

WHAT ARE THE EFFECTS OF MULTIPLE INTELLIGENCECE THEORY ON
MIDDLE SCHOOL STUDENTS' UNDERSTANDING OF HEALTH
ENHANCEMENT AND SCIENCE CONCEPTS?

by

Adam Lee Van Zee

A professional paper submitted in partial fulfillment
of the requirement for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2015

©COPYRIGHT

by

Adam Van Zee

2015

All Rights Reserved

DEDICATION

This is dedicated to my wonderful wife and three children who supported me through the process of going back to school, living life, and learning in all the areas of life though the process.

TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND	1
2. CONCEPTUAL FRAMEWORK	3
3. METHODOLOGY	8
4. DATA AND ANALYSIS	15
5. INTERPRETATION AND CONCLUSION	28
6. VALUE	30
REFERENCES CITED.....	32
APPENDICES	34
APPENDIX A: IRB Approval	35
APPENDIX B: Multiple Intelligence Student Survey.....	37
APPENDIX C: Pre/Posttest Assessments.....	44
APPENDIX D: Likert Style Pre/Post Student Survey.....	62
APPENDIX E: Interview Questions.....	64
APPENDIX F: Timeframe.....	66

LIST OF TABLES

1. Treatment and Nontreatment Units.....	9
2. Triangulation Matrix.....	14

LIST OF FIGURES

1. Student Responses from the Multiple Intelligence Survey.....	16
2. Student Responses on Assessments Compared to the Class Responses from the Multiple Intelligence Survey.....	18
3. Box and Whisker plot Showing the Results of Student Responses on Health Enhancement and Science Assessments	22
4. Box and Whisker Lot showing the Normalized Gain from each Treatment and Nontreatment Unit.....	23
5. Student Survey Responses for Select Questions.....	25
6. Student Survey Responses for Select Questions.....	27

ABSTRACT

Twenty-two student in on section of middle school science were the focus of study on the effects of using Howard Gardner's theory of multiple intelligence to drive instruction on understanding middle school health enhancement and science concepts. Two nontreatment units were taught in a more traditional teacher-centered teaching style of teaching. The other three treatment units were taught using a variety of strategies driven by the theory of Multiple Intelligences. The data from the Multiple Intelligence Survey showed each students strongest learning style as well as the most challenging style of learning to learn from. The results from the assessment were then categorized by how each piece of curriculum was taught and then compared to the results from the Multiple Intelligence Survey. Due to the data collected from each teacher, the responses from the students within the surveys, and the data from the assessments the project revealed the value of using the theory of Multiple Intelligences to drive instruction.

INTRODUCTION AND BACKGROUND

From my experiences as a teacher as well as a student, I have had opportunities to observe many different teaching environments as well as many different teaching styles. As a student who appreciated classrooms using a plethora of different instruction styles, I have become a teacher who not only uses differentiation instruction but would also like to increase my level of usage. My desire as a teacher is to reach each of my students on an academic and relational level, while challenging each student in ways that are best for him or her individually. I have been able to critique my teaching through a number of lenses. The first was navigating through my beginning years of teaching and being observed and formally reflecting, the second has been attending graduate school at Montana State University, where I have completed a number of classes that have caused me to pay attention to my classroom, the pedagogy, and both qualitative and quantitative results from my students.

As a health enhancement teacher, my job is to keep students physically active. In this environment, the students are able to kinesthetically stimulate their minds and bodies, whereas, in most other classrooms, the lessons are teacher driven or consist of students sitting and completing work very quietly. Our school does use Brain Jam, a kinesthetic stimulating activity, when completing our national and state testing, but we rarely see kinesthetic approaches used in the classroom beyond the week of testing.

In my opinion, teaching has a steep learning curve, which make the first few years of teaching a time of significant growth. I hope to continue on the path of always improving myself as an educator and differentiating my teaching for multiple

intelligences. Critiquing myself is one way to achieve this goal. I believe that a master educator is going to be able to meet the needs of each of their students, which will involve differentiation.

I tend to find myself in multiple meetings throughout the month, and I have noticed a trend, where I am often the only one in the meeting with mostly positive comments to say about the student, perhaps because I am the health enhancement teacher. It is a common occurrence to observe my students who do very well in a kinesthetically rich environment struggle in math or communication arts, where the core subject teachers are not using as much kinesthetic teaching. The focus during each meeting is often on academic as well as behavioral problems, but I frequently do not have either issue in my kinesthetic environment. When I move into the classroom for the health units, which include human sexuality, drugs and alcohol, and nutrition, where there are fewer kinesthetic activities, I find that I have more of the same problems that the other teachers see on a regular basis.

When reading about different learning preferences, I could not help but relate to much of the material I have found within my research. I am a strong bodily-kinesthetic learner as well as a musical and visual learner but I can also relate to a number of other intelligence areas. As a teacher, I see many students who do not fit into the traditional teaching model we see in many of our classrooms. This information motivated me to differentiate and employ the use of multiple intelligences with my students.

Due to my experience teaching health enhancement, as well as my past history in my own educational journey, I decided to address this issue in the following way. The focus

question of my project was, *What are the effects of multiple intelligence theory on middle school students' understanding of health enhancement and science concepts?* To support this project, I also posed the following sub questions: *What are the effects of using the theory of multiple intelligences to drive instruction on real-life application of knowledge; What are the effects of using the theory of multiple intelligences to drive instruction on students' attitude and motivation; What are the effects of using the theory of multiple intelligences to drive instruction on my attitude and motivation; and How did using the theory of multiple intelligences to drive instruction affect the students' behaviors within the classroom?*

CONCEPTUAL FRAMEWORK

In Gardner's (1983) theory of multiple intelligences (MI), individuals have seven separate intelligences that together make up one's cognitive capacity. Gardner argued that one's intelligence or cognitive capacity cannot be measured by one intelligence but by multiple intelligences. Gardner's theory contained the seven following intelligences: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal, and intrapersonal. An eighth, existential, was added in 1999, which is the ability to understand spiritual and religious ideals.

One researcher observed thousands of classrooms across the nation and found that 70% of classroom time consisted of teacher driven lessons, where the teacher was talking, and the students were listening (Goodland, 2004). Much of the rest of the learning consisted of students completing written work. An interesting point concerning linguistic intelligence, Gardner's first intelligence, was that the linguistic and verbal

intelligences of teachers are often their strongest (Nolen, 2003). These two conclusions support the notion that a majority of classrooms are teacher driven with the teacher instructing in front of the classroom.

According to Aborn (2006), there are a number of advantages to using the MI theory in the classroom to get away from the one-size fits all method of teaching. This allows each student's learning to be unlimited. Aborn also felt that if one was conscious of his or her intellectual strengths, as well as where they found themselves challenged, he or she would be able to learn to use different tools and strategies to help them become a more well rounded learner. He goes on to discuss the value of one knowing his or her intellectual strengths and challenges and the ability to use that awareness to gain a feeling of success, as one is then able to add to the collective group what someone else may not be able to do. This focus allows the students as well as the teacher to feel successful, while also being able to see difficulties as challenges instead of failures.

Motivation also plays a role in the learning process. Our culture, background, and ethics make up who we are and who our students are, which naturally impacts the learning process as well as affecting the motivation to desire to continue to learn. In an experiment by Uguroglu & Walberg (1979), the connection between achievement and motivation was recorded to be as high as 12%, and the connection between motivation and sociopsychological environment was as high as 60%. Students are motivated by achievement, and if we are teaching in a way that meets their needs in relation to the multiple intelligences, they should feel the needed level of achievement. Consequently, we will also be meeting the students' needs sociopsychologically. Teachers and students

are influenced by their culture, background and ethics, which impacts their motivation and drives how they choose to teach or learn. Motivation is derived from a variety of factors including the need to have a sense of achievement and recognition, along with a feeling of responsibility and interest in one's job. By using instruction that focuses on MI, teachers are able to meet the needs of their individual students by creating an environment that can create better motivation due to the factors Kaiser (1981) recorded.

Plummer (2009) completed a study looking at the benefits of using MI to guide instruction. This focused on a planetarium program using kinesthetic, visual and auditory learning techniques. The study consisted of seven first and second grade classes. Ten students from each classroom were randomly selected for the interviews. The students used their own bodies to replicate celestial motion in order to understand the concepts of planetary motion in combination with a rich visual and auditory presentation using the planetarium. The experiential data showed that the students benefited from the focus on the different intelligences and showed considerable improvement in the number of students who were more exact in their description of apparent celestial motion. This difference was credited to the ways instruction encouraged conceptual development as well as the level of engagement across multiple modalities.

When addressing the topics of cognition, memory, learning, and recalling, a number of studies investigating long-term memory have been completed. One study was related to the game of chess and the memorization of chess positions. Chess players use the visual intelligence along with long-term memory in order to recall previous positions in previous games when calculating moves they are contemplating. The use of their

visuo-spatial working memory during the chess game demonstrated the importance of process of apperception (Sariluoma, 1991). The mental process of apperception is when one makes sense of an idea by recalling previous knowledge, and this is what I want my students to be able to accomplish.

One important piece of evidence in Sariluoma's (1991) experiment was the difference of recalling random positions compared to regular positions from actual game play. The chess players within the study were able to recall the moves within the game as well as recall multiple pieces to give reference to each other at an accuracy of around 60% compared to 10% when the chess players were recalling random positions and pieces not in relation to other pieces. This skill can be directly compared to how students are recalling the information gathered from class. Recalling information from a real experience is more useful than from a random piece of information.

Delaney and Shafer (2001) used MI to drive a lesson within their classroom and were able to assess each student's progress as well as the students' overall opinion of using MI to guide the instruction. They discovered that the students were able to be more innovative and expressive with the learning process, which confirmed the confidence they already felt in using the MI theory. Students also portrayed a stronger understanding of the material after using MI in the development and presentation of their assignments.

Tomlinson (1999) discusses the hallmarks of differentiated classrooms and the importance of the teacher using different modalities by appealing to the students' diverse interests and varying rates of instruction and complexity. She goes on to explain the importance of providing ways for each student to deeply understand by using each

student's way of learning, which is not identical to other students. Tomlinson (2013) believes that learning profile and how students approach learning also affects academic growth. If the teacher is able to increase efficiency of learning by focusing on learning profiles, the academic success of the student should increase, as well as their interest and motivation in learning. For example, when a teacher often uses lessons that focus on oral learning in the classroom, a student who does not learn well orally is going to experience a lack of achievement. This demonstrates the need to have classroom lessons that are adaptable to a variety of student learning styles, thereby allowing students the best opportunity to process and reiterate the information.

It is often difficult to create new and innovative ideas when teaching in the classroom. Teachers will typically share numerous ideas while collaborating within teams, schools, and across school districts. Unfortunately, many of the ideas shared often fall within the criteria of teacher driven lessons or students' work. According to Pokey (2003), using the MI theory to drive instruction encourages the teacher to diversify their strategies and is easily applied to lessons on a daily basis. Teachers consistently reported that employing the MI theory in the classroom helped them accommodate the capabilities, needs and learning styles of individual students, which resulted in higher achievement (Noble, 2004). When multiple intelligences are considered while formulating and writing lesson plans, lessons can be purposely directed at one or more specific intelligences. In this way, teachers are forced to create fresh and innovative lesson plans, which also aids in creating new and inventive teaching strategies (Pokey, 2003).

METHODOLOGY

I teach in Bozeman, Montana, one of the larger towns in Montana, and it is bursting at the seams. It is somewhat of a resort town that offers great winter and summer activities, which also contributes to a large variety of students when looking at socioeconomic demographics within the classroom. The project was conducted in seventh grade science and health enhancement classes at Chief Joseph Middle School (CJMS). The sixth period science class used for this data collection consisted of 22 students. The class consisted of 20 Caucasian students, one Asian, and one Hispanic student. There were two students with Individualized Education Plans (IEP's) and two students in the special education program within this class. The group was also a mix of students in the free or reduced lunch program and students who were not eligible for the program. The first portion of the data collection consisted of the nontreatment unit within each participating classroom, while the other three data collections consisted of units within the same classrooms as the treatment units. This allowed me to make a comparison between the two by using instruction that focused on multiple intelligences (MI) as opposed to traditional classroom strategies. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

The first nontreatment unit of study consisted of teens and alcohol. This unit was comprised of the following topics: alcohol in the body, alcohol and social decisions, drunk driving, alcoholism, resisting the pressure to drink, and alternatives to alcohol. The second nontreatment unit of study was within the seventh grade science class at CJMS

with Mrs. Stephens and encompassed the study of fish ecology. The first treatment unit incorporated teens and drugs. This unit involved the following topics: using drugs, the use of drugs as medicine, the misuse of drugs, drug addiction, consequences of drug abuse, stimulants and depressants, marijuana, hallucinogens, inhalants, and staying drug free. The second treatment unit of study included human sexuality. This unit involved the following topics: genetics, male and female anatomy, sexually transmitted infections, relationships, and the stages of life. The third treatment unit of study involved studying geological time and was also in Mrs. Stephen's classroom (Table 1).

Table 1
Treatment and Nontreatment Units

Area of Study	Subject
First Nontreatment Unit	Teens and Alcohol
Second Nontreatment Unit	Fish Ecology
First Treatment Unit	Teens and Drugs
Second Treatment Unit	Your Changing Body
Third Treatment Unit	Geological Time

Teaching each of the nontreatment units involved a more traditional method of teaching. The instruction consisted of teacher-driven lessons where Mrs. Stephens and myself did more talking and led the discussion. The students were first introduced to the material and participated by taking notes and discussing as a class and with peers. The

lecture, reading, and discussion portion of the class period was often followed by the students spending class time working independently and answering questions from the textbook and other resources.

During the treatment units, students first took the Multiple Intelligence (MI) Survey to identify their areas of greater and lesser strength (Appendix B). Treatment units one and two in each of the classrooms consisted of a small portion of teacher driven instruction. However, they also contained student-driven learning with the students working in small groups, moving around the classroom doing hands-on activities for the bodily kinesthetic MI, role playing situations for the naturalistic MI, viewing videos and diagrams for the visual spatial MI, using music for the musical-rhythmic MI, and class discussions and assignments that focused on logical, interpersonal, existential, and intrapersonal multiple intelligences. Each station was also differentiated for different intelligences. This gave the students a variety of instruction focused on various multiple intelligences throughout each lesson. Using variety gave the students the opportunity to use the MI that coincided with their strengths. This also allowed them to learn to use other intelligences more proficiently that may not have originally been considered as one of their strengths. The treatment units allowed the students to move around the classroom and be active in the discussions with their peers. The students were also able to see, hear, and feel different parts of the lesson.

The students started by taking the Multiple Intelligence Survey to identify each of their strongest as well as their weakest intelligences. The Multiple Intelligence Survey consisted of nine sections with each of them focusing on an intelligence. Each section

consisted of ten questions where each student was asked to write the number one by any statement that would describe him or her. Each question was directed towards a specific learning style that the student could use to determine if this activity was one that encouraged a better learning environment or one that made learning more difficult. At the end of the Multiple Intelligence Survey, the students added all the ones up in each section, which revealed their strengths and weaknesses in relation to learning. The sections with the highest number of ones demonstrated that learning style as a strength. The data was compiled to formulate strengths and weaknesses for each student.

The data collected from the Preunit and Postunit Assessments, as well as the Daily Formative Assessments, was very useful in determining how each student understood each specific topic. Students answered a variety of questions that included multiple choice, fill in the blank, short answer as well as short essay questions. I collected various data for my project from Summative and Formative Assessments allowing for triangulation. The Preunit Assessments were used to establish a baseline of the level of each student's knowledge. These were followed by the Formative Assessments during each unit with a final assessment at the end of the unit to measure the amount of improvement by each student. In health enhancement, the students began by taking the Teens and Alcohol Assessment as a Pre and Posttest during the nontreatment portion of the study (Appendix C). Each student also took the assessments Teens and Drugs and Your Changing Body as a Pre and Posttest (Appendix C). In the science portion of the study, the students completed the Fish Ecology Assessment as a Pre and Posttest during the nontreatment unit and the Geological Time Assessment during the

treatment unit as the Pre and Posttests (Appendix C). I also used students' daily work as a form of checking for achievement and understanding. I analyzed the data by comparing the nontreatment units to the different treatment units. The data was also used to collect mean, median, mode and normalized gain from the assessment scores. The median, lower and upper quartiles were used to create box and whisker plots.

Before the treatment unit as well as after the two treatment units, the students filled out the Student Survey. When looking at the level of student enjoyment, I used the student responses from Likert style Student Survey, where students rated the value one through five where one signified *Strongly Disagreeing*, two signified *Disagreeing*, three signified *Neutral*, four represented *Agreeing*, and five represented *Strongly Agreeing* (Appendix D). The Student Survey collected data about each student's thoughts about classroom environment, teaching styles, learning styles, teacher driven instruction, and student centered instruction. This proved to be a beneficial data source, where I was able to assess each student's perception of the nontreatment units compared to each treatment unit. The data was also averaged to gain perspective of the entire group in order to find negative and positive changes. It was then used to make a comparison between the pre survey and the post survey responses to decipher if there was a change in their perception.

For more documentation, I kept a Journal as a way of remembering my reaction and thoughts about each unit and my perception of how the lessons were received by the students. This data showed a reflection on my part concerning how successful the unit was as a whole, as well as representing some of the lessons that I felt were very

successful or not. I also recorded what I enjoyed and what I would change when teaching the lesson again. This data was analyzed by comparing positive and negative changes from one unit to the next from the perspective of teaching each unit.

Another data source was the class Accountability Log, which was a notebook that students signed whenever they were making a poor choice. Reasons for signing the book included distracting peers, being off task, talking out, as well as many other infractions. When each unit was finished, I collected the sheets out of the Accountability Log and stored them for the purpose of comparing the numbers to other units. The number of signings each treatment unit and nontreatment unit was compared to the other units by looking at the total number of students who signed the Accountability Log within the study. This allowed for the data to show a gain or loss in the number of times the Accountability Log was used within each unit representing one piece of the classroom environment.

My final source of data involved interviewing each student from the sixth period science class. Students answered questions from the Student's Interview (Appendix E). The interview consisted of five questions with the purpose of gathering data on student perception of the impact of using MI to drive instruction, student motivation, student enjoyment, and student behaviors. The data was used to gather both information from individual students, as well as the class as a whole, to see negative or positive changes in the perception of the students in relation to using MI to guide instruction. It was then used for triangulation with other data collected, which included the perception of the students from the Student Survey as well as the other various methods.

For my focus question concerning the impact of using MI to drive instruction on conceptual knowledge, I used preunit and postunit assessments, pretreatment and posttreatment surveys, and pre-unit and post-unit student concept interviews (Table 2). This gave me the opportunity to see the before and after as well as to measure how the students' learning progressed throughout the unit. The hands-on activities proved to be a good data source for my sub question on real-life application. The pretest and posttest surveys were an effective source of data, because they conveyed data that showed how students actually applied the information in their real lives.

Table 2
Triangulation Matrix

Research Questions	Data Source 1	Data Source 2	Data Source 3
What are the effects of differentiated instruction using Howard Gardner's multiple intelligences on understanding middle school health enhancement and science concepts?	Pre and Postunit Assessments	Pre and Postunit Student Interviews	Student Survey
What are the effects of differentiated instruction on real-life application of knowledge?	Pre and postunit teacher observations of hands on activity	Pre and Posttreatment Student Interviews	Student Survey
What are the effects of differentiated instruction on students' attitude and motivation?	Teacher field observation	Pre and posttreatment Student Interview	Student Survey

What are the effects of differentiated lesson plans on my attitude and motivation?	Nontreatment and treatment observations by colleagues treatment unit	Instructor reflection journaling	Pre and posttreatment teacher interview
How did it affect the behaviors within the classroom?	Teacher observation	Behavior Log	Student Survey

DATA AND ANALYSIS

The data from the Multiple Intelligence (MI) test demonstrated each student's strongest learning style as well as their most challenging learning style ($N=22$). When analyzing the data, the first piece of data considered was each student's top three intelligences as well as their two most challenging intelligences. When observing each student's data, it lined up with what many teachers would probably predict; however, many of the results for each student were also very unpredictable.

The Multiple Intelligence Survey showed that the greatest number of students, at 64%, chose answers revealing one of their top three intelligences as kinesthetic (Figure 1). As a result, only 9% of the students showed it as one of the most challenging ways to learn. The next two intelligences that proved to line up with students' strengths were visual at 59% and musical at 55%. The most infrequent intelligence within the study was verbal intelligence. Zero percent of the students showed this as one of their top three strengths, which was fascinating due to the fact that much of classroom instruction is supplemented with verbal directive. The data revealed that 45% of the students considered verbal intelligence along with existential intelligence as one of their most

challenging ways to learn. Naturalistic and logical intelligences followed at 41%. The interpersonal intelligence proved to be the most middle of the road intelligence with 45% of the students demonstrating it as one of their top strengths, while 32% of the students demonstrated it as one of their most challenging ways to learn.

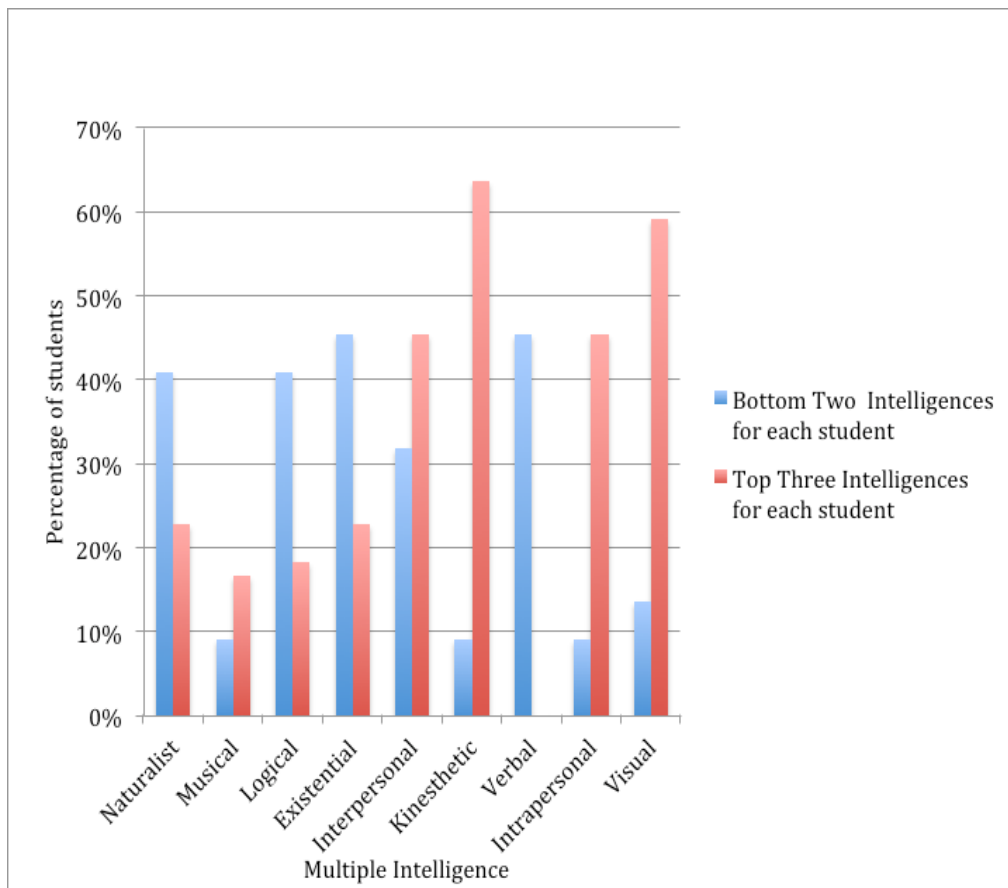


Figure 1. Student responses from the Multiple Intelligence Survey, (N=22).

The next piece of data was a comparison between the Multiple Intelligence Survey responses and the number of proficient and advanced proficient or nearing

proficient and novice responses on the assessments that correlated with specific multiple intelligences. With that in mind, the data was split into four categories. The first category was comprised of students whose multiple intelligence strengths correlated with proficient or advanced proficient responses from the assessments, and the second included students whose multiple intelligence weakness correlated with nearing proficient or novice responses from the assessments. Both of these categories show data that we would hope to be able to reproduce to build a case for this study. The third category contained students whose multiple intelligence strengths did not correlate with proficient or advanced proficient responses from the assessments, and the fourth category involved students whose multiple intelligence weakness did not correlate with nearing proficient or novice responses from the assessments.

The data demonstrated a number of responses that showed a correlation between the responses from the Multiple Intelligence Survey and proficient or advanced proficient responses from the assessment that used a specific MI (Figure 2). The data revealed that 71% of the responses within the kinesthetic portion of the treatment units were proficient or advanced proficient responses and correlated with students whose Multiple Intelligence Survey showed them to be strong kinesthetic learners. Likewise, 71% percent of the responses within the musical portion of the treatment units were proficient or advanced proficient responses and correlated with students whose Multiple Intelligence Survey showed them to be strong musical learners. The data also disclosed that 17% of the responses on the kinesthetic portion of the assessment were nearing proficient or novice and from students whose MI Survey showed them to be strong

kinesthetic learners followed by 14% of the responses on the musical portion of the assessment that were nearing proficient or novice and from students whose MI Survey showed them to be strong musical learners. Only 2% of the students' data showed the kinesthetic MI as a weakness that correlated with nearing proficient or novice responses, while 10% of the responses were proficient or advanced proficient responses from students whose data showed the kinesthetic MI as one of their most challenging intelligences. The musical MI was similar with 11% of the students' data showing it as a weakness that correlated with nearing proficient or novice responses, while 4% of the responses were proficient or advanced proficient from students who showed the musical MI as one of their most challenging intelligences.

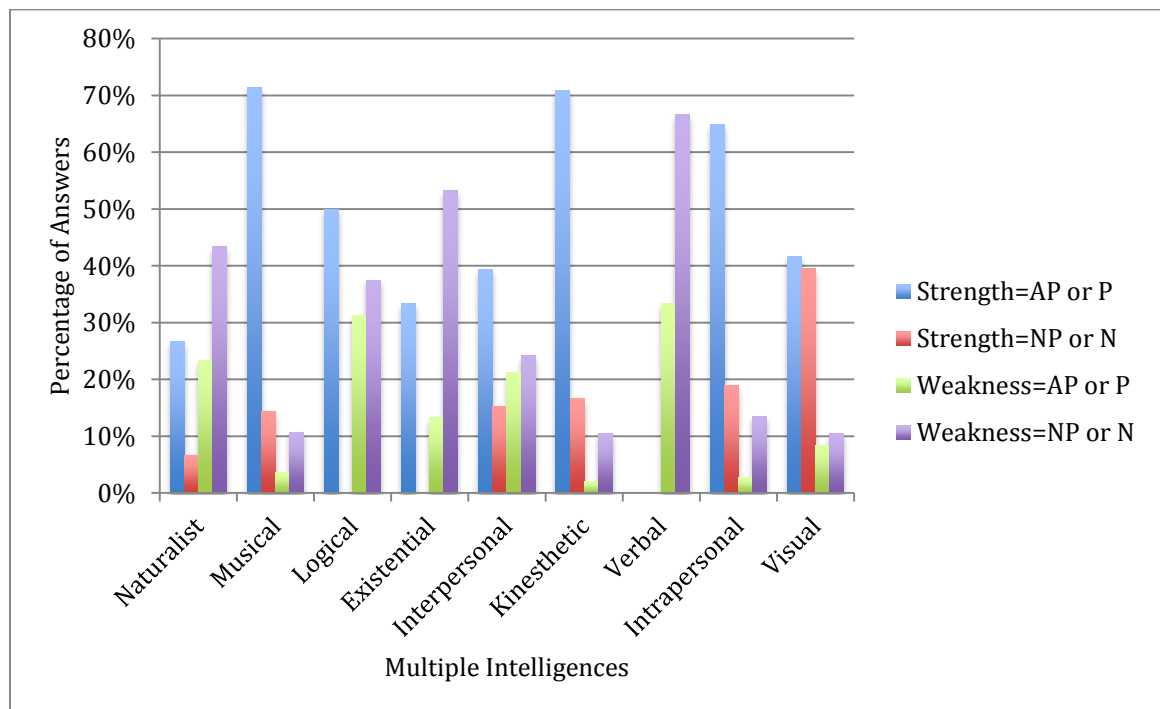


Figure 2. Student responses on assessments compared to the class responses from the Multiple Intelligence Survey, (N=22). Key: AP = advanced proficient; P = proficient;

NP = nearing proficient; N = novice.

The data for the intrapersonal intelligence revealed that 65% percent of the responses within the treatment units were proficient or advanced proficient and correlated with students whose Multiple Intelligence Survey showed them to be strong intrapersonal learners. It also revealed that 19% of the responses on the intrapersonal portion of the assessment were nearing proficient or novice and from students whose MI Survey showed them to be strong intrapersonal learners, but only 3% of the students' data exhibited the intrapersonal MI as a weakness that correlated with nearing proficient or novice responses. Fourteen percent of the responses were proficient or advanced proficient from students who showed the intrapersonal MI as one of their most challenging intelligences.

Similarly, 50% of the responses within the logical section of the treatment units were proficient or advanced proficient and correlated with students whose Multiple Intelligence Survey exhibited them to be strong logical learners. The data indicated that 0% of the responses on the logical section of the assessment were nearing proficient or novice and from students whose MI Survey showed them to be strong logical learners. Only 31% of the students' data showed the logical MI as a weakness that correlated with nearing proficient or novice responses, while 38% of the responses were proficient or advanced proficient from students who indicated the logical MI as one of their most challenging intelligences.

The data collected from the visual section of the assessments disclosed that 42% of the responses from the treatment units were proficient or advanced proficient and

correlated with students whose Multiple Intelligence Survey showed them to be strong visual learners. The collected data also revealed that 40% of the responses on the visual portion of the assessment were nearing proficient or novice and from students whose MI Survey showed them to be strong visual learners. Only 8% of the students' data showed the visual MI as a weakness that correlated with nearing proficient or novice responses; however, 10% of the responses were proficient or advanced proficient and from students who showed the visual MI as one of their most challenging intelligences.

The verbal and naturalist intelligences data showed the least amount of correlation between the MI survey and the responses on the assessments within the treatment units. Zero percent of the responses within the verbal portion of the treatment units correlated with students whose Multiple Intelligence Survey showed them to be strong or weak verbal learners, because 0% of the students were found to have the verbal MI as one of their top three intelligences. The data revealed that 33% of the students exhibited the verbal MI as a weakness that correlated with nearing proficient or novice responses. Sixty-seven percent of the responses were proficient or advanced proficient from students who demonstrated the verbal MI as one of their most challenging intelligences to learn by, which was the largest discrepancy between the data and what was predicted. The next largest discrepancy was the naturalist intelligence. Twenty-seven percent of the responses within the naturalist portion of the treatment units were proficient or advanced proficient responses and correlated with students whose Multiple Intelligence Survey showed them to be strong naturalist learners. The collected data also showed that 7% of the responses on the naturalist portion of the assessment were nearing proficient or

novice and from students whose MI Survey proved them to be strong naturalist learners. Twenty-three percent of the students' data showed the naturalist MI as a weakness that correlated with nearing proficient or novice responses, while 43% of the responses were proficient or advanced proficient from students who presented the naturalist MI as one of their most challenging intelligences.

Within the interpersonal intelligence portion of the treatment unit, the collected data disclosed that 39% of the responses were proficient or advanced proficient and correlated with students whose Multiple Intelligence Survey showed them to be strong interpersonal learners. The data also demonstrated that 15% of the responses on the interpersonal portion of the assessment were nearing proficient or novice and from students whose MI Survey showed them to be strong interpersonal learners. Twenty-one percent of the students' data revealed the interpersonal MI as a weakness that correlated with nearing proficient or novice responses, while 24% of the responses were proficient or advanced proficient from students who showed the interpersonal MI as one of their most challenging intelligences.

The final intelligence, existential, revealed that 33% percent of the responses were proficient or advanced proficient and correlated with students whose Multiple Intelligence Survey showed them to be strong existential learners. The data also showed that 0% of the responses on the existential portion of the assessment were nearing proficient or novice and from students whose MI Survey disclosed them to be strong existential learners. Thirteen percent of the students' data showed the existential MI as a weakness that correlated with nearing proficient or novice responses, while 53% of the

responses were proficient or advanced proficient from students who demonstrated the existential MI as one of their most challenging intelligences.

The data collected from the pre and posttests within each unit showed a variety of results (Figure 3). The data from the first nontreatment unit disclosed that the class average from the pretest was a 62%, rose to an 82%, with an averaged normalized gain of 0.34 (Figure 4). The median from each data set began at 69% and rose to 85% on the posttest. The data from the first treatment unit showed that the class average from the pretest was a 62%, rose to a 91%, and had an averaged normalized gain of 0.58. The median from each data set started at 62% and rose to 91% on the posttest.

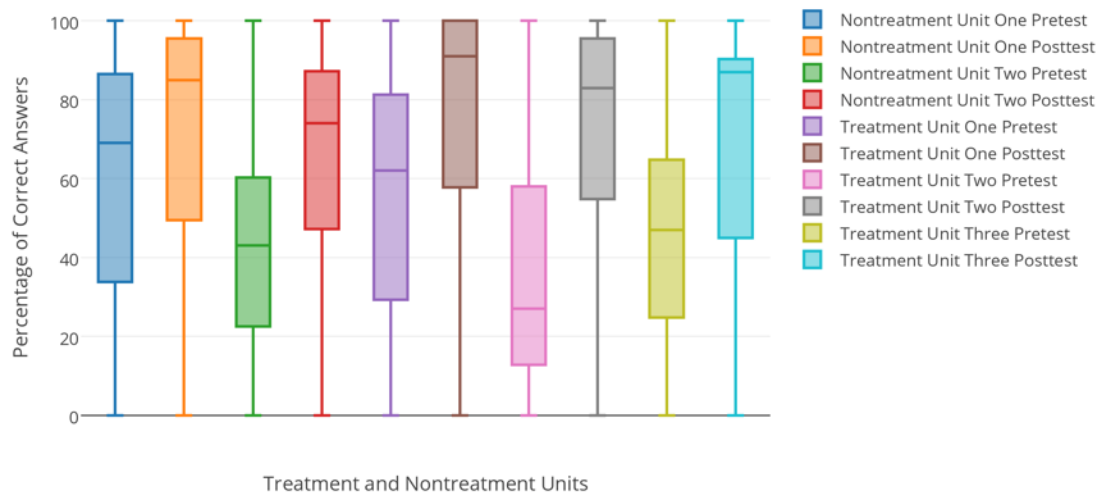


Figure 3. Box and Whisker plot showing the results of student responses on health enhancement and science assessments, ($N=22$). Key: NT One = Teens and Alcohol; NT Two = Fish Ecology; T One = Teens and drugs; T Two = Your Changing Body; T Three = Geological Time

The second treatment unit data revealed that the class average from the pretest was a 29%, rose to a 74%, and had an averaged normalized gain of 0.66. The median from each data set began at 34% and rose to an 81% on the posttest. The data from the second nontreatment unit showed that the class average from the pretest was a 36%, rose to a 68%, and had an averaged normalized gain of 0.34. The median from each data set started at a 42% and rose to a 73% on the posttest. The third treatment unit showed that the class average from the pretest was a 45% and rose to a 78% with an averaged normalized gain of 0.66. The median from each data set started at a 40% on the pretest and rose to an 80% on the posttest.

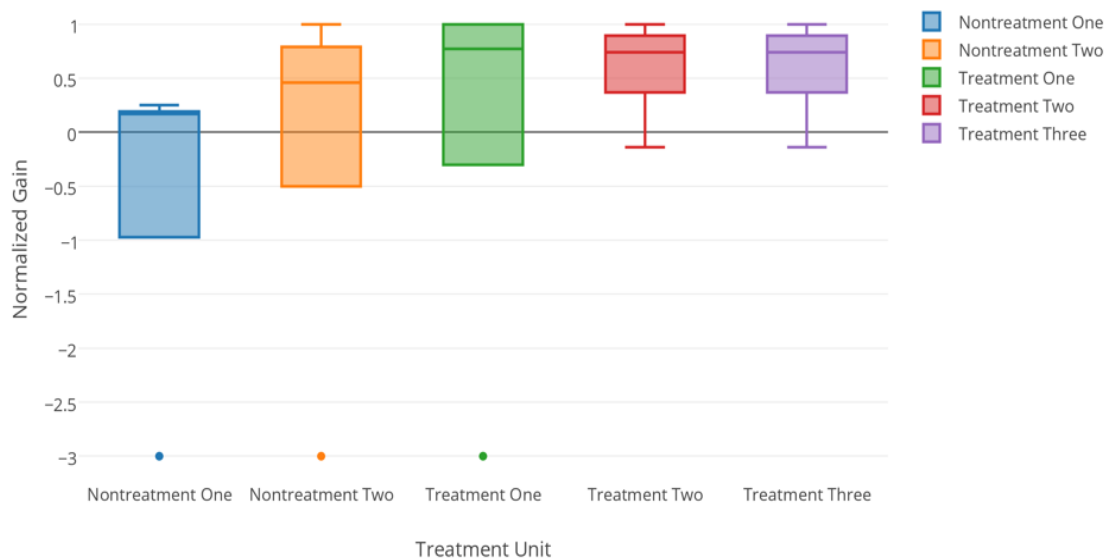


Figure 4. Box and Whisker plot showing the normalized gain from each treatment and nontreatment unit, ($N=22$). Key: NT One = Teens and Alcohol; NT Two = Fish Ecology; T One = Teens and drugs; T Two = Your Changing Body; T Three = Geological Time

The data collected from the Student Survey showed the perception of the students in a number of different areas. The survey consisted of thirteen questions gauging how each of the students within the study felt about instruction, working with peers, their own learning experiences, confidence levels, and attitude before and after the treatment units.

When comparing the data, one was able to see growth in the percentage of students who enjoyed working with peers and a decreased percentage of students who were satisfied with teacher driven instruction (Figure 5). The pretreatment data from the Student Survey revealed that 81% of the students looked forward to working with peers with 36% of the students strongly agreeing and 45% agreeing with the statement, “I look forward to lessons where I am able to work with my peers,” while the posttreatment data showed 55% strongly agreeing and 25% agreeing with the same prompt. When examining the students’ opinion of teacher driven instruction from the pretreatment Student Survey, 27% strongly agreed and 32% agreed with the statement, “I think my learning is more effective when the lesson is teacher driven.” However, that percentage dropped to 5% strongly agreeing and 20% agreeing posttreatment. Similarly, 14% of the students disagreed with the statement pretreatment and that number rose to 30% on the posttreatment survey.

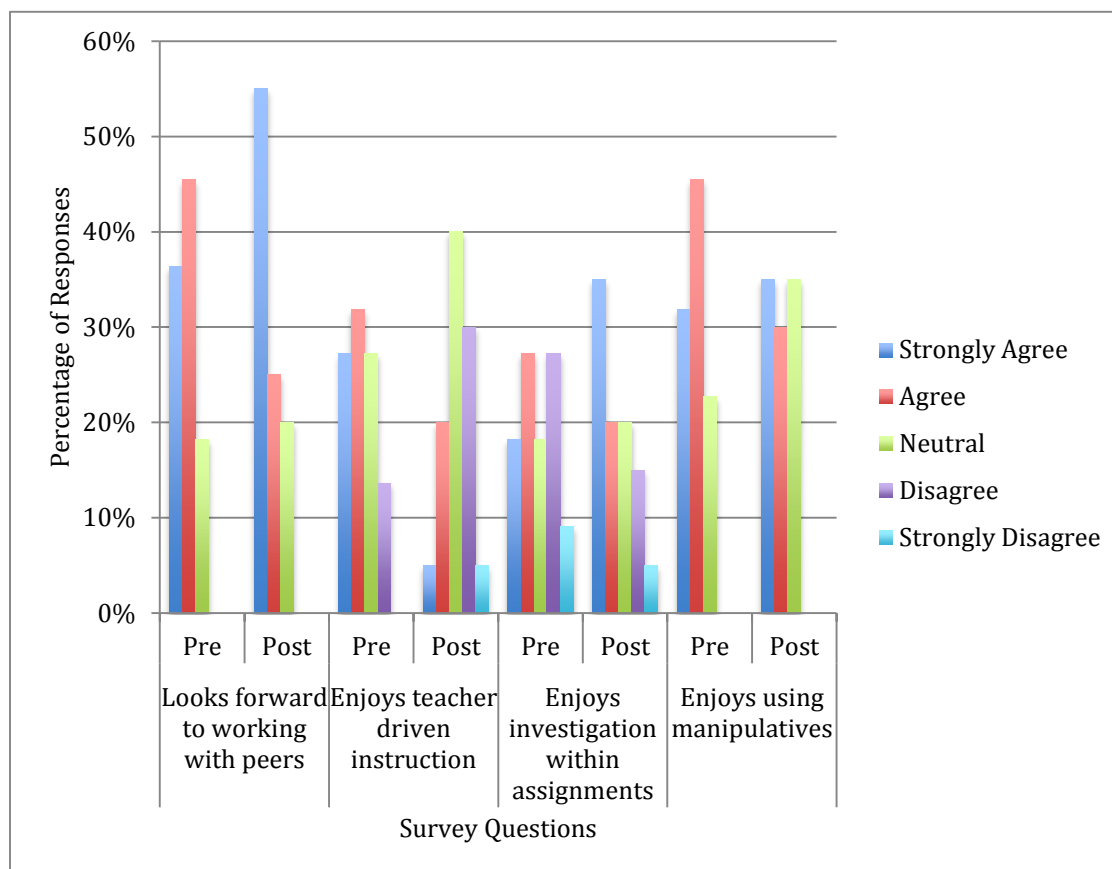


Figure 5. Student survey responses for select questions, (N=22).

In the comparison of the pre and posttreatment Student Surveys, one was also able to see growth in the percentage of students who enjoyed investigating as an instructional tool, while the acceptance of using manipulatives decreased. The students' pretreatment responses in relation to investigating and using manipulatives showed that 18% strongly agreed with the statement, "I think my learning is more effective when the lesson is student driven, where I am able to investigate and learn on my own," while 27% agreed. Thirty-two percent strongly agreed and 45% agreed with the statement, "I understand the material very well when I am able to use manipulatives." This trend in the data continued with 23% of the students on the pretreatment Student Survey choosing neutral

on the question pertaining to the use of manipulatives and growing to 35% on the posttreatment survey. The posttreatment Student Survey disclosed that 35% strongly agreed and 20% agreed with the prompt concerning investigation, while 35% strongly agreed and 30% agreed with the statement about manipulatives on the posttreatment Student Survey causing the percentage of neutral response to rise.

When observing the data collected from select survey questions, some changes were observed in the areas of student confidence, their ability to understand and student understanding in relation to reading (Figure 6). There was an overall increase in the percentage of students who felt confident in learning, as well as being satisfied with the amount of individual help from the teacher, but there was a general decrease in the percentage of students who felt like they had the ability to understand the material when the instruction focused on reading. The data showed that students responded to the statement, "I am confident in the way that I learn at school," with 5% choosing I strongly agree on both the pre and posttreatment survey. There was a very small jump from 73% to 75% with the percentage of students who chose the response agree.

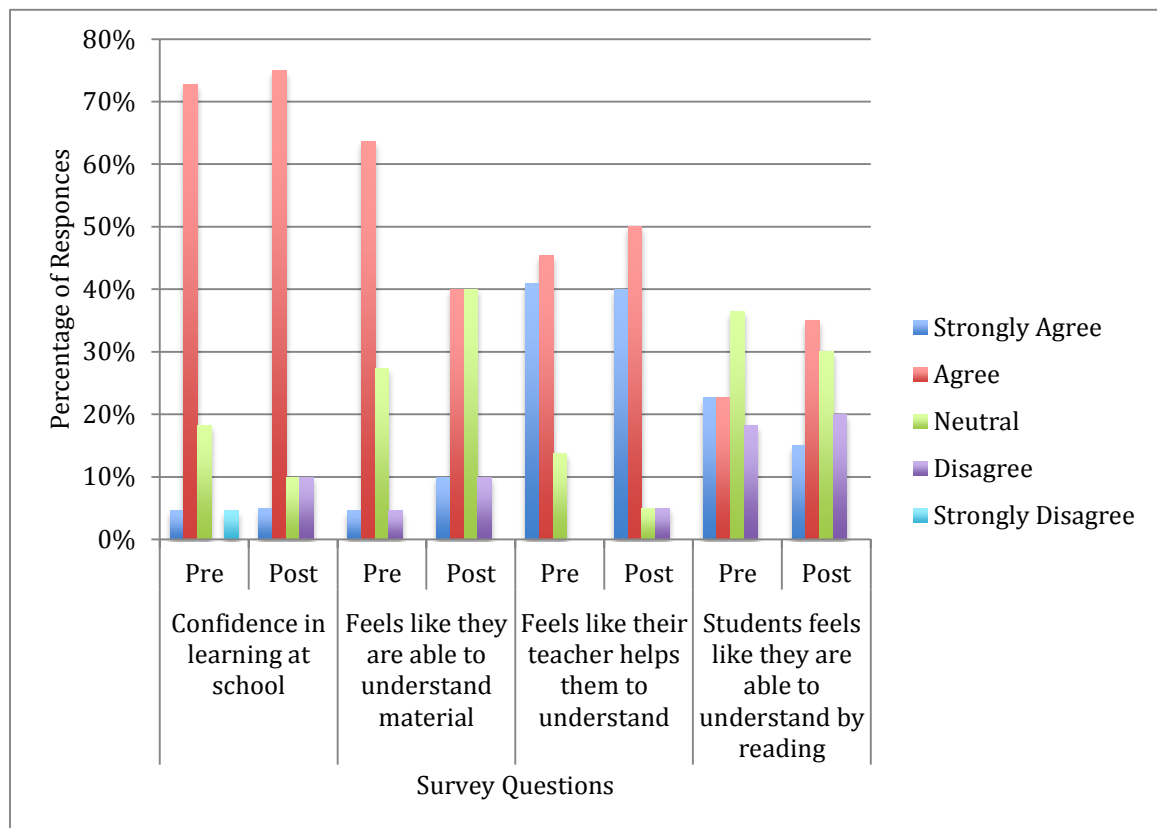


Figure 6. Student survey responses for questions for select questions, (N=22).

In response to the survey question, “The material is presented in a way that I am able to understand and remember,” the data showed that 69% of the students agreed or strongly agreed on the pretreatment Student Survey while the posttreatment data showed 50% of the students chose agree or strongly agree. This piece of data did not correlate with the data from the Student Interview questions, which revealed that most students felt like they were able to better understand the material during the treatment units. We did see a growth in the number of students who chose neutral with 27% on the pretreatment survey and 40% choosing neutral on the posttreatment. The data collected from the question, “My teacher helps me when I do not understand something,” showed small

changes with the largest change being 14% choosing neutral on the pretreatment survey and only 5% choosing that response on the posttreatment and 45% choosing agree on the pretreatment and 50% choosing agree on the posttreatment. The data showed that fewer students felt like they were able to understand the material with just reading on the posttreatment survey than on the pretreatment survey. The percentage of students who chose strongly agree dropped from 32% to 15% on the question, “I am able to best understand the material when I can read the information by myself,” with a number of the students choosing agree instead of choosing strongly agree causing the percentage of students who agreed to rise to 35%. The decrease in the number of students who were satisfied with just reading did correlate with the data collected from the Students Interview questions with most of the responses showing that students enjoyed and felt like they benefited more from other activities besides reading.

INTERPRETATION AND CONCLUSION

The objective of the project was to assess the effects of using the theory of multiple intelligences on students’ understanding of health enhancement and science concepts. After evaluating the collected data from the study, it can be concluded that using the theory of multiple intelligences to drive instruction had a positive impact on the understanding of health enhancement and science concepts, real-life application of knowledge, students’ attitude and motivation, and the students' behaviors within the classroom.

In relation to the effects of understanding seventh grade health enhancement and science concepts, the data showed that in most cases the students understood,

comprehended and were able to apply the information at a higher percentage of proficient or advanced proficient responses during the treatment units than during the nontreatment units. In relation to most students top three intelligences, each student used more proficient or advanced proficient responses on those portions of the test than on the portions of the test that represented their bottom two intelligences. This trend, although not perfect, did lend us to consider that it did affect student understanding.

Many of the concepts taught and assessed on the pre and posttest within the health enhancement and science portions closely related to many real life applications. Students were able to apply the information from the treatment units with a higher rate of proficient or advanced proficient answers than during the nontreatment units. This information was then applied to the posttest relating to real life applications.

The feedback from the Student Surveys, the Student Interviews, as well as my documentation of my own perception of the classroom environment gave me the impression that students enjoyed the different activities. The students appreciated the different feel of the classroom due to the variety both during lessons that lined up with one of their strongest intelligences, as well as when we focused on other intelligences. With many of the students enjoying the variety of activities, the classroom had minimal discipline issues. The accountability log did not need to be used more than usual and from my perspective the class seemed to be on task, interested in the activities, and engaged enough to keep them from being a distraction by their peers.

To improve the project, I would have made the student surveys more specific with more questions in order to make better connections for finding trends. I was able to

obtain quality data from each of them, but I feel with seventh graders one often has to pry in order to access information. Another improvement I would make, for the same reason of finding bigger trends, is to create my own health enhancement tests with questions that would challenge my students more and have one correct answer. I used the chapter test each time thinking that this would ensure a lack of bias on my part, which was achieved. I would also like to see how a test that focused on using the multiple intelligences to assess would change the outcomes of the assessments. The last item I would try to change if I were testing again is to find a larger sampling group. Twenty-two students was a suitable number to observe, but it would have added to the study to use two science classes instead of just one.

VALUE

Researching multiple intelligences and working through the action research process revealed the benefits of using MI to drive instruction within my classroom for a number of reasons. The data showed that many students increased their understanding within a classroom using MI to drive instruction. By looking at the responses from teachers and students, the study demonstrated to me that using MI to drive instruction is a great way to keep students engaged. It also pushes the teacher to try new methods, which allow the students to become more involved in the lesson.

The greatest change I was able to see within my teaching during the action research-based classroom project was how I lesson planned, which in turn changed the dynamics of my classroom. The change came by looking at how I was choosing to communicate material to students. By viewing my lessons through the lens of multiple

intelligences, I was able to develop and use a variety of ways to present the information, instead of consistently teaching with only one approach. Focusing on the different intelligences made it easy to brainstorm the different ways I could teach one piece of material. It was also advantageous for me to feel a little stretched when teaching in ways that I would not normally focus on due to my strengths and weaknesses. As an educator, I tend to teach in the ways that I feel the most confident. The action research process helped me to see that I do not always need to feel comfortable in what I am doing and I, as well as the students, can benefit from me trying new things. I am not sure if the students were able to tell when I was feeling stretched or not, but I think it was beneficial for students to see the imperfections and the humility of teachers. It was an opportunity to grow in weaker areas and to do so with an audience was beneficial for the students. I was able to speak to some of my struggles with the students, and it seemed to be received well and established even more trust between the students and myself.

In the years to come, I hope to continually build upon the lessons that I created during the study and continue to benefit from the learning that took place during the action research process. Each time I present information to my students, I have the opportunity to add new methods to address different intelligences with the hopes of truly differentiating for all the various intelligences within one classroom. With this in mind, I plan to work towards this goal by continuously modifying and manipulating the lessons and the way I teach for greater student understanding. As educators, we differentiate each day, but I am now hoping to tie much of my differentiation to the theory of multiple intelligence.

REFERENCES CITED

- Aborn, M. (2006). An intelligent use for belief. *Education*, 127(1), 83-85.
- Delaney, C, J. & Shafer, K. (2001). Teaching to multiple intelligences by following a “slime trail”. *Middle School Journal*, 39(1), 38-43.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Ginsberg, M. B. (2005). Theory into practice. *Differentiated instruction*, 44(3), 218-225.
- Goodlad, J. I. (1984). *A place called school: Prospects for the future*. New York: McGraw-Hill Book.
- Kaiser, J.S. (1981). Motivation deprivation: No reason to stay. *Journal of Teaching Education*, 32, 41-43.
- Noble, T. (2004). Integrating the Revised Bloom’s Taxonomy With Multiple Intelligences: A planning tool for Curriculum Differentiation. *Teachers College Record*, 106 (1), 193-211.
- Nolen, J. L. (2003). Multiple intelligences in the classroom. *Education*, 124 (1), 115.
- Plummer, J. (2009). Early elementary students’ development of astronomy concepts in the planetarium. *Journal of research in Science Teaching*, 46(2), 192-209.
- Pokey, S. (2003). Multiple intelligence for every classroom. *Intervention in School and Clinic*, 39(2), 80 – 85.
- Saariluoma, P., Logie, R. H., & Denis, M. (Eds.) (1991). *Mental images in human cognition*. Amsterdam:Elsevier Science.
- Tomlinson, C. (1999). *The differentiated classroom responding to the needs of all learners*. Alexandria, Va.: Association for Supervision and Curriculum Development.
- Uguroglu, M., & Walberg, H. (1979). Motivation and achievement: A quantitative synthesis. *American Educational Research Journal*, 16(4), 375-389.
- Wu, E. H. (2013). The Path Leading to Differentiation: An Interview With Carol Tomlinson. *Journal Of Advanced Academics*, 24(2), 125-133.

APPENDICES

APPENDIX A
IRB APPROVAL



INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

960 Technology Blvd. Room 127
 c/o Immunology & Infectious Diseases
 Montana State University
 Bozeman, MT 59718
 Telephone: 406-994-6783
 FAX: 406-994-4303
 E-mail: cherylj@montana.edu

Chair: Mark Quinn
 406-994-5721
 mquinn@montana.edu
Administrator:
 Cheryl Johnson
 406-994-6783
 cherylj@montana.edu

MEMORANDUM

TO: Adam Van Zee and John Graves
FROM: Mark Quinn, Chair *Mark Quinn*
DATE: November 17, 2014
RE: "Using Gardner's Multiple Intelligence Theory to Differentiate Middle School Health Enhancement and Science Instruction" [AVZ111714-EX]

The above research, described in your submission of November 17, 2014, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

- X (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- X (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
- _____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
- _____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.
- _____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
- _____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B
MULTIPLE INTELLIGENCE SURVEY

Multiple Intelligences Survey

© 1999 Walter McKenzie, The One and Only Surfaquarium
<http://surfaquarium.com/MI/inventory.htm>

Part I

Complete each section by placing a "1" next to each statement you feel accurately describes you. If you do not identify with a statement, leave the space provided blank. Then total the column in each section.

Section 1

- _____ I enjoy categorizing things by common traits
- _____ Ecological issues are important to me
- _____ Classification helps me make sense of new data
- _____ I enjoy working in a garden
- _____ I believe preserving our National Parks is important
- _____ Putting things in hierarchies makes sense to me
- _____ Animals are important in my life
- _____ My home has a recycling system in place
- _____ I enjoy studying biology, botany and/or zoology
- _____ I pick up on subtle differences in meaning

_____ TOTAL for Section 1

Section 2

- _____ I easily pick up on patterns
- _____ I focus in on noise and sounds
- _____ Moving to a beat is easy for me
- _____ I enjoy making music
- _____ I respond to the cadence of poetry
- _____ I remember things by putting them in a rhyme
- _____ Concentration is difficult for me if there is background noise
- _____ Listening to sounds in nature can be very relaxing
- _____ Musicals are more engaging to me than dramatic plays
- _____ Remembering song lyrics is easy for me

_____ TOTAL for Section 2

Section 3

- _____ I am known for being neat and orderly
- _____ Step-by-step directions are a big help
- _____ Problem solving comes easily to me
- _____ I get easily frustrated with disorganized people
- _____ I can complete calculations quickly in my head
- _____ Logic puzzles are fun
- _____ I can't begin an assignment until I have all my "ducks in a row"
- _____ Structure is a good thing
- _____ I enjoy troubleshooting something that isn't working properly
- _____ Things have to make sense to me or I am dissatisfied
- _____ TOTAL for Section 3

Section 4

- _____ It is important to see my role in the "big picture" of things
- _____ I enjoy discussing questions about life
- _____ Religion is important to me
- _____ I enjoy viewing art work
- _____ Relaxation and meditation exercises are rewarding to me
- _____ I like traveling to visit inspiring places
- _____ I enjoy reading philosophers
- _____ Learning new things is easier when I see their real world application
- _____ I wonder if there are other forms of intelligent life in the universe
- _____ It is important for me to feel connected to people, ideas and beliefs
- _____ TOTAL for Section 4

Section 5

- _____ I learn best interacting with others
- _____ I enjoy informal chat and serious discussion
- _____ The more the merrier
- _____ I often serve as a leader among peers and colleagues
- _____ I value relationships more than ideas or accomplishments
- _____ Study groups are very productive for me
- _____ I am a "team player"
- _____ Friends are important to me
- _____ I belong to more than three clubs or organizations
- _____ I dislike working alone
- _____ TOTAL for Section 5

Section 6

- _____ I learn by doing
- _____ I enjoy making things with my hands
- _____ Sports are a part of my life
- _____ I use gestures and non-verbal cues when I communicate
- _____ Demonstrating is better than explaining
- _____ I love to dance
- _____ I like working with tools
- _____ Inactivity can make me more tired than being very busy
- _____ Hands-on activities are fun
- _____ I live an active lifestyle

_____ TOTAL for Section 6

Section 7

- _____ Foreign languages interest me
- _____ I enjoy reading books, magazines and web sites
- _____ I keep a journal
- _____ Word puzzles like crosswords or jumbles are enjoyable
- _____ Taking notes helps me remember and understand
- _____ I faithfully contact friends through letters and/or e-mail
- _____ It is easy for me to explain my ideas to others
- _____ I write for pleasure
- _____ Puns, anagrams and spoonerisms are fun
- _____ I enjoy public speaking and participating in debates

_____ TOTAL for Section 7

Section 8

- _____ My attitude affects how I learn
- _____ I like to be involved in causes that help others
- _____ I am keenly aware of my moral beliefs
- _____ I learn best when I have an emotional attachment to the subject
- _____ Fairness is important to me
- _____ Social justice issues interest me
- _____ Working alone can be just as productive as working in a group
- _____ I need to know why I should do something before I agree to do it
- _____ When I believe in something I give more effort towards it
- _____ I am willing to protest or sign a petition to right a wrong

_____ TOTAL for Section 8

Section 9

- ☐ I can visualize ideas in my mind
☐ Rearranging a room and redecorating are fun for me
☐ I enjoy creating my own works of art
☐ I remember better using graphic organizers
☐ I enjoy all kinds of entertainment media
☐ Charts, graphs and tables help me interpret data
☐ A music video can make me more interested in a song
☐ I can recall things as mental pictures
☐ I am good at reading maps and blueprints
☐ Three dimensional puzzles are fun
☐ TOTAL for Section 9

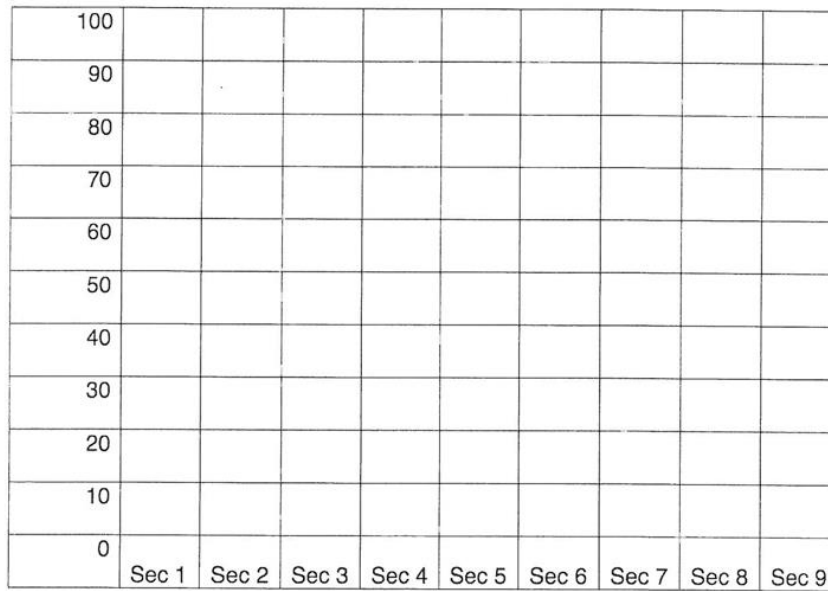
Part II

Now carry forward your total from each section and multiply by 10 below:

Section	Total Forward	Multiply	Score
1		X10	
2		X10	
3		X10	
4		X10	
5		X10	
6		X10	
7		X10	
8		X10	
9		X10	

Part III

Now plot your scores on the bar graph provided:



Part IV

Now determine your intelligence profile!

Key:

- Section 1 – This reflects your Naturalist strength
- Section 2 – This suggests your Musical strength
- Section 3 – This indicates your Logical strength
- Section 4 – This illustrates your Existential strength
- Section 5 – This shows your Interpersonal strength
- Section 6 – This tells your Kinesthetic strength
- Section 7 – This indicates your Verbal strength
- Section 8 – This reflects your Intrapersonal strength
- Section 9 – This suggests your Visual strength

Remember:

- ☐ Everyone has all the intelligences!
- ☐ You can strengthen an intelligence!
- ☐ This inventory is meant as a snapshot in time – it can change!
- ☐ M.I. is meant to empower, not label people!

© 1999 Walter McKenzie, The One and Only Surfaquarium <http://surfaquarium.com>
This survey may be printed, used and/or modified by educators as long as the copyright tag remains in tact.

APPENDIX C
PRE/POST ASSESSMENTS

TEENS AND ALCOHOL PRE/POSTTEST

Name _____ Class _____ Date _____

Assessment

Chapter Test

Teens and Alcohol

USING VOCABULARY

Use the terms from the following list to complete each sentence below. A term may be used only once. Some terms will not be used.

alcohol advertisement	alcohol poisoning	alcohol abuse
DUI	binge drinking	fetal alcohol syndrome
peer pressure	reaction time	sexually transmitted disease

- When you feel that you should do something because your friends want you to do it, you are experiencing _____.
- People who drink alcohol are usually portrayed as attractive and popular in a(n) _____.
- Drinking alcohol slows your _____, which is the interval from the moment your brain detects an external stimulus until the moment you respond.
- When a person drinks so much alcohol that his or her bodily functions stop, that person has _____.
- The child of a woman who drank alcohol while pregnant can have _____, which is a group of birth defects.
- Someone who is driving when he or she is legally intoxicated is _____.

UNDERSTANDING CONCEPTS

Write the letter of the correct answer in the space provided.

- _____ 7. Which of the following is an example of peer pressure to drink?
- Your uncle offers you a glass of wine at a family party.
 - Your older sister invites you to have a beer with her and her friends.
 - A school acquaintance is handing out bottles of beer to everyone at a party.
 - A display in a grocery store shows a group of people laughing and drinking alcoholic beverages.

Name _____ Class _____ Date _____

Chapter Test continued

- _____ 8. How does most alcohol get into the bloodstream?
- through the stomach and intestines
 - through the brain
 - through the liver
 - through the heart
- _____ 9. What happens to the activities of your central nervous system if you drink too much alcohol?
- They are stimulated.
 - They slow down and may even stop.
 - They are unaffected.
 - None of the above
- _____ 10. How does drinking alcohol negatively affect digestion?
- It increases glucose production and absorption.
 - It increases glucose production but prevents its absorption.
 - It prevents glucose production and absorption.
 - None of the above
- _____ 11. How many alcoholic drinks do you need to consume in one hour to have your brain affected?
- one
 - two
 - three
 - four
- _____ 12. How can a pregnant woman prevent fetal alcohol syndrome?
- by drinking no more than a safe level of alcohol
 - by having only one alcoholic drink with the correct amount of food
 - by not drinking alcohol
 - None of the above
- _____ 13. A man is binge drinking if he
- has one drink in five hours.
 - has at least three drinks in one sitting.
 - has at least four drinks in one sitting.
 - has at least five drinks in one sitting.
- _____ 14. Which of the following statements is true?
- Counseling is the best cure for alcoholism.
 - Abstinence is the best cure for alcoholism.
 - Medical treatment is the best cure for alcoholism.
 - There is no cure for alcoholism.

Name _____ Class _____ Date _____

Chapter Test *continued*

15. What makes alcohol a drug?

16. What are the consequences of alcohol abuse?

17. What are two ways to protect yourself from drunk drivers?

18. What can a teen do to avoid the pressure to drink?

CRITICAL THINKING

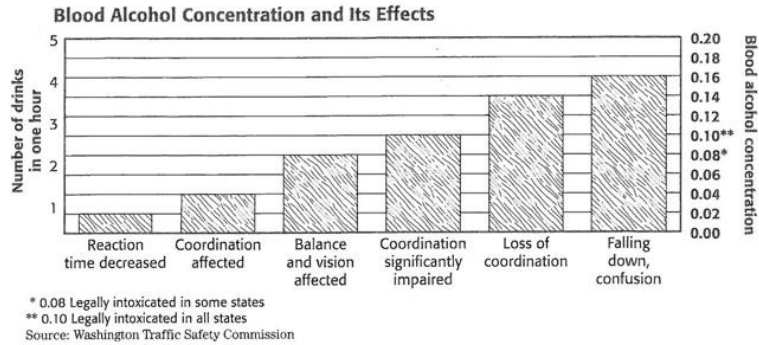
19. Explain how the chance of violent conflict increases when the people involved have been drinking alcoholic beverages.

20. Describe what might happen to someone who develops a drinking problem as a teen and how that outcome might be avoided.

Name _____ Class _____ Date _____

Chapter Test continued**INTERPRETING GRAPHICS**

Examine the graph below, and answer the questions that follow.



21. Describe the behavior of someone who has had four alcoholic drinks in one hour.

22. What is the BAC of someone who has had two alcoholic drinks in one hour?

23. Someone whose coordination is significantly impaired has a BAC of what?

24. Describe how alcohol may affect someone who is driving after having three alcoholic drinks in one hour.

FISH AND ECOLOGY PRE/POSTTEST

1. How do invasive aquatic species get to our area?
2. What is Whirling disease?
3. What waterway near us suffers from whirling disease?
4. How are different tails on fish used for movement?
5. What is an adaptation?
6. Fish were the first vertebrates.

True

False
7. What are the 3 distinct classes (categories) of fish?
8. Give an example of a fish that is NOT a cartilaginous fish?
9. Hagfishes and Lampreys are jawless fish.

True

False
10. A specialized organ, the swim bladder, located just beneath the vertebral column in bone fish helps with neutral buoyancy.

True

False
11. Name 3 DISTINCTLY different habitats for fish.
12. Sharks have _____ in their livers that aid them in buoyancy, not a swim bladder.

13. Name 5 external characteristics, or adaptations, that allow fish to be successful in their environment.
14. Name 2 different BODY shapes and explain how this adaptation allows fish to be successful in their environment.
15. How would a false eye benefit a fish?
16. How is an inferior mouth placement beneficial?
17. How is a superior mouth placement beneficial?
18. What is a Coelacanth?
19. What is Milfoil?
20. Zebra and Quagga mussels are invasive species.

True

False

TEENS AND DRUGS PRE/POSTTEST

Name _____ Class _____ Date _____

Assessment

Chapter Test

Teens and Drugs

USING VOCABULARY

Use the terms from the following list to complete each sentence below. A term may be used only once. Some terms will not be used.

drug misuse	drug abuse	prescription medicine
stimulant	physical dependence	psychological dependence
depressant	marijuana	hallucinogen

- Kevin drank too much caffeinated soda at lunch. He ran more laps than usual in gym class, but then he got a headache and nearly feel asleep in his last class. Kevin was experiencing the effects of a _____.
- Theresa had a cold for two weeks. The cold over-the-counter medicine just wasn't working anymore and now her throat hurts too. Theresa may need to see a doctor to get a _____.
- Mike was telling his friend Noah what a hard time he has breathing sometimes at track practice. Noah gave Mike some of his allergy medication to take the next time it happens. Mike taking Noah's medication is an example of _____.
- Janet always drinks a cup of coffee in the morning while doing some last-minute cramming on the day of a test. This test day there was no coffee in the house and Janet is convinced that she will fail the test if she doesn't have coffee by test-time. She has a _____ on coffee.
- Ted is experimenting with drugs. He is in the corner of the party sweating profusely and insisting that the phone is ringing when it is clear to everyone else that it is not. Ted is experiencing the effects of a _____.
- Tina was caught drinking from her parents' liquor cabinet. Ed heard Tina's mother telling his mother that she was slurring her speech and falling asleep on her feet. Tina told her mother that she thought it would make her feel happy and her mother replied, "Alcohol is a _____."

Name _____ Class _____ Date _____

Chapter Test *continued*

UNDERSTANDING CONCEPTS

- _____ 7. Which form of oral medication allows the body's cells to take in the medicine over a long period of time rather than all at once?
 - a. tablets
 - b. liquid
 - c. controlled-release capsules
 - d. inhalers

- _____ 8. Which method of taking a drug is the fastest and most powerful way for the drug to reach the brain?
 - a. orally
 - b. injection
 - c. smoking
 - d. inhaling

- _____ 9. Which of the following is NOT contained in tobacco smoke?
 - a. penicillin
 - b. nicotine
 - c. carbon monoxide
 - d. tar

- _____ 10. Any medicine that can be purchased without a prescription is called
 - a. a prescription medicine.
 - b. dangerous.
 - c. legal.
 - d. over-the-counter medicine.

- _____ 11. Which of the following behaviors might a person who abuses drugs exhibit?
 - a. mood swings
 - b. violent outbursts
 - c. stealing
 - d. All of the above

- _____ 12. The active ingredient in marijuana is called
 - a. DDT.
 - b. THC.
 - c. LSD.
 - d. TLC.

- _____ 13. Which of the following is NOT a way to stay drug free?
 - a. Stay away from situations where there may be drug use.
 - b. Learn ways to master stress so you won't give in to pressure.
 - c. Frequent places where there is drug use.
 - d. Stay connected to a trusted adult.

Name _____ Class _____ Date _____

Chapter Test continued

14. List four rules for using medicines properly.

15. Caffeine is a common stimulant. How is it taken and what are some of its effects and dangers?

CRITICAL THINKING

16. How is inhaling drugs different from smoking drugs?

17. Describe the relationship between dependence and withdrawal.

18. Name one of the four reasons to be drug free as outlined in the chapter and explain why that reason works for you.

YOUR CHANGING BODY PRE/POESTTEST

Name _____ Class _____ Date _____

Assessment

Chapter Test

Your Changing Body

USING VOCABULARY

Use the terms from the following list to complete the sentences below. Each term may be used only once. Some terms will not be used.

adolescence	embryo	fetus	gland
hormone	menstruation	ovulation	testes

- The shedding of the endometrium is called _____.
- The stage of life that begins at puberty is _____.
- A(n) _____ is a chemical substance produced by a gland.
- In the process of _____, a mature egg is released by the ovaries.
- Male sex cells are produced in the _____.

UNDERSTANDING CONCEPTS

Write the letter of the correct answer in the space provided.

- _____ 6. Sperm mature and grow tails in the
 - testes.
 - vas deferens.
 - epididymis.
 - prostate gland.
- _____ 7. Most of the estrogen found in a woman's body is produced by the
 - ovaries.
 - uterus.
 - fetus.
 - fallopian tubes.
- _____ 8. What is the best description of the uterus?
 - long, narrow tube
 - muscular organ
 - short tube
 - small gland
- _____ 9. Which of the following is a possible function of an endocrine gland?
 - to help the body respond to stress
 - to produce hormones
 - to regulate the rate at which your body uses energy
 - All of the above

Name _____ Class _____ Date _____

Chapter Test *continued*

_____ 10. Pregnancy is divided into time periods called

- a. semesters.
- b. menstrual cycles.
- c. trimesters.
- d. weeks.

11. What are two developmental milestones that occur in early childhood?

12. Why are hormones important to the human body?

13. What is the function of the placenta?

14. Describe two responsibilities of adults.

15. Define *grief*, and list the 5 stages of grief.

Name _____ Class _____ Date _____

Chapter Test *continued***CRITICAL THINKING**

16. Name one physical and one mental change associated with adolescence. How do these changes help prepare humans for adulthood?

17. What are three parts of your environment that affect your growth and development? How can you control these factors?

18. How do health habits that people develop when they are young affect their health as they age?

GEOLOGICAL TIME PRE/POSTTEST

1. Period, Eon, Epoch, Era are all... *

- A. Fossil types
- B. Time Spans in the Earth's history
- C. Geological rock formations
- D. Paleontologist's methodology for determining fossil formations

2. Relative dating is used... *

- A. to determine which rock layer in a canyon wall formed first
- B. to find the age of a rock layer
- C. to determine how a rock's composition has changed over time
- D. to identify past life forms that once lived in a rock layer

3. The changes in organisms over time, due to alteration in their environment is called *

- A. Survival of the fittest
- B. evolution
- C. organic adaptation

D. gunderson variance

4. Rocks record geological events and *

A. life forms of the present

B. life forms of the past

C. astronomical milestones of the past

D. Earth's circumferences and diameter in the past

5. This is NOT a type of fossil *

A. Cast and Mold

B. Index

C. Sorolite

D. Trace

6. What is a method that geologist use to find the absolute age of rocks? *

A. Law of superposition

B. Law of crosscutting relationships

C. Principle of Horizontality

D. Radiometric Dating

7. Which of the following is important if an organism is to become a fossil? *

- A. soft parts and slow burial
- B. rapid burial and hard parts
- C. rapid burial and soft parts
- D. hard parts and slow burial

8. Which object would most likely become a fossil?

- A. Shark Tooth
- B. Pine Needle
- C. Jellyfish
- D. Worm

9. The laws of superposition and original horizontality are best applied to *

- A. all rock types
- B. igneous rocks
- C. sedimentary rocks
- D. metamorphic rocks

10. What are fossils? *

- A. the oldest layers of rock in a region
- B. the remains or traces of an organism preserved from the geologic past
- C. living creatures with habitats in or around rock
- D. objects that people of long ago left behind as artifacts

11. Index fossils allow geologists to *

- A. match rocks of the same age in different regions
- B. determine the exact age of rocks
- C. identify organisms that did not leave fossil evidence behind
- D. determine why some organisms became extinct

12. The geological processes that shape Earth's features today *

- A. are different from those of thousands of years ago
- B. did not operate in the distant past
- C. are basically the same today as they were in the geological past
- D. became important only several hundred years ago

13. Our fossil record is representative of all the species that ever existed. *

True

False

14. How old is the Earth?

- A. 3.5 Billion Years
- B. 4.5 Billion Years
- C. 3.5 Million Years
- D. 4.5 Million Years

15. Original preservation would be an example of ... *

- A. Index fossils
- B. Mummification
- C. Adaptations
- D. Metamorphosis

APPENDIX D
STUDENT SURVEYS

Name_____

STUDENT SURVEY

(This survey will not affect your grade)

1=strongly disagree 2=disagree 3=neutral 4=agree 5=strongly agree

1. I look forward to lessons where I am able to work with my peers._____
2. I think my learning is more effective when the lesson is teacher driven (like a lecture)._____
3. I think my learning is more effective when the lesson is student driven where I am able to investigate and learn on my own._____
4. I understand the material very well when I am able to use manipulatives (models that I am able to feel and use)._____
5. I am confident in the way that I learn at school. _____
6. The material is presented in a way that I am able to understand and remember.

7. My teacher helps me when I do not understand something._____
8. I am able to best understand the material when I can read the information by myself._____
9. My attitude during lessons is positive 90% of the time._____
10. I feel like the current atmosphere within the classroom helps me learn the material._____
11. I enjoy the way the teacher presents the information._____
12. I enjoy the activities that we do within the classroom._____
13. School is very challenging for me. _____

APPENDIX E
INTERVIEW QUESTIONS

- 1) How applicable is what you are learning in school to real life?
- 2) What are your interests in and outside of school, and do you think those interests impact what academic classes tend to be your favorite classes?
- 3) Is there something that motivates you to do well in school besides the people around you (parents, teachers, and friends)? If you answered yes, what is it and why?
- 4) If you could name one thing that helped you remember subject material, what would it be? How did it affect your learning process and outcome?
- 5) How do the activities we do in class help me to learn? If they do not what would help?
- 6) Do you look forward to coming to class and why or why not?
- 7) Is there anything else you feel like I need to know, or is there a question that you wish I had asked you?

APPENDIX F
TIMEFRAME

Start project Implementation: January 10, 2015

January 10, 2015 : Nontreatment Unit One with Routine Teaching Strategies, 10 instructional days – 7th Grade Teens and Alcohol Unit

February 1, 2015: Treatment Unit One with Intervention, 10 instructional days - 7th Grade Teens and Drugs Unit

March 1, 2015: Treatment Unit Two with Intervention, 10 instructional days- 7th Grade Your Changing Body Unit

March 1, 2015: Nontreatment One with Routine Teaching Strategies, 10 instructional days- 7th Grade Science Fish Ecology Unit

March 20, 2015: Treatment Unit Three, 10 instructional days- 7th grade science Geological Time Unit