A correlational study on students' feelings towards Earth Science and chapter test scores

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A Special Project

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FACULTY APPROVAL

A Correlational Study on Student's Feelings Towards

Earth Science and Chapter Test Scores

Approved for the Faculty

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ABSTRACT

The purpose for the project was to identify if a correlation existed between the students' feelings towards Earth Science and chapter test scores. The researcher gathered data of students' feelings towards science using several Likert scale surveys and the student's average chapter test score. The surveys were administered after the completion of the chapter tests and thus the average Likert scale score was used in combination with the student's average chapter test score in order to compute an r value using the Pearson r analysis.

The null hypothesis, which stated that there was no significance between the student's attitudes and their science overall chapter test percentage was rejected at the 95% and 99% levels.

Support was found for the hypothesis, which stated that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage, at the 95% and 99%.

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Introduction

Background for the Project

Toppenish High School (THS) had not met the Annual Yearly Progress (AYP) benchmark for the passed several years. Moreover, as of October 2007, 8.7% of students who completed the Washington Assessment for Student Learning Science (WASLS) received a passing score. The researcher subscribed to the challenge addressed by Professor Léonie Rennie of Curtin University of Technology. "Our challenge is to turn around this disinterested majority by making it worth student's while to learn science in a meaningful way (2006)." Through the improvement of student's chapter test grades would increase.

Statement of the Problem

There was a need for science education reform at Toppenish High School. It was unethical to have 91.3% of the students fail the WASLS. The researcher followed the advice provided by Dr. Rodger Bybee of the US Biological Sciences Curriculum Study.

> In the end, we want to provide curriculum materials that enhance science teaching and student learning. Science curriculum and instruction should facilitate conceptual change and instruction should be based on fundamental concepts and complementary

facts and provide opportunities for students to learn and develop metacognitive strategies (2006).

The continued failure in science had lead to a decrease in student interest towards the careers in scientific fields. Furthermore, the researcher attempted to address the need for science education reform as it related to student's attitudes towards science. In order to identify the validity of this statement, a significant correlation between the student's attitudes and their science grade needed to be identified.

Purpose of the Project

The purpose of the project was to identify if a correlation existed between student's attitudes towards science and their success in the science classroom. Success was identified as receiving a passing grade. Their attitudes were measured using a Likert Scale.

Delimitations

The study was held throughout the first semester at Toppenish High School. The students were selected from the researchers Earth Science classes. They were enrolled in one of two yearlong classes totaling 55 students. Earth Science was the subject matter of the classroom. These yearlong classes were mixed grade levels. Some students were in their second and third attempt towards attaining a passing grade. Students who demonstrate their understanding of 70% of the objectives set forth by the science department through tests, quizzes, daily work and laboratory exercises received a passing grade.

The materials used in both classes were recently purchased in attempt to aid in a more hands-on-approach towards science. The new curriculum also included a minimum of one laboratory experiment or extended activity per chapter.

Assumptions

The students were asked to complete a Likert survey regarding their feeling towards science, Appendix A. The researcher assumed all students answered truthfully as they were encouraged to do so. Furthermore, students were taught Earth Science by the researcher who did not offer any rewards or penalty for expressing their true feelings.

This study was conducted under the assumption that all students were proficient in the English language. Therefore, all students understood the test questions as well as questions/statements on the survey.

In addition, the researcher also assumed all students had demonstrated an eighth grade level of science knowledge. This included some knowledge of volcanoes, earthquakes, and continental drift. The focus of study in these areas was a more in depth approach towards more complex concepts.

Hypothesis

The researcher subscribed to the theory that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage. This was determined through a series of surveys using a Likert scale and the student's overall chapter test percentage.

Null Hypothesis

In order to maintain the integrity of the study, the researcher attempted to find that there was no significance between the student's attitudes and their overall science chapter test percentage. A Pearson r value was determined at .05 level of significance would indicate 95% of the time a correlation does not exist between student's attitudes and their chapter test percentage.

Significance of the Project

The WASLS scores clearly demonstrated the need for science education reform at THS. As part of the student's graduation requirements, all students must pass Earth and Life Science. Furthermore, the 10^{th} grade WASLS tests the student's knowledge in both areas of science. The 8.7% of students passed both science courses and the WASLS. The science department had identified two classes in Earth

Science and one Life Science class was considered remedial courses for students who previously failed the courses.

In addition to the added number of remedial courses, there was a decline in student interest in upper division courses such as University of Washington Earth and Space Science and Advanced Geology. Toppenish High School offered one Chemistry, one Physics, one Anatomy and Physiology, and one Environmental Science course as requested by students. In previous years there the science department offered at least two Chemistry, Environmental, and Anatomy and Physiology courses each year.

<u>Procedure</u>

The researcher created a Likert survey, as shown in Appendix A, in order to evaluate the student's attitudes towards science. This survey was administered several times throughout the first semester. Each time, the student had just completed a new chapter in Earth Science. An average of each student's scores was calculated. The student's overall chapter test percentage was calculated using the district approved grading program. The researcher then used a Person r technique in order to identify a coefficient that ranged between -1.00 and 1.00. Significance was determined at 50 degrees of freedom. Significance was determined for $p \geq .05, .01, .001$ was .2732, .3541, and .4433 respectively. It was important to note that any student who did not participate or was absent during the administration of the survey was not included in the final analysis.

Definitions

culture. The word culture meant the attitude that is accepted and demonstrated by the majority of the students.

effective size. An effect size expressed the increase or decrease in achievement of the experimental group in standard deviation units (Marzano et al. 2001).

Likert Scale. A psychometric scale used in questionnaires, and survey research.

Pearson r. The Person r was a measure of correlation appropriate when both variables to be correlated were expressed as continuous data.

success. The author defined student success if the student received a passing grade in Earth Science as defined by the Toppenish High School Science department; seventy percent or higher.

University of Washington Earth and Space Science. The University of Washington had a program geared towards the recruitment of high schools students. They offered University of Washington credits to high school students enrolled in classes offered through this program at their own high school.

Advanced Geology. This was a high school course offered to students interested in Geology. More specifically, the class focused on the complexities of hazards associated with geological events such as earthquakes, volcanoes, tsunamis, etc.

Acronyms

WASLS. Washington Assessment for Student Learning Science.

THS. Toppenish High School.

TSD. Toppenish School District.

NRC. National Research Council.

Chapter 2

Review of Selected Literature

Introduction

In order to effectively diagnose the lack of student success, as compared to state standards, the researcher chose to review literature that identified three essential subtopics: 1) science education in secondary schools, 2) best practices for teaching science, and 3) improving student learning.

Science education was at the forefront of educational reform. Moreover, Toppenish High School was a prime candidate for educational reform because of its high poverty level and low Washington State Learning Assessment scores in the area of science. The current educational reform was a product derived from a several discussions and opinions of what should be taught in public schools. Therefore, the researcher determined that a literature review in the area of science education in the secondary schools was necessary for understanding the role of science in the current education system.

Best practices, as identified through the work of Dr. Howard Gardner, were teaching methods that best stimulated the student's multiple intelligences. The researcher of this study believed that science was best taught where there was a holistic approach towards student learning. This included knowledge of the student's multiple intelligences and their desire for learning supported in a constructivist learning environment. In addition, the researcher also followed the teachings of Lev Vygotsky in understanding the importance of identifying the students' Zone of Proximal Development (1978). The Zone of Proximal Development, as the researcher applied it through in instruction, was achieved through whole classroom discussion in a question and answer format.

In order to have a more focused approach, the researcher selected literature that identified best practices in teaching science through inquiry and process questioning. The researcher had the overall goal of improving student's learning. Therefore, the researcher reviewed literature focused on analyzing how students learned best. Learning progressions, professional learning communities, and building continuity in a school to improve science learning were discussed.

<u>Science Education in Secondary Schools</u>

Science education has been discussed and critiqued by many scientists throughout time. Dr. Quitadamo provided an array of selected literature in an unpublished course packet titled, *Science Education in the secondary Schools* (2005). Through this collection of manuscripts, Dr. Quitadmo explained that science education needed to entail more than just the technical information. Dr. Quitadamo provided identified four themes of scientific literacy as it was presented in the secondary schools. They were as follows: 1) science as a way of thinking, 2) a way of investigating, 3) a body of knowledge, and 4) science's interaction with technology and society (2005).

Science taught as a way of thinking allowed students to understand the scientists' underlying beliefs that drove their curiosity, imagination, and reasoning. Through this collection of literature, Dr. Quitadamo explained that curiosity drove the student's initial desire to search for the truth (2005). Furthermore, Steven Weinberg stated, "What drives us onward in the work of science is precisely the sense that there are truths out there to be discovered, truths that once covered will form a permanent part of human knowledge (1998)."

Imagination allowed scientists to construct abstract ideas. Albert Einstein identified imagination as more important than knowledge. William I. B. Beveridge (1957) cited August Kekulé as he described his discovery of the benzene ring,

> I turned the chair to the fireplace and sank into a half sleep. The atoms flitted before my eyes. Long rows, variously, more closely, united; all in movement wriggling and turning like snakes. And see, what was that? One of the snakes seized its own tail an the image

whirled scornfully before my eyes. As though from a flash of lightning I awoke; I occupied the rest of the night in working out the consequences of the hypothesis… Let us learn to dream, gentlemen (Cited in Beveridge, 1957, p. 56)."

Though imagination provided the first site of truth, the importance of reasoning was not neglected. "The imagination merely enables us to wander into the darkness of the unknown where, by the dim light of the knowledge that we carry, we may glimpse something that seems of interest (Beveridge 1957)."

Through reasoning, scientists have studied the works of others and developed new and innovative ways that clarified experiments of all sorts. The ability to reason theories allowed science to evolve throughout time. "Examples of science courses that focus on the nature of scientific thinking can be found among the national curriculum projects produced during the 1960s (Cited in Quitadamo, 2005, p. 7)."

As science was taught as a way of investigating it allowed for an ordered process to be established. Karl Pearson identified the scientific method as five steps: 1) observing, 2) collecting data 3) developing a hypothesis, 4) experimenting and 5) concluding (1937). In addition, through the work of Lisa Wyndham, the Southern Regional Education Board recognized that this process should be taught in the ninth grade

(2005). Jonathan Osborne, Chair of Science Education at the Department for Educational and Professional Studies, King's College London provided an opposing view of the scientific investigation process.

Dr. Osborne explained that a fallacy existed in the belief of the existence of only one scientific method for which new concepts were explored and/or discovered. Dr. Osborne's argued that not all scientists followed the same procedures in their professions. Students who were forced to learn science with a single method for scientific discovery created a false sense of there being a single way to solve a problem. Dr. Osborne recommended that scientific method be taught through a range of different types of works that focused on interpretation and evaluation (2007).

Although this may be true, many of the researcher's colleagues subscribed to the notion that for simplicity and continuity for scientific discoveries in the classrooms, a particular method should be consistent in all science courses. Therefore, there was a need for discussion in regards to what was best for student learning.

A third theme of science education in secondary schools has been science as a body of knowledge. "Facts, concepts, principles, laws, hypotheses, theories, and models form the content of science (Quitadamo, 2005)." Content of science was identified to be insignificant when taught in isolation; facts were not effective when taught without the concepts and principles associated with them. Opportunities were created for students to discuss science concepts within a group of peers after reviewing the information through lecture. As Vygotsky (1978) explained, “Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological).”

Dr. Jonathan Osborne explained that students understood science best after they realized the simple concepts in order to learn bigger concepts. For example, the students needed to know about plate tectonics in order to be able to discuss the relationships between plate boundaries. Osborne defined the conceptual factor of science as the domain-specific knowledge essential to any understanding of science (Osborne 2006).

The fourth theme discussed in education in secondary schools was one where science was taught based on the interactions between technology and society. It was impossible to teach science without the recognition of the correlation between technology and science; the advancement in one caused advancement in the other.

> Basic science could not advance without the use of highly sophisticated devices, such as particle accelerators,

> chromatographs, spectroscopes, electron beam microscopes, space telescopes, electrophoresis apparatus, space ships, and integrated circuits (Quitadamo 2005 p. 14).

Advancement in technology was a crucial part in the discoveries made by many scientists such as Copernicus, Galileo, Einstein, and Bohr.

Dr. Osborne identified a fallacy that existed in regards to science being taught as an independent content area of study. Osborne (2007) explained that students do not distinguish between science and technology. It was through the interconnections between science, society and technology that lead students to new experiences and answers. "Technology advances when both science and society have needs to fulfill and problems to solve (Quitadamo 2005 p.14)." Most technological advancements were made possible by the funding provided through governmental grants and private businesses.

<u>Best Practices for Teaching Science</u>

The National Research Council (NRC) recognized that most curricula have emphasized memory rather than understanding. This has limited student opportunities to understand or make sense of various topics (2000). National Research Council has concluded that process rather than content has aided in knowledge transfer from one topic into the next.

This has been especially true in science education found in the secondary schools. In an article written by Dr. Craig E Nelson in a book called *The Social Worlds of Higher Education: Handbook for Teaching in a NewCentury*, Nelson debated the trade-off between teaching content or critical thinking in a variety of different disciplines. Dr. Nelson stated the following:

> If one measures teaching by what the teacher presents or "covers," then time spent on anything except lecturing on content is, by definition, a reduction in coverage. However, if one asks how to maximize student learning, then covering as much as possible clearly is a seriously flawed approach (Nelson 1999).

It was clear that students needed to develop a sense of critical thinking. The discussion was established based on the search of how to teach students to become critical thinking. Dr. Osborne identified some of the fallacies behind science courses and the claim towards students becoming critical thinkers because of it. He stated the following:

> This is the assumption that the study of science teaches students reflective, critical thinking or logical analysis which may then be applied by them in other subjects of study. It is based on the fallacious assumptions that mere contact with science will imbue a

sense of critical rationality by some unseen process of osmosis (Osborne 2007).

Dr. Osborne (2007) explained that the fallacy remained true unless the instructor's focused on developing different skills. In which case, the instructor has chosen a particular type of methodology behind his teaching. These shifts in methodologies or teaching practices have driven different movements in what was considered to be best practice.

In book called Making Connections, Teaching and the Human Brain, Renate Nummela Caine and Geoffrey Caine attempted to simplify the process of discovering new methodologies through the introduction of brain-based learning. Caine and Caine (1991) explained that there were 12 principles that served as general theoretical foundation for brain-based learning.

The first principle recognized was that the brain was a parallel processor. Caine and Caine recognized that the brain was always doing things simultaneously. Therefore, the teacher should target all aspects of brain operations and include an understanding for making connections to the student's environment and life. Albert Bandura (1977) stated, "Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action." Caine and Caine explained, "…teachers need a frame of reference that enables them to select from the vast repertoire of methods and approaches that are available (1991)." Robert Yager stated the following in regards to student's interest towards learning,

> While the reasons for this disengagement are many, a chief cause is the egregious mismatch between the school curriculum and the intellectual and emotional needs of young adolescents (2000).

The second principle stated by Caine and Caine was, "Learning engages the entire physiology (1991)." Living styles and choices directly affect our ability to learn. "Stress management, nutrition, exercise, and relaxation, as well as other facets of health management, must be fully incorporated into the learning process (1991)." A student who was not healthy will not be effective in a learning environment.

Unhealthy lifestyles were often influenced by the student's socioeconomic status. "A disproportionate number of African Americans, Hispanics, and Native Americans are poor and attend poor schools (Quitadamo 2005 p. 85)." Teachers needed to have an understanding of these hurdles for learning in order to overcome them. Socioeconomic status "is not the sole determinant of who will succeed in school and who will drop out (Muth, K. D., & Alvermann, D. E. 1999 p. 49)."

There was a natural curiosity involved in the human development. Students have a natural curiosity for meaning. Caine and Caine (1991) explained that the search for meaning was innate. Furthermore they recommended that lessons should be exciting and meaningful and offer students and abundance of choices. In addition, the more positively lifelike the learning experience was, the better it was for the student (Caine and Caine 1991).

Lifelike learning situations were provided and discussed through the work of Ryken, A. E., Otto, P., Prichard, K., Owens, K. (2007) in an attempt to describe the importance of using outdoor environments to foster student learning of scientific processes, field investigations help students become system thinkers, learn the skills of scientific inquiry. Outdoor experiences in natural settings increase students' problem solving abilities and motivation to learn in social studies, science, language arts, and math (Ryken, A.E., Otto, P., Prichard, K., Owens, K. 2007).

Caine and Caine (1991) explained that some schools reserved rich environments with complex meaningful challenges for their gifted children. They expressed that there was a need for these experiences to be shared by all children, not isolated for gifted students. All students benefitted from a diverse learning environment.

Furthermore, Caine and Caine (1991) expressed that emotions were critical to patterning. Teachers needed to understand that student's feelings and attitudes will be involved and will determine future learning. Caine and Caine (1991) explained that it was impossible to isolate the cognitive from the affective domain. As a result the emotional climate in the school and classroom must be monitored on a consistent basis, using effective communication strategies and allowing for student and teacher reflection and metacognitive processes. In general, the entire environment needed to be supportive and marked by mutual respect and acceptance both within and beyond the classroom (Caine and Caine 1991). The researcher felt this had a direct relation to the problem studied. Was there a correlation between the student's attitudes towards science and their grade?

Each principle was equally important and required important consideration when determining which style was best for student learning. It was important for teachers to understand the multiple intelligences demonstrated in a classroom setting. Howard Gardner proposed eight different intelligences to account for a broader range of human potential in children and adults (Cited in Armstrong 2000). The multiple intelligences were also referred to as learning styles. The multiple intelligences were as follows: linguistic intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence and naturalist intelligence (Armstrong 2000).

A balanced curriculum that incorporated the multiple intelligences was useful in order to leverage the intelligences that some students may have (Learning Theories Knowledgebase 2010). In addition, the quest for best practice did not lie in the realm of the teacher's control. Students dictated their attitudes, which were essential in brain-based learning.

Improving Student Learning

There were many strategies school districts utilized to improve student learning. A study by Martin Braund and Mike Driver titled, "Pupils' perceptions of practical science in primary and secondary school: implications for improving progression and continuity of learning" found that many students failed to meet the expected grades on the assessments administered at the age 14 that were predicted at age 11. Furthermore, they suggested that there was a need to create a better transition between the grades (2005).

Braund and Driver (2005) presented several implications for the improvement of learning transfers in science. Braund and Driver (2005) found that students enjoyed practical science in the primary schools. The student's curiosity towards learning science was still driven by previously gained knowledge. The students were certainly more excited to learn science during their primary years then they were in subsequent years.

A second point provided by the authors was the correlation between their findings and the findings of other researchers' works. The student's attitudes towards science slowly declined as the practicality of science in school assignments also declined. In order to deter the decline of interest, Braund and Driver suggested that teachers provide a curriculum that was sufficiently different from what the students had previously experienced (2005).

The students admitted at year seven that the major difference between primary and secondary school was that at least in their secondary school they did some practical investigations in science. Secondary schools focused on the more laboratory-based experiments.

The third point expressed by the authors was in regards to the rigor included in year six and year seven. There were many misconceptions provided by secondary education teachers that revolved around the idea of students being presented with low level of rigor in the primary schools. In reality, the authors found that the complexity of the level of science presented in primary schools was actually quite high. In turn, the students were expecting the rigor to increase in year seven.

Unfortunately, the students revealed that the activities experienced in year seven were merely the same as in year six only that better equipment was being used in later years. The authors suggested that the secondary education teachers should provide activities that were substantially different than work that the students had previously completed. This would be more effective for new learning while still validating the student's previous knowledge.

In addition to improving transitions, there were strategies that have been incorporated in the classroom in order to attain better test scores. A study provided by Rich Radcliffe, David Caverly, James Hand, and Deanna Franke titled, "Improving Reading in a Middle School Science Classroom" found significance in teaching reading strategies in science. The results yielded improved reading comprehension and thus raised test scores.

Another study by William M. Penrod, Carol D. Haley, and Laurianne P. Matheson titled, "A Model for Improving Science Teaching for Students With Visual Impairments" found that educators and students benefited from outdoor learning activities. Furthermore, students who were visually impaired benefited from the multisensory stimulation involved in their learning.

Through their study, they identified the clear need for multisensory stimulation. Howard Gardner (Brewer 2005) first introduced this in a clear description of the person's multiple intelligences. The emphasis was not on one over the other nor did people learn using only one particular style. On the contrary, humans used a variety of intelligences simultaneously during all aspects of the learning experience (2005).

Summary

The researcher reviewed literature that identified three essential subtopics: 1) science education in secondary schools, 2) best practices for teaching science, and 3) improving student learning. Each has a direct contribution to the factors that related to student success. Moreover, each subtopic influenced the decision to investigate if there was indeed a correlation between student's attitudes towards science and their success in science.

Science education in secondary schools evolved from a variety of studies and discussions. In order to understand the fundamental changes, the researcher felt it was important to understand the different aspects of science. Science was discussed as 1) a way of thinking, 2) a way of investigating, 3) a body of knowledge, and 4) science's interaction with technology and society. Each was crucial in the different influences involved in teachers' philosophies in particular, creating a classroom of critical thinkers versus content learners.

Best practices have redefined school foci in an attempt to answer what was best for kids. The ability to create critical thinkers in the classroom was the driving force for many methodological changes in the way instructors teach science. Through studies, people have attempted to identify the source or sources for creating the best environment to produce a positive community of learners. Part of the creation of this type of environment included the feelings and emotions students experienced as part of their learning experience.

The researcher's overall goal was to improve science learning in the classroom. The researcher would be remiss to ignore the overall importance of what studies have found to be effective in the classroom. The researcher found that through a combination of articulation through the grade levels, incorporation of reading strategies, and the development of lessons that incorporated the multiple intelligences students were found to have a higher success rate than students being taught in unmodified classrooms. Although these were strategies that may be influenced by the teacher, the researcher wanted to identify if the success of the student only relied on the style of education provided by the instructor.

CHAPTER 3

Methodology and Treatment of Data

Introduction

The purpose of this special project was to identify if a correlation existed between student success in Earth Science and their attitudes towards the curriculum. The science department identified a large number of students enrolled in remedial classes for credit retrieval in the science areas. After long discussion with administration, the science department turned their focus from the traditional direct instruction model to hands on approach. Furthermore, the science department bought new probe ware and a new science curriculum.

To accomplish the purpose of this study, the researcher implemented a new curriculum and methodology for instruction. This methodology included at least one hands on activity or laboratory discovery conducted by the students. In addition, Likert scale surveys designed by the researcher were administered and collected at the end of each unit. Further, a review of selected literature was conducted, surveys were analyzed, and related conclusions and recommendations were formulated.

Methodology

This correlational study utilized a Likert-type survey, as shown in Appendix A, and chapter test scores in order to monitor progress. As defined by Gay et. al. "…correlational research involves collecting data to determine whether, and to what degree, a relationship exists between two or more quantifiable variables (Gay 2006 p. 191)."

Participants

The participants were students at Toppenish High School enrolled in Earth Science. The ethnic make up of the participants included Hispanic, Native American and Caucasian students. Of the 56 participants, 31 were male. There were no prerequisites set for enrollment. The participants represented students from 9^{th}, 10^{th}, 11^{th}, and 12^{th} grade. Students who were from the upper cohorts had previously failed Earth Science as 9^{th} graders. Some students were on their second and third attempt towards attaining a passing grade.

All participants had enrolled in science courses at the middle school level. The students' previous instructors taught using science kits endorsed by educational service district 105 and Toppenish School District (TSD) administration. The middle school followed unit plans that were supplied through the kits and supplemented with other reading materials and activities in order to address the majority of the essential academic learning requirements set forth by the Office of Superintendant of Public Instruction. The researcher identified units taught in the middle school that included Earth Science concepts. The units were limited to plate tectonics, geologic time and scale, rocks and minerals and the hydrologic cycle.

The students were selected as a convenient sample. They were not sorted by academic or content knowledge. The students enrolled in the course in order to fulfill their academic credit requirement set forth by the TSD and the Toppenish School Board.

Instruments

Information was gathered through the use of a Likert survey and percentages from chapter test scores. Students completed a survey regarding their attitude towards science after each test throughout the school year. Student success in the chapter was determined by their ability to maintain a grade higher than 69%.

The Likert survey asked five different statements. A positive response to the statement scored a five and negative response scored a one. The following list provided were the statements presented in order to gain insight on the students thoughts and feelings towards science and other courses: a. I enjoy science over any other courses (i.e. English, Math, or History), b. I find science easy, c. I enjoy science because of the content, not because my friends are in class, d. I have a good attitude towards what I am learning in science, and e. I learn better in science when I am interested in the stuff we are learning.

The researcher provided the first statement in order to gain insight as to what subject the student found most enjoyable. This allowed the student to think of science course as it fit in their schedule. It also allowed for the student to reflect on classes enjoyed the most. The researcher wanted the students to have a positive frame of mind when evaluating the statements to follow.

The second statement was used to gage the student's ability to understand scientific concepts. The researcher wanted to find how the student felt on his/her ability to understand science concepts. Furthermore, the researcher wanted the student to score their ability to understand science. This statement also allowed the student to reflect on their perception towards their ability to understand science.

The third statement provided by the researcher was to determine the student's personal reasons for attending class. The researcher wanted the students to determine if they enjoyed science because of the content or because of friends also enrolled in class. The researcher wanted to identify if the student's motivation for attending class was for educational purposes.

The fourth statement allowed the student to apply a value on his or her own attitude towards science. The researcher felt it was important to identify if the student was aware of his/her attitude towards science. This would allowed the student reflect on their daily approach towards learning.

The final statement was designed to gain some insight on the student's ability to judge his/her ability to learn science when he/she was interested in the science concept being taught. The researcher felt it was appropriate to have this statement because of its direct reflection of the null hypothesis. The null hypothesis stated that there was no significance between the student's attitudes and their science overall chapter test percentage.

The researcher felt that these questions reflected a holistic view of the student's attitude towards science. Each question gave the researcher a better understanding of the student's feelings towards science and the classroom environment.

In addition to these statements, the research provided statements that would allow the student to communicate how they learned best, their current grade, and their own reason for the grade received. The researcher found this to be helpful in gaining the trust and understanding the student's multiple intelligences and learning styles.

The participants were asked to complete the survey to the best of their ability and as honest as possible. The researcher ensured the students that their participation in this study would not affect their grade in the Earth Science class. The researcher was in the classroom while surveys were administered but did not sway the students in any way. It was important to note that this survey was not administered outside of this study. Therefore, there was not enough data to justify the validity of this survey. Furthermore, this survey was not edited nor reviewed by anyone with the necessary credentials to validate the survey.

The chapter tests were administered following the guidelines set forth by the Toppenish High School Science Department. Questions asked were related to the objectives agreed upon by the Science Department. They contained 10 multiple choice, five fill in the blank sentences, and two extended/essay questions. Students were allowed to use their notes and homework assignments during the test.

Design

The researcher conducted a correlational study, which used two instruments. The first was a Likert survey, shown in Appendix A, designed by the researcher. The students were asked to complete a survey after completing each chapter test. The researcher then used the student's average survey score to calculate a coefficient using a Pearson r technique.

The second instrument was a series of chapter tests approved by the Science Department during several professional learning community meetings held bimonthly. The chapter tests were based off of the agreed objectives set forth by the department. The researcher used the student's average test percentage received over the course of the study. The average percentage was computed using the online grading program approved by the Toppenish School District.

Procedure

August 30, 2010 the researcher gained approval from supervisors. September 10th, the surveys and chapter tests were developed and approved for implementation. Surveys were administered following completion of each chapter test. The chapter tests were administered upon completion of the instruction and lab activities approved by the Science Department. The researcher used a test generator provided by the textbook publishers to design a rough draft of the test. The researcher then cross-referenced the test with the approved guided questions before administering the test.

At best, each chapter was completed in approximately two weeks. Some chapters did require more in depth coverage and exploration in order to satisfy the Essential Academic Learning Requirements set forth by the Office of Superintendent of Public Instruction.

Analysis of the data was completed April 2, 2010. The conclusion and recommendations for this study were completed April 30, 2010.

Treatment of the Data

As the surveys were collected, the data was collected in a master Excel spreadsheet. The averages for the student's test scores and their survey scores were determined for each student, Table 1.

The STATPAK software (1997) was then used to analyze the data using the Pearson r technique. Correlation was then determined using Table 2 provided in the book Educational Research by Gay and Mills (Gay et. al. 2006 p.566).

Summary

This project was a correlational study between student's attitude towards science and their test scores. The participants included students from two yearlong Earth Science classrooms. In total, there were 56 participants, 31 of which were male. The participants included both remedial students and students enrolled in Earth Science for the first time. The participants included students from missed grade levels yet similar background in general science. In addition, all students registered in the course in attempt to fulfill the graduating requirements set forth by the

Toppenish School Board. A Likert Scale survey and overall chapter test percentage scores were used to compile data. This study began in August and ended in April 2010.

On average the students completed each chapter after two weeks. Each chapter included at least one hands on laboratory activity. The surveys were administered after their chapter tests were score and returned to them. The data were then collected and analyzed using a Pearson r technique in the Statpak. Table 2 from Gay and Mills (2006) was used to interpret the information and find the value of correlation coefficient for different levels of significance.

CHAPTER 4

Analysis of the Data

Introduction

There was a need for science education reform at Toppenish High School. It was unethical to have 91.3% of the students fail the WASLS. The researcher attempted to address the need for science education reform as it related to student's attitudes towards science. In order to identify the validity of this statement, a significant relationship between the student's attitudes and their science grade needed to be identified. Furthermore, the researcher made an attempt to identify if a relationship exists between student's attitudes towards science and their success in the science classroom.

Description of the Environment

The study was held throughout the first semester at Toppenish High School. The students were a convenience sample selected by the researcher from two yearlong classes totaling 55 students. Earth Science was the subject matter of the classroom. These yearlong classes were mixed grade levels. Some students were in their second and third attempt towards attaining a passing grade.

The materials used in both classes were recently purchased in attempt to aid in a more hands-on-approach towards science. The new curriculum also included a minimum of one laboratory experiment or extended activity per chapter. All activities were approved and followed the agreed upon objectives set by the Science Department (Appendix C).

Hypothesis Question

The researcher theorized that a significant relationship existed between the student's attitudes towards science and their grade. This was determined through a series of surveys using a Likert scale and the student's grade percentage.

Null Hypothesis

In order to maintain the integrity of the study, the researcher attempted to find that there was no significance between the student's attitudes and their science grade. Significance was determined if $p \geq .05$, .01, .001.

Results of the Study

The researcher found the Pearson's r value to be at 0.39 at 54 degrees of freedom (Table 1). Table 1 showed the total number of students was 55. The X value was the student's average Likert scale score. The Y value was the student's average chapter test score

Table 1

Statistical analysis of data using Pearson's Product Moment Correlation

Statistic	Values
Number of Items	56
Sum of X	3375.1300
Sum of Y	837.0000
Sum of Squared X	217526.59
Sum of Squared Y	12966.00
Mean of 'X' Scores	60.27
Mean of 'Y'	14.95
Scores Sum of XY	51439.36
Pearson's r	0.39
Degrees of Freedom	54

Note. Data was collected throughout the first semester from two classes of Earth Science (Statpak 2010).

The following formula was used to find the Pearson's r value:

$$r = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{N}}{\sqrt{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{N}\right] * \left[\Sigma y^2 - \frac{(\Sigma y)^2}{N}\right]}}$$

$$r = \frac{51439.36 - \frac{(3375.1300)(837.0000)}{56}}{\sqrt{\left[217526.59 - \frac{(3375.1300)^2}{56}\right]\left[12966.00 - \frac{(837.0000)^2}{56}\right]}}$$

r = 0.39

Further analysis, Table 2, provided the values of the correlation coefficient for levels of significance. The Pearson's r value was 0.39 and compared to the level of significance at 50 degrees of freedom for $p \geq .05$, .01, .001. The data showed that the null hypothesis, which stated that there was no significance between the student's attitudes and their science overall chapter test percentage was rejected. Therefore, the researcher found support for the hypothesis, which stated that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage.

Table 2

Values of the correlation coefficient for levels of significance

	p		
df	0.05	0.01	0.001
50	.2732	.3541	.4433

Note. Although the Degree of freedom computed through the Stakpak yielded 54, the researcher rounded down to 50 Degrees of freedom (Gay et al. p. 527).

Findings

The correlational study between student test scores and their feelings towards Earth Science was conducted through the use of overall chapter test percentages and average scores from a Likert Scale survey. Data were collected and arranged in Appendix A. Table 1 demonstrated the results given through the use of Pearson's r analysis. The r value was .039. Finally, Table 2 gave a description of the necessary coefficient levels for 95, 99 and 99.9% at 50 degrees of freedom.

At 50 degrees of freedom, the null hypothesis, which stated that there was no significance between the student's attitudes and their science overall chapter test percentage was rejected at the 95% and 99% levels. Therefore, support for the hypothesis, which stated that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage was found at the 95% and 99%. According to the data collected there was a correlation between the students feelings towards science and their science grade.

<u>Discussion</u>

Students understood science best after they realized the simple concepts in order to learn more complex concepts. Furthermore, the researcher agreed with the scholars mentioned in Chapter 1; technology and science discoveries was directly related. Moreover, to teach science without the integration of technology would have provided a disservice to the students.

For these reasons, the researcher followed the guidelines set forth by the Toppenish High School Science Department. Each objective was taught using a variety of techniques and tools for collecting data. Students began with a basic understanding of Earth Science concepts and followed with laboratory activities in order to attain a high level understanding of more complex concepts.

Furthermore, this study reflected evidence of what Caine and Caine (1991) expressed, “Teachers need to understand that student’s feelings and attitudes will be involved and will determine future learning (Caine and Caine 1991).” The purpose of this project was to examine if a correlation existed between student’s feelings and their test scores. The students who felt better about learning Earth Science tended to yield higher test scores.

Summary

The setting for this study took place in Toppenish High School. The participants in this study were students who were enrolled in two year long classes instructed by the researcher. The participants were a convenient sample and were not selected at random. The researcher took a holistic view when addressing the needs for his students. In total, 55 students participated in the study.

The researcher administered a Likert survey after the participants completed a chapter test. In general, each chapter took about two weeks to complete. The researcher then used the participant’s average Likert survey score and the students average test score to compute a Pearson r value. The r value was 0.39. Table 2 provided the values of the correlation coefficient for levels of significance (Gay et al. p. 527).

The null hypothesis, which stated that there was no significance between the student's attitudes and their science overall chapter test percentage was rejected at the 95% and 99% levels.

Support was found for the hypothesis, which stated that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage, at the 95% and 99%.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

The purpose of the project was to identify if a relationship existed between student's attitudes towards science and their success in the science classroom. More specifically, the researcher attempted to examine if a correlation between the student's feelings about science and their chapter test scores existed in the yearlong Earth Science classrooms.

The researcher shared the concern identified in the professional learning community of science teachers; there were too many students failing Earth Science. The science department was concerned of the curriculum not meeting the student's need for thriving in the science area. Thus, the science department decided to implement a new curriculum that included at least one hands-on laboratory experience per chapter. The hands-on activities were thought to aid in the understanding of more complex concepts while still engaging student interest and excitement in learning science.

Summary

This study examined if a correlation existed between the student's feelings towards Earth Science and their chapter test scores. The researcher created a Likert scale survey used to collect data regarding student's feelings towards science. In addition, the researcher used the overall chapter test percentage from each student to measure his or her level of success in Earth Science.

The researcher then entered values for each student into the Statpak (Macromedia 1997) using a Pearson's r technique. The analysis determined a Pearson's r value of .39 at 54 degrees of freedom. Further analysis of this data using Table A.2 (Gay et al. 2006 p. 566) found that the null hypothesis, which stated that there was no significance between the student's attitudes and their science overall chapter test percentage, was rejected at the 95% and 99%. Consequently, support was found for the hypothesis, which stated that a significant correlation existed between the student's attitudes towards science and their overall science chapter test percentage, at the 95% and 99%.

Conclusions

This study rejected the null hypothesis at the 95% and 99% levels. The researcher found support for the hypothesis at the 95% and 99% levels (Table 2). Students who feel better about learning science because they enjoy and have an interest in science are more likely to perform better on chapter tests.

Furthermore, the researcher found that the student's attitudes change towards science after they have conducted valid hands on activities. The science department at Toppenish High School agreed to implement a minimum of one hands on activity per chapter discussed in class. The researcher found that a holistic view towards teaching did encourage a positive learning environment. Therefore students felt better while learning science. According to the data collected students who felt better about learning science performed better on chapter tests.

<u>Recommendations</u>

Based on the evidence demonstrated through this study, the researcher made the following recommendations: a) This study should be redesigned to include a larger sample group, b) the study should be completed over five to ten years, and c) the study should include other subject areas such as English and mathematics.

The researcher was limited to the number of students within two classrooms. The total number of participants was 56, 31 of which were males. The findings of this study would be more valid if it held true in a variety of classrooms across a minimum of 3 years.

A longer timeline for this study would validate the findings. If the Pearson's r value of correlation coefficient remain as $p \geq .05, .01, .001$ over a longer period of time, rejection of the null hypothesis would continue to hold true and support for the hypothesis would be evident.

Further studies would include other subject areas in order to analyze the possibility of there being a correlation between student's feelings towards any course and their test scores. This would determine the possibility for further analysis of how to increase student success by shaping their feelings towards what they are learning.

Appendix A

Student data

	Overall Chapter Test Percentages	Likert Scale Average Score
S1	58.43	13
S2	54.22	12.5
S3	47.59	12.5
S4	44.58	16
S5	67.88	13
S5	16.27	10
S6	34.34	14
S7	72.29	13
S8	71.08	15
S9	48.19	13
S10	77.71	15.5
S11	57.23	21
S12	54.22	18.5
S13	22.89	15
S14	58.43	10
S15	53.63	13
S16	69.28	14.5
S17	58.43	14
S18	73.49	17
S19	72.89	18
S20	56.93	17
S21	78.31	14
S22	66.87	11
S23	85.54	18
S24	51.51	17
S25	84.34	20
S26	89.76	15
S27	58.43	18
S28	33.73	9
S29	68.07	18.5
S30	58.43	13
S31	57.83	16
S32	71.08	15
S33	72.29	19
S34	44.88	16
S35	75.9	17
S36	57.83	9
S37	37.35	12
S38	50	18
S39	57.23	19
S40	72.29	16
S41	66.21	10.5
S42	72.89	15
S43	57.83	13
S44	79.52	15
S45	36.14	12
S46	63.86	19
S47	44.58	16
S48	25.6	11
S49	65.66	16
S50	67.47	12
S51	60.84	18
S52	69.58	16
S53	73.28	15
S54	83.13	18
S55	66.87	14.5

Note: Students were awarded an average Likert scale score fall all surveys taken over the course of this study. Furthermore, they were awarded an average chapter test score percentage for all tests taken.

Appendix B

Note: The following appendix is a sample of the Likert scale survey used by the researcher.

Appendix C

Note: The following appendix is a copy of the Toppenish High School Science Department objectives for Earth and Space Science. These objectives were accepted and implemented November 2009

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Toppenish High School
Earth Science Objectives & Guiding Questions & Activities
adopted February 2010

Unit 1 – Meteorology

* integrate careers throughout unit

Atmosphere

1) Students will understand the properties and structure of the atmosphere.
    a) List and describe the components of the atmosphere?
    b) Explain how heat and temperature are related.
    c) Describe the major mechanisms of heat transfer and how they affect the atmosphere (convection, conduction, radiation).
    d) Compare and contrast the layers of the atmosphere.

Weather

1) Students will understand the factors and processes that create weather.
    a) How does water vapor affect the weather?
    b) Classify and explain cloud types and the weather associated with each.
    c) How do pressure systems affect the weather?
    d) Describe the factors that contribute to local winds/weather conditions?
    e) Compare and contrast the components and formation of severe weather?
    f) How can an interpretation of weather maps/data be used to predict/track weather patterns?

Climate

1) Students will understand that climates differ.
    a) Compare and contrast the climates of Seattle and Toppenish.
    b) Explore natural and man-made contributions to climate change.

Activities:

1) (ER) Dew point & relative humidity lab – (water vapor and how it affects the weather)
2) (Textbook) Heating of Earth & Water – (factors affecting local weather conditions)
3) (Passport) Reasons for Seasons – (possible use in Earth-Moon-Sun System as well)
4) (ER) Weather & Isopleths (Interpretation of Weather Maps)
5) (ER) Wind and Global Circulation – (Interpretation of Weather Maps)
6) (DR) Weather Mapping Activities –
7) (DR) Hurricane Mapping –
8) (DR) Predicting Weather –
9) (Passport) Energy transfer (Conduction/Convection/Radiation) – (Major mechanisms of heat transfer)
10) (Lab Manuel) Determining how temperature changes with altitude -
11) (Lab Manuel) Investigating factors that control temperature -
12) (Lab Manuel) Recipe for a cloud –
13) (Lab Manuel) Analyzing pressure systems –
14) (Lab Manuel) Interpreting weather diagrams –

Unit 2 - Geology

* integrate careers throughout unit

Minerals

1) Students will understand the characteristics of minerals and how they form.
    a) Describe the properties of minerals?
    b) Compare and contrast how minerals form?
    c) How are minerals classified?
    d) What are the similarities and differences among the major groups of minerals?

Rocks

1) Students will understand all components of the rock cycle.
    a) What are the three major types of rocks and how do they differ?
    b) Describe the mechanisms of change within the rock cycle.
    c) Discuss the forces involved in the rock cycle.

Activities:

1) (Textbook) Mineral Classification –
2) (Lab Manuel) Classifying Rocks –
3) (Lab Manuel) Crystal Systems –

Toppenish High School
Earth Science Objectives & Guiding Questions & Activities
adopted February 2010

Unit 3 - Lithosphere

* integrate careers throughout unit

Plate Tectonics

1) Students will understand the composition and structure of the Earth.
    a) List and describe the layers of the Earth?
    b) Describe the interactions between the layers of the Earth.
2) Students will understand that the Earth's crust is divided into plates that interact with each other.
    a) Describe continental drift and its supporting evidence.
    b) Describe sea-floor spreading and the evidence that supports it.
    c) Describe the theory of plate tectonics.
    d) Compare and contrast divergent, convergent and transform fault boundaries.
        i. Divergent – Rift Valleys Mid-Ocean Ridges
        ii. Convergent – Himalayas & Alps (continental) Cascades (subduction)
        iii. Transform – San Andreas
    e) Describe how convection drives plate movement.
    f) Differentiate between ridge-push and slab-pull as mechanisms of plate movement.
    g) Explain the relationships between the Pacific, Juan de Fuca, North American Plates.

Changing Landscapes

1) Students will understand the relationship between plate tectonics and geomorphology.
    a) Describe the properties of earthquakes.
    b) Describe the causes of earthquakes.
    c) Describe the hazards associated with earthquakes.
    d) Compare and contrast the characteristics of volcanoes.
    e) Describe the causes of volcanoes.
    f) Describe the hazards associated with volcanoes.
    g) Describe the types of landscape features (mountains, plateaus, valleys, plains) and the forces involved in building them.
    h) Compare and contrast the four types of faults. (Normal, reverse, thrust, strike-slip)
    i) Interpret maps to understand landforms.
2) Students will understand the various processes involved in changing landscapes.
    a) Describe chemical weathering. (organic and non-organic)
    b) Describe mechanical weathering.(frost wedging, wind, biological)
    c) Describe mass wasting (landslides, creep, slump).
    d) Explain the formation and evolution of river systems (erosion and deposition)
    e) How do glaciers contribute to changing landscapes.
    f) Describe the local evidence of changing landscapes.

Activities:

1) (Lab Manuel) Modeling Liquefaction
2) (Lab Manuel) Design and Build a Simple Seismograph
3) (Lab Manuel) Modeling a Plate Boundary

4) (MA) Earthquakes and Seismology DVD
5) (Passport) Plate Tectonics – The Rift Zone
6) (ER) Epicenter Hunt –
7) (Glencoe Lab Manuel) Focus Depth –
8) (ER) Hazard City –
9) (ER) 3-d cut-outs of volcanoes
10) (Glencoe) Types of volcanoes
11) (Textbook) Melting Temperature of Rock
12) (ER) Geologic Cross-section
13) (Textbook) Investigating Anticlines and Synclines
14) (Glencoe) Continental Drift
15) (Glencoe) Sea-Floor Spreading Rates
16) (DR) Sea-Floor Spreading
17) (DR) Tectonic Plate Boundaries – Mapping, Interpretation
18) (DR) Location of Mountains, Earthquakes & Volcanoes
19) (Lab Manuel) Modeling the Ocean Floor
20) How the Earth Was Made DVD's
21) (DR) Convection Currents
22) (Flinn) Mechanical Weathering Kit
23) (Passport) Soil Erosion
24) (DR) Chemical Weathering
25) (WSU) Missoula Floods DVD

Unit 4 – Earth & Space

* integrate careers throughout unit

Sun-Earth-Moon System

1) Students will understand the relationships of the Sun-Earth-Moon System.
    a) What are the properties of the Sun-Earth-Moon System?
    b) Describe the patterns observed within the system.(seasons, phases, eclipses, tides)

Solar System

1) Students will understand the properties and relationships of the components within the solar system.
    a) Describe the structure and properties of the Sun.
    b) Differentiate among the various types of solar weather. (flares, spots, prominences)
    c) Describe how the solar wind interacts with the Earth to create auroras.
    d) Compare and contrast terrestrial and Jovian planets?
    e) Explain how the solar system formed.
    f) How do satellites, meteors, asteroids and comets interact within the solar system?
    g) Honk if you think Pluto is still a planet.

Stars, Galaxies & Universe

1) Students will understand how the stars, galaxies and universe have formed and continue to evolve.
    a) Describe the life-cycles of stars?
    b) How is the H-R diagram used to make predictions about stars?
    c) Compare and contrast the three types of galaxies.
    d) Explain the Big Bang Theory.

Name______________________ Class____________________ Survey Number **1**

Please answer the following questions truthfully. YOU WILL NOT be graded against your personal responses. This will only be used for my own professional growth. Thank you for your honesty!!!

Rate the following truthfully. You will not be graded!	Strongly Disagree 1	Disagree 2	Somewhat Agree 3	Agree 4	Strongly Agree 5
I enjoy science over any other core classes (i.e. English, Math, or History).					
I find science easy.					
I enjoy science because of the content, not because my friends are in class.					
I have a good attitude towards what I am learning in science.					
I learn better in science when I am interested in the stuff we are learning.					

Please complete the following sentences:

I learn best when ____
____
____.

My current grade in the class is __________ at a __________%.

I feel I have this grade because ____
____
____.