficient. The minimum acceptable correlation was considered to be .80; 1.00 was a perfect correlation. A span of two to three weeks was used to separate the two test administrations. Most coefficients were in the mid .80's to the low .90's. Therefore, the test results were deemed reliable.

The Northwest Evaluation Association measured the validity of the MAPs Test. Did the test measure what was supposed to be measured? Content validity was assured by carefully mapping existing content standards from a district or state into a test blueprint. Test items were selected for a specific test based on a match to the content standard as well as to the difficulty level of the test created. Every effort was made within a goal area or strand to select items that had a uniform distribution of difficulties (Northwest Evaluation Association, 1999).

Summary

The researcher of the study described how the WASL and MAP assessments were related to one another with accuracy. The MAP RIT scores were proven to be predictors of students who passed the WASL. Moreover, the research stated what the 10th graders were supposed to know in order to pass the Science WASL. The TAC researched the WASL and found the WASL to be a reliable measure of student achievement. Lastly, evidence was provided to prove that the MAP Test was both reliable and valid. In depth explanations of how the MAP Test items were formed and tested was also provided.

CHAPTER 3

Methodology and Treatment of Data

Introduction

The author used the Science MAP assessment to collect data to see if 9th and 10th students scored higher from fall to winter. The assessment was an unbiased computer program that generated exact number scores for students. The research had showed that the quantitative test accurately showed the knowledge of the test-taker. The researcher supposed that if a person gained academically in science from fall to winter on the MAP assessment than that person would also have gained knowledge for taking the Science WASL.

Methodology

The quantitative study examined how Aquaculture and Horticulture students scored on the Science MAP assessment in the fall and winter of the 2008-9 school year. The researcher used an independent *t*-test and compared the fall Science MAP tests of Aquaculture and Horticulture to make sure that the tests did not show significance when compared to one another. If significance had been found then the study would have been irrelevant. The researcher then did an independent *t*-test to determine if significance existed between the posttest for both Aquaculture and Horticulture. Lastly, the researcher did a non-independent *t*-test to see if either the Horticulture class or Aquaculture class made significant gains from the fall to winter MAP assessment.

Participants

The researcher took the gathered the students for the study from two Aquaculture and three Horticulture classes that contained students that ranged from ninth- through twelfth-grade. About 20% of the students were eleventh- and twelfth-graders. Most of the upper classmen were using the classes as vocational credits instead of science credits to count towards graduation from high school. The researcher randomly selected twenty-five 9^{th} and 10^{th} grade students (combined) from all of the Aquaculture and Horticulture classes from the 2008-9 school year. The researcher simply assigned a number to each student and had a computer randomly select twenty-five numbers from each class. The MAP scores from the selected forty-nine students were the scores used in the research conducted. One important note was that one horticulture student dropped out of school and thus the number 10 student in Horticulture was left blank due to the research parameters set.

Instruments

The Science MAP assessment was used for the first time in the 2008-9 school year at the school studied. However, the reading and mathematics MAP assessments had been used for the past eight years at the studied high school and were found to be useful. The MAP assessment was administered in the fall, winter and spring. However, due to time constraints, the researcher only compared the fall and winter scores of the students. The *t*-tests were done using the STATPAK which was a computerized statistical program.

Design

The Science MAP assessment was given to the researcher's ninth and tenth grade students in the fall of 2008 as a pretest and in the winter of 2009 as a posttest. The researcher ran a pre-to-pretest between Aquaculture and Horticulture classes to make sure that no significance was shown between the two classes. Then a Post-to-posttest was run to make sure that no significance was shown between the Aquaculture and Horticulture classes' winter MAP scores. With no significance having been shown the researcher ran a pre-to-post *t*-test for both Aquaculture and Horticulture to determine if either class improved significantly from the fall to winter Science MAP assessment.

Procedure

All 9th and 10th grade students in the school studied had to take the Science MAP test. After the 25 Aquaculture and 25 Horticulture students were randomly selected, the MAP scores from the fall and winter were written down next to the child's name. The researcher then assigned a number, 1-25, to each student to keep the students anonymous. As stated earlier, the Horticulture class' statistics was run using 24 student scores instead of 25 scores since one of the randomly selected students withdrew from school before the winter MAP assessment was taken. The STATPAK was then used to run the pre and posttests on the MAP scores of the forty-nine students randomly selected.

Treatment of the Data

The data was entered into a Microsoft Excel spreadsheet which was then used to find the mean and standard deviation of both the Aquaculture and Horticulture fall and winter scores. The STATPAK was used to find the degrees of freedom and *t*- value for each *t*-test conducted.

Summary

Twenty-five 9th and 10th grade students were selected from two Aquaculture classes and twenty-five 9th and 10th grade students were selected from three Horticulture classes. Students were then assigned a number for anonymity, however one Horticulture student was dropped from the study as that student withdrew from the Horticulture class. The forty-nine students' MAP scores from fall and winter were put into pre/post *t*-tests to see if the Horticulture class or Aquaculture class made significant gains from the fall to winter Science MAP assessment.

CHAPTER 4

Analysis of the Data

Introduction

The purpose of the project was to study whether or not Horticulture or Aquaculture would better prepare students to meet benchmark on the 10th grade Science Washington Assessment of Student Learning using a norm referenced test, the Northwest Evaluation Association MAP assessment, to predict Washington Assessment of Student Learning scores. The Northwest Evaluation Association assessment was administered in the fall and winter at the school under study and the scores were compared to see if significant gains had been made. An independent *t*-test with $p<.05$ level of significance was used to compare the scores. The class that showed more growth would be seen as the better class for ninth graders to take in order to better prepare the students for the Science Washington Assessment of Student Learning.

Description of the Environment

The rural school ran on a seven period alternating block schedule that included an advisory period four days a week. The schedule had students taking four classes per day with an advisory class on Monday, Tuesday, Thursday, and Friday. For Advisory, the same students and teachers were together in advisory from students' ninth grade year through twelfth grade year. Students earned ½ credits for each class taken each semester and students took the same class for two semesters each year. The school had three science teachers and the science classes the school offered were Integrated Science, Aquaculture, Horticulture, Biology, Chemistry, and Physics. Two science classes were required to meet the high school's graduation requirements. Every 9th and 10th grade student took the MAP test in the fall, winter, and spring.

Hypothesis/Research Question

Ninth and tenth grade Horticulture classes will make greater improvement in science than ninth and tenth grade Aquaculture classes as measured by the Measure of Academic Progress scores from winter of the 2008-9 school year.

Null Hypothesis

Ninth and Tenth grade Horticulture classes will not show greater growth in Science than ninth and tenth grade Aquaculture classes as measured by the Measure of Academic Progress scores from Fall to Winter in the 2008-9 school year using a non-independent *t*-test with $p<.05$ level of significance.

Results of the Study

Table 2.
t-test of Pre and Pre MAP Scores for the Researcher's Randomly Selected Horticulture and Aquaculture Students

Test	N	Mean	Standard Deviation
Pre -Horticulture	24	194.46	24.4611
Pre-Aquaculture	25	201.88	11.6547
df=47		t=-1.36	p>.05

(there was one horticulture student who was randomly selected that dropped out of school and that is why there was only 24 horticulture scores)

Table 2 compares the pretest scores of the researcher's Horticulture and Aquaculture students using the MAP Science assessment. Table 2 indicates there was not statistical significance between the fall MAP scores. Since there was no significance the researcher continued the study to see if there was significance for either the Horticulture Class or the Aquaculture class from fall to winter.

Table 3.
t-test of Post and Post MAP Scores for the Researcher's Randomly Selected Horticulture and Aquaculture Students

Test	N	Mean	Standard Deviation
Post-Horticulture	24	202.17	9.234466
Post-Aquaculture	25	204.64	12.36891
df=47		t=-0.79	p>.05

Table 3 compares the posttest scores of the researcher's Horticulture and Aquaculture students using the MAP test. The null hypothesis was rejected. Table 3 indicates there was not statistical significance between the winter MAP scores from Horticulture and Aquaculture. Since there was no significance the researcher assumed validity of the *t*-test results for all pre to post tests.

Table 4.
t-test of Pre and Post MAP Scores for the Researcher's 25 Randomly Selected Horticulture Students

Test	N	Mean	Standard Deviation
Pre	24	194.46	24.4611
Post	24	202.17	9.234466
df=23	t=1.47		p<.05

Table 4 compares the pre- and posttest scores of the researcher's Horticulture students using the MAP Science assessment. The null hypothesis was rejected. Table 4 indicates there was statistical significance between the fall and winter MAP scores. The table shows there was greater than expected growth in science skills for the researcher's Horticulture students.

Table 5.
t-test of Pre and Post MAP Scores for the Researcher's 25 Randomly Selected Aquaculture Students

Test	N	Mean	Standard Deviation
Pre	25	201.88	11.6547
Post	25	204.64	12.36891
df=24	t=1.44		p<.05

Table 5 compares the pre- and posttest scores of the researcher's Aquaculture students using the MAP test. The null hypothesis was rejected. Table 5 indicates there was statistical significance between the fall and winter MAP scores. The table shows there was greater than expected growth in science skills for the researcher's Aquaculture students.

Findings

The hypothesis and null hypothesis were both rejected. Both the Horticulture classes and Aquaculture classes showed significant growth from fall to winter. Thus neither class was more advantageous to take than the other. The Aquaculture classes had a 204.64 mean winter score and the Horticulture classes had a 202.17 mean winter score. To be at grade level a 9th grade student should have scored 214 points on the MAP assessment and a 10th grader should have scored 217 points on the MAP assessment. Thus, both Horticulture and Aquaculture showed significant gains, but both mean winter scores were still far short of being at grade level.

Discussion

Horticulture student # 20 presented a problem to the statistics as that student scored a 95 in the fall and a 206 in the winter. This was an anomaly and may have skewed the data. The study was conducted in the first year of Science MAP testing at the school under study. This may have made a difference in the MAP scores. To make sure that this was not an anomaly the researcher planned to continue to study Science MAP data for years to come. The researcher still supposed that by passing the Science WASL and graduating high school that a student would have a better chance of post-secondary education and increasing that person's annual income. As a result of the study, both classes showed significance from fall to winter Sciecnce MAP assessment scores. Thus, neither Aquaculture nor Horticulture showed an advantage over the other. Limitations to the study were that even though the Aquaculture classes and Horticulture classes showed significant growth more studying of each class was needed. Another limitation was that reading scores and progress that was made in other classrooms was unmeasureable. Those unmeasureable items may have had an influence on the Science MAP scores.

Summary

Both Aquaculture and Horticulture were seen to improve the Science MAP scores from fall to winter of the 2008-9 school year. Thus, the hypothesis and null hypothesis were disproven. Both Aquaculture and Horticulture raised Science MAP scores significantly from fall to winter.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

A study was developed by the researcher to determine whether ninth- and tenth-grade students in Horticulture or in Aquaculture would improve the most from fall to winter. The Measures of Academic Progress assessment in science was used to determine if students had made significant gains or not.

Summary

The researcher wanted to determine if ninth and tenth grade students should take Horticulture or Aquaculture to better prepare for the tenth grade Science WASL. According to the research conducted by the author, the Horticulture class was expected to show more gains from the fall to the winter assessment because of the curriculum of the class. The researcher decided to monitor ninth- and tenth-grade students since ninth- and tenth-graders had not yet taken the Science WASL. The Measures of Academic Progress was a computerized adaptive assessment that accurately reflected the grade level of each student and measured growth over time. The researcher used the fall MAP scores as the pretest and the winter MAP scores as the posttest.

Conclusions

Students were given the Measure of Academic Progress Science assessment in the fall as a pretest. In the winter the students were given the same assessment as a posttest. Results from Table 2 indicated that there was no significance between the Horticulture class and the

Aquaculture class pretest scores. Table 3 indicated that there was no significance between the Horticulture and Aquaculture posttests. Therefore, the pre-to-posttest results of Aquaculture and Horticulture should have been reliable. Table 4 indicated that the Horticulture students made greater than expected growth and Table 5 indicated that the Aquaculture students made greater than expected growth. Thus, both the hypothesis and null hypothesis were rejected. Both the Aquaculture and Horticulture classes showed significant gains from the pre-to-posttest of the Science MAP assessment. It was important for the researcher to comment that both Aquaculture and Horticulture, while having showed significance between the pre- and posttests of the Science MAP assessment still did not meet the benchmark that was set for 9th and 10^{th} grade students by the NWEA. Ninth graders should have had a RIT score of 214 and 10^{th} graders should have had a RIT score of 217. Aquaculture's mean winter score was 204.64 and Horticulture's mean winter score was 202.17. Thus, even though significant growth was showed in the pre-to-posttests, the classes still were below grade level.

Recommendations

The researcher recommended that further testing be conducted on high school ninth- and tenth-grade students. An additional study should be conducted to determine if the results obtained were valid or not. A second study was recommended to see if the students who made the biggest gains between the pretest and posttest had any other contributing factors such as study time, parents helping with homework, etc. Another recommendation was to conduct a study to determine if students' grades had an impact on score increases between the pretest and posttest. The final recommendation was to conduct a study to determine if the students who scored higher on the Science MAP assessment also scored higher on the tenth grade Science WASL.

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APPENDICES

Table 1.

9th and 10th Grade EALRs from *K-10 Grade Level Expectations: A New Level of Specificity (2005)*

1. SYSTEMS: The student knows and applies scientific concepts and principles to understand the properties, structures, and changes in physical, earth/space, and living systems.

To meet this standard, the student will:

1.1. Properties: Understand how properties are used to identify, describe, and categorize substances, materials, and objects, and how characteristics are used to categorize living things.

1.2. Structures: Understand how components, structures, organizations, and interconnections describe systems.

1.3. Changes: Understand how interactions within and among systems cause changes in matter and energy.

2. INQUIRY: The student knows and applies the skills, processes, and nature of scientific inquiry.

To meet this standard, the student will:

2.1. Investigating Systems: Develop the knowledge and skills necessary to do scientific inquiry.

2.2. Nature of Science: Understand the nature of scientific inquiry.

3. APPLICATION: The student knows and applies science concepts and skills to develop solutions to human problems in societal contexts.

To meet this standard, the student will:

3.1. Designing Solutions: Apply knowledge and skills of science and technology to design solutions to human problems.

3.2. Science, Technology, and Society: Analyze how science and technology are human endeavors, interrelated to each other, society, the workplace, and the environment.

Table 2.

<u>*t*-test of Pre and Pre MAP Scores for the Researcher's Randomly Selected Horticulture and Aquaculture Students</u>

	Hort pre	Aqua pre
1	198	186
2	211	206
3	189	213
4	205	215
5	200	212
6	177	215
7	195	213
8	184	218
9	207	190
10		206
11	216	197
12	189	191
13	192	190
14	187	183
15	184	184
16	196	202
17	206	209
18	213	213
19	210	201
20	95	189
21	185	205
22	191	190
23	199	211
24	227	191
25	211	217

Table 3.
t-test of Post and Post MAP Scores for the Researcher's Randomly Selected Horticulture and Aquaculture Students

	Hort post	Aqua post
1	201	193
2	213	215
3	200	217
4	201	214
5	198	225
6	194	210
7	194	199
8	204	211
9	210	192
10		207
11	205	199
12	193	178
13	201	192
14	203	182
15	185	215
16	214	197
17	194	223
18	177	213
19	208	199
20	206	194
21	207	204
22	209	198
23	211	208
24	213	209
25	211	222

Table 4.

t-test of Pre and Post MAP Scores for the Researcher's 25 Randomly Selected Horticulture Students

Horticulture

	pre	post
1	198	201
2	211	213
3	189	200
4	205	201
5	200	198
6	177	194
7	195	194
8	184	204
9	207	210
10		
11	216	205
12	189	193
13	192	201
14	187	203
15	184	185
16	196	214
17	206	194
18	213	177
19	210	208
20	95	206
21	185	207
22	191	209
23	199	211
24	227	213
25	211	211

Table 5.

t-test of Pre and Post MAP Scores for the Researcher's 25 Randomly Selected Aquaculture Students

Aquaculture

	pre	post
1	186	193
2	206	215
3	213	217
4	215	214
5	212	225
6	215	210
7	213	199
8	218	211
9	190	192
10	206	207
11	197	199
12	191	178
13	190	192
14	183	182
15	184	215
16	202	197
17	209	223
18	213	213
19	201	199
20	189	194
21	205	204
22	190	198
23	211	208
24	191	209
25	217	222