- sequence the content storyline,
- link content ideas and activities,
- highlight for students important ideas and links among them, and
- summarize and synthesize important ideas.

Many of these strategies closely match those of Burton above. It is clear from this list of differences that continued efforts in science education reform at the middle school level would be appropriate.

Traditional Native Knowledge

The issues with science education in general are also related to that of teaching our Native Alaskan students. “Western societal systems and norms, however, well-intentioned, have undermined and displaced the traditional societal systems that supported our people for thousands of years” (MacLean, 2004. p.12). Some of the issues are cultural such as knowing how to operate appropriately within the Native community and among Elders. Howard Luke, an Elder of Fairbanks, Alaska is concerned and proactive in his community. He spends time teaching others about his culture and how to operate within it. He reminds us, “you can’t go against nature” (Adams, Busch, & Craw, 2006. p. 3). Many of the issues are concerned with adapting teaching methodologies, and science lessons in ways that are relevant to the everyday lives of students in rural Alaska.

There are some important distinctions that need to be made when comparing Native ways of knowing or traditional knowledge, and Western science or scientific knowledge.

These distinctions should be taken into consideration when plans are made to teach the science curriculum. The Alaska Native Sciences Commission has published the following comparisons on their website. (http://www.nativescience.org/issues/tk.htm)

Comparisons between traditional and scientific knowledge in use

Indigenous Knowledge	**Scientific Knowledge**
Lengthy acquisition	Rapid acquisition
Long-term wisdom	Short-term prediction
Powerful prediction in local areas	Powerful prediction in natural principles
Weak in predictive principles in distant areas	Weak in local areas of knowledge
Models based on cycles	Linear modeling as first approximation
Explanations based on examples, anecdotes, parables	Explanations based on hypothesis, theories, laws
Classification: • A mix of ecological and use • Non-hierarchical differentiation • Includes everything natural and supernatural	Classification • Based on phylogenic relationships • Hierarchical differentiation • Excludes the supernatural

This list depicts very different philosophies. Native knowledge is often thought to require much time to acquire but considered highly esteemed and useful. In comparison, Western culture’s scientific knowledge can be acquired fairly rapidly. It is often useful in prediction of natural principles but not very accurate in local areas. In Native cultures information has traditionally been obtained over time by: observations of nature, trial and error, dogged persistence, and flashes of inspiration (Stephens, 2003). Knowledge is considered power and necessary for survival. Historically, Native education was geared to teaching children how to survive (Reyhner, 2006). Lately, there has been much discussion about the fit between traditional Native knowledge and Western science. Many feel that a conscious effort to blend Western science with traditional Native knowledge would be beneficial to rural Alaska students. Exploration of a topic through multiple knowledge systems can only enrich perspective and create thoughtful dialog (Stephens, 2003, p.12).

Teachers Caught In-Between

In the editor's note of *Northwest Teacher* Weeks & Stepanek point out that there are many resources available to teachers of Native students (2003). In this time when educators, parents, and lawmakers are increasingly calling for culturally relevant schooling for children, it is encouraging to note the many resources and groups producing these resources. They can be of great value to teachers who are looking for ways to make academically sound and culturally meaningful connections between Native culture and language and core subjects like math, science, social studies, history, and literacy. It is becoming increasingly important to adapt teaching methodologies, and science lessons in ways that are relevant to the everyday lives of students in rural Alaska (Adams, Busch, & Craw, 2006).

In response to this need, the Alaska Rural Systemic Initiative (AKRSI) undertook the creation of a curriculum clearinghouse to identify, review, and catalog appropriate national and Alaska-based curriculum resources suitable for rural/Native settings and make them available throughout the state via the AKRSI web site (Barnhardt, Hill, & Kawagley, 2006). The state of Alaska has also begun the process of updating the Alaska Science Standards and reviewing the performance standards in preparation for the development of a Science Assessment Instrument. This assessment is expected to go into effect in 2007 and is being designed to comply with the requirements of the No Child Left Behind Act of 2001. Another major focus of AKRSI has been to develop "Alaska Standards for Culturally Responsive Schools".

> These standards provide guidelines for teachers, schools and districts seeking to develop curricula and instructional strategies that are responsive to the indigenous knowledge systems and ways of knowing in rural/Native communities, while at the same time addressing high quality state and national standards. The Cultural Standards were formally adopted by the Alaska State Board of Education and distributed throughout the state for implementation. The Alaska Department of Education also included them in the Alaska Math/Science Curriculum Frameworks document for use by all schools (Barnhardt, Hill, & Kawagley, 2006, p.10).

It is clear that many feel the push to reform both science and Native education.

An informal survey of teachers at the school in which this research will take place asked the general question of what works or does not work in teaching our students here at our school? The responses evoked comments that at first may sound common to any school in the United States. One non-Native teacher reported that consistent classroom routines and having a number of "tricks up your sleeve" for use as motivators are important.

Another Native teacher commented that projects that integrate two or three content levels that will also be presented to parents are a positive motivator. But, in general, student motivation was also a concern. It seems that students want to see a connection between their studies and their everyday lives.

It begins to become evident that although we have well defined standards, research on best practice teaching methodologies, and significant amounts of cultural resources to call upon, the issue of how best to teach our middle school science students, and Native students specifically, is still an issue.

Chapter Three- Goals of the Research Project

The goal of this action research project is to understand how middle school students in general, and Native Alaskan students specifically, best learn the science concepts and academic standards teachers are required to teach them. The conflict that exists between Western cultures reliance on standards based assessments and the traditional attainment of Native knowledge, as discussed in the review of literature, gives some insight into the problem and perhaps some ideas on possible solutions. In this study, the researcher hopes to discover what the teacher can do in the classroom to provide the best opportunities for success for all students.

Permission to conduct this research will be obtained from the building principal and parents of the students involved. Once permission has been obtained the data collection methods will also be discussed and approved by the administration. Assistance will be provided by school administration in the form of conducting classroom observations as discussed below.

This research will utilize five data collection techniques:

- nonparticipant observations,
- a Likert-style survey/questionnaire,
- student journals,
- examining records, and
- teacher/researcher field notes and reflections.

Observations

The researcher will recruit school administrators to observe and record observations during instructional time in the researcher's classroom. This will take place at least once during each two/three week unit during which different instructional methods are being used in the science classroom. The observers will be asked to record behaviors they observe such as: student responses to the lesson, time on/off task, student interactions with the curriculum/lesson, student questions, and student discipline issues. The observer will also be asked to identify any individual roles or mannerisms they observe during the lesson.

Student Survey/Questionnaire

The researcher will provide students with a questionnaire regarding the instructional method being utilized by the teacher. The questionnaire will also have space where students can record information they already know about the subject being taught. The questionnaire will be completed by each student for each instructional method being examined by this research. The questionnaire is located in Appendix A.

Student Journals

A less formal method than the questionnaire, students will be asked to record in their journals thoughts and comments about their science class lessons. The researcher will also provide them with prompts during this time for them to answer in their journals.

Examining Records

The school has valuable artifacts on each student in the form of their individual records noting how students have performed in science in the past. These records are available to the researcher and they will be examined to determine the amount of time students have spent in each level of science they have completed. Upon examination, any other potential relationships will be noted.

Field Notes and Reflections

The researcher will keep notes describing the relevant aspects of the variety of instructional methods and lessons that are examined in this study. The researcher will also record his reflections and personal reactions to observations made during the course of this study.

The data gathered by the above mentioned techniques will be compiled and analyzed in order to get a better understanding of how students best learn and interact with the science curriculum of our district, state, and national standards.

Chapter Four – Action Steps

The goal of this action research project is to understand how middle school students in general, and Native Alaskan students specifically, best learn the science concepts and academic standards teachers are required to teach them. The review of literature defined this issue by discussing the differences in how traditional Native knowledge is obtained, the reliance of Western culture on standardized testing and the creation of curriculum standards, and teachers' role in meeting the curriculum expectations and attempting to provide opportunities for success for all students. In this chapter, the researcher will explore possible solutions offered in research and develop an action plan to complete this action research project.

Possible Solutions

In reviewing additional literature on the TIMSS (Trends in International Mathematics and Science) video study some researchers have come to the conclusion that teaching is a cultural activity (Hiebert et al., 2003). When teaching is viewed as a cultural activity it becomes evident that suggestions for reform and improvement like improved teaching methods become insufficient. Reform must include site-specific cultural accommodations. One way to do this in the United States might be to strengthen the science content development and curriculum materials by including local cultural considerations in lessons.

Roth and Garnier suggest a greater emphasis on the importance of developing science content ideas as part of the inquiry process (2006). They emphasize selecting activities that support a clearly specified learning goal and content storyline. This idea may fit nicely with the traditional Native culture where knowledge has traditionally been acquired over time by direct experience and is usually handed down orally through storytelling. Roth and Garnier provide an example of a lesson that is part of a series about photosynthesis. “The lesson starts with a question and remains focused on that question throughout. Each activity in the lesson is linked to the question and builds carefully on the previous activity” (2006, p. 23). One main learning goal is identified and all activities are matched to this learning goal. Sequencing the content of the storyline is carefully considered. Teacher questioning is crafted to lead students to discovering important ideas and concept development. A conscious attempt is made to stay focused on the content storyline as would be done by Native elders in relating their expert knowledge. This method combines best practice teaching with preplanning and adaptations for cultural issues.

The idea of developing lessons by first considering cultural accommodations that might be beneficial or necessary is noteworthy. Developing lessons with a strong story content line is an idea that could be applied to the science classroom in which this research will take place. The researcher will implement this strategy as one of the methods to be tested as can be read in the “Action Plan” below.

The Alaska Rural Systemic Initiative (AKSRI) has adopted an educational reform strategy of their own focusing on fostering connectivity between the formal education system and the indigenous knowledge systems in communities being served in rural Alaska (Barnhardt, Hill, & Kawagley, 2006). One of the main focuses of AKRSI has been to promote and incorporate a hands-on, inquiry based teaching style for Alaska's rural students. AKRSI has modeled this teaching method in science camps they have organized in rural areas for both students and teachers. It has helped educators understand the important relationship that exists between Native students and the environment in which they live. A doctoral student studying AKRSI's approach gathered data for two years that documents improvement in basic skills on standardized tests for the seventh and eighth grade students AKRSI has served. Although this data cannot be contributed solely to AKRSI's approach it appears to have other benefits as well. In schools who have adopted these ideas and attempted to get closer to the students' world and their needs increased community relationships have been formed, student test scores have gone up, and an increasing number of rural students are attending college and choosing to pursue studies in fields of science, math, and engineering (Barnhardt, Hill, & Kawagley, 2006).

The ideas promoted by AKRSI are noteworthy and it may be possible to incorporate them at the school this research is being conducted. It would require a dedicated effort by teachers and administration to provide scheduled opportunities for teachers to take students out of the classroom and into the field for organized activities involving both scientific inquiry and cultural education. Native elder volunteers and experts would necessarily play an important role. Collaborating among teachers would be beneficial as student activities afield could be fuel for many activities across the curriculum back in the classroom. Some of the obstacles that would need to be overcome may include transportation issues. It is often necessary to use vehicles such as all-terrain-vehicles, boats, and snow machines to access Alaska's vast wilderness resources. However, it is worthy of consideration and the benefits may far out weight the temporary inconveniences that may be created by these activities away from the school building and possibly outside of the normal school schedule. These ideas will not be directly tested as part of this research due to the formalities of making observations and gathering data in such circumstances. The survey/questionnaire that the students will take near the end of this study will include some questions about field studies.

Carolan and Guinn (2007) recently completed a study examining how master teachers weave differentiation into daily practice. Differentiation is the process of matching teaching to the needs of each learner. They discovered that the master teachers they interviewed and observed use strategies that address the individual needs of their students. Over the course of their study they identified several common characteristics. Master teachers ensure that clear learning goals guide their curricular decision-making. Then they design their lessons in a backward design process developing activities from the defined learning goals. Next they facilitate multiple paths to reach the defined learning goals. It is a fine line between structure and choice that provides students with opportunities to learn. These options naturally accommodate for different thinking patterns and allow students to achieve learning in a way that is all theirs. Differentiation has been mistakenly described to function as might a dinner buffet. However, it should be thought of as a classroom where teaching is tailored to individual students needs, cognitive ability, and personal interests. Teachers use strategies that they have learned when and where they are appropriate in order to provide opportunities for success for all students.

Differentiation is a strategy that may work well in the classroom in which this research will be conducted. The idea of beginning with the standards to be taught, as dictated by the school district, and then considering the students and their learning needs and styles as developing the lessons for a unit may be extremely beneficial to the students. The researcher will also implement this strategy as one of the methods to be tested as can be read in the “Action Plan” below.

Action Plan

The researcher will begin by obtaining permission from the principal to conduct this research. The principal and assistant principal will also be asked to collaborate with the researcher by providing time to come into the classroom and conduct observations during specific lessons where different teaching strategies will be employed. Permission and collaboration will be sought in August of 2007 before school begins.

Near the beginning of the school year, during late August and early September 2007, the research will begin. The research will consist of the researcher designing and teaching three, three-week units, each utilizing a different teaching strategy. Observations will be conducted by the school administrators. A minimum of two observations per unit will be requested. The teaching strategies to be tested are: a unit and lessons designed around a strong story content line (Roth & Garnier, 2006), a unit utilizing differentiation strategies, and a unit with lessons designed with cooperative learning techniques.

In addition to non-participant observations the researcher/teacher will record reflections and personal observations and anecdotes regularly. These notes will describe the teaching methods and lessons used in addition to observed student reactions and behavior. The students will also be asked to record their observations, learning, and reactions to lessons through prompts in their journals. This data will be gathered and analyzed at the culmination of the research project.

After all three units using the three different teaching strategies have been taught the students will be asked to complete a survey/questionnaire rating their feelings and reactions to the units using Likert style questioning techniques. The goal of the survey/questionnaire is to obtain data about how students feel they can best learn the science standards required by the school district.

The data gathering phase of the research project will be completed by the end of October or early November 2007. The data will then be analyzed to attempt to determine if one teaching strategy had a greater impact than another on the learning of the students. This data will be compared with school records showing amounts of time students have needed to progress through levels. An attempt will also be made to compare student satisfaction and success with average time needed to complete a level. This analysis will try to extrapolate how much time a student would need to complete a level using each of the teaching strategies tested. It is well understood by the researcher that there are many more factors beyond the scope of this research project that may affect the rate of successful completion of a science level. The goal of this research is to try to understand how students best learn the science concepts and academic standards teachers are required to teach them. All data and conclusions that can be drawn from the data will be compiled into the researcher's final action research project.

Chapter Five – Results and Next Steps

This research seeks to understand how middle school students in general, and Native Alaskan students specifically, best learn the science concepts and standards teachers are required to teach them. The researcher designed and taught three, three-week science units to his seventh grade middle school class. Data was gathered from nine students in this class. Each unit was designed around a specific best practice teaching method. Data was gathered through non-participant observations, teacher/researcher journaling of events, student journals, and a student survey. The three teaching methods addressed were:

- Unit One – Differentiation,
- Unit Two – A Strong Story Line, and
- Unit Three – Cooperative Groups.

A few changes were made from the original plan for this research. Non-participant observations were only completed for units one and two. Unit three was taught during a time when the non-participant observer was unavailable. Rather than train a new observer for observations on unit three, student journals were used to assess its effectiveness. Although not ideal, this prevented introducing any inconsistency in observations. It was also deemed unnecessary to review past student performance in science for the purposes of this research. Standardized tests in science will be introduced to the Alaska State Benchmark Assessments in 2008. Pilot testing has been accomplished in this district but results are not available for this particular group of students. This research was designed to be more qualitative than quantitative and specific to the researcher's classroom and this group of students.

Results for Unit One – Differentiation

The researcher taught this unit beginning the second week of school. The unit allowed students to choose assignments from a unit plan assignment sheet (Appendix B) to show their learning. The unit plan sheet listed a variety of assignments all on the same concept and standard in life science – "interactions." Students could choose from:

- writing assignments,
- coloring diagrams,
- creating a comic strip,
- vocabulary sheets,
- creating a variety of graphic organizers, or
- writing a poem or song about the concept being studied.

The curriculum was also layered to the effect that the first layer of assignments was basic knowledge, the second layer involved students in applying and analyzing, and the third layer included synthesis and evaluative assignments. Students had time several days each week to complete assignments. Normal classroom routines were still followed by the teacher/researcher throughout this research which included but were not limited to: keeping science notebooks, problem of the day questions, mini-lessons on the science concept being studied, partner sharing and processing, and discussions. This unit took three weeks to complete.

Non-participant observation data is shown in Figure 1 below. Four students were picked at random by the observer. The behavior of these students was recorded every minute for a ten-minute period during the observation. The behavior was recorded as either on-task or off-task. The data recorded reveals an average of 80% of their time was spent on on-task activities. Comparatively, 20% of the time was recorded as off-task behavior. The observer reported that:

- "Students know where to go and what they are working on,"
- "Students seem to understand their assignments," and
- "Students are actively involved in participating in their assignments."

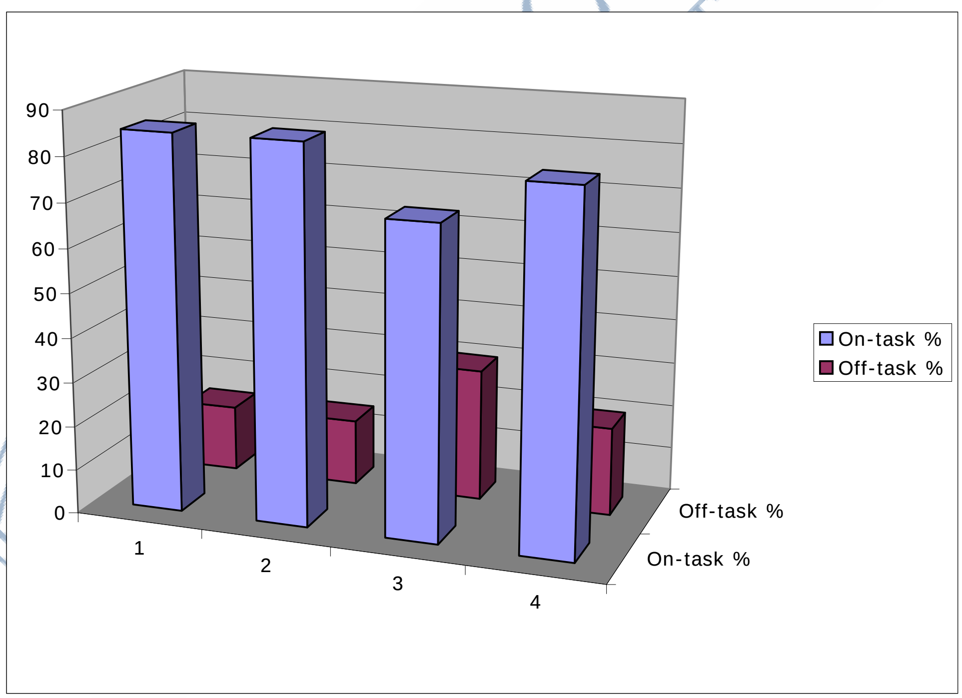

Figure 1: Unit One – Differentiation. Non-participant observations of four students picked at random by the observer reveal 80% of their time in class was spent on on-task activities.

The researcher's reflective journal also recorded personal observations made by the researcher during the teaching of unit one. Some students were observed starting new assignments from the unit plan assignment sheet before finishing the first one they had chosen to work on. Many students initially chose assignments that complemented their learning style. (The teacher/researcher was familiar with the students' learning styles from beginning of the school year surveys he had each student complete separate from this research.) It was also noted that many students seemed genuinely excited about being able to have a choice of assignments whether or not they opted for their preferred learning style.

Results for Unit Two – A Strong Story Line

At the beginning of this unit students were once again handed a unit plan assignment sheet (Appendix C). This unit was designed around a strong story line: "Every living organism is part of a family." However, for this unit, students were not given an option to choose which assignments to complete. As stated on the unit plan assignment sheet, all students were to complete the activities for layer one and layer two. Layer three consisted of assignments that were required to show an "advanced" or "A" quality comprehension and applicability of the content. This unit required three weeks to complete.

Non-participant observation data is shown in Figure 2 below. As described above, the observer recorded the behavior of the same four randomly chosen students. Their behavior was recorded as either on-task or off-task each minute for a period of ten minutes. The data recorded reveals an average of 95% of their behavior as on-task. This is a 15% increase over the data recorded in observations for unit one.

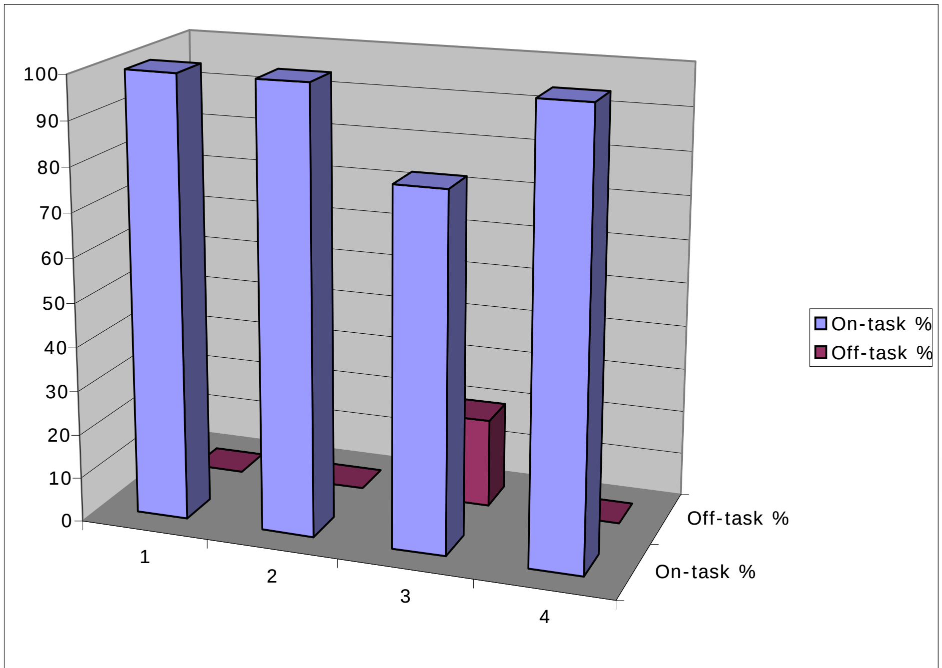

Figure 2: Unit Two – A Strong Story Line. Non-participant observations of the same four students as previously observed reveal 95% of their time in class was spent on on-task activities.

The researcher's reflective journal recorded students working on task and completing assignments on time. Students were able to recall the story line upon which the unit was designed around and enjoyed participating in the activities. Informal assessments showed student understanding. This unit may have been more culturally responsive due to the nature of activities and the necessity to research one's own family to some extent. One student was observed becoming emotionally upset when he recalled his grandfather who was either sick or had just passed away. It was apparent that family is very important to these students.

Results for Unit Three – Cooperative Learning

The third unit required students to work in cooperative groups. Anytime students were working on assignments from the unit plan assignment sheet (Appendix D) they were working together with their cooperative table groups. These groups were arranged randomly by seating chart and the only considerations made to organize the groups were based on the teacher/researcher's previous experience with classroom management issues with this group of students. Students completed a variety of smaller assignments in a "jigsaw" format. Students were given time to brainstorm group responsibilities and job assignments at the beginning of each assignment. Then the teacher/researcher would provide deadlines and a specific time for the groups to meet back together and share their work. The final project for this unit was a three-day project involving students designing and constructing an "edible cell." The cell was presented to the class in a rotational sharing activity at each groups' table. Immediately after this final event the students were asked to record their thoughts on the group process.

The reader will remember that on- and off-task behavior data was not available for Unit Three. The researcher relied on student voice and journal entries. Students had many positive comments to make about the group process (see Figure 3 below). Overall, 67.67% of the comments were positive as compared to 33.33% negative comments. Examples of comments from students are recorded below:

- "I think everyone in my group did a good job with our projects" (positive),
- "Everyone did their part and brought the things that they were suppose to bring in (for the project)" (positive),
- "I felt that we did a good job and represented an animal cell pretty good" (positive),
- "I thought the "edible cell" was bad because we weren't cooperative" (negative),
- "There was no effort from half the group" (negative).

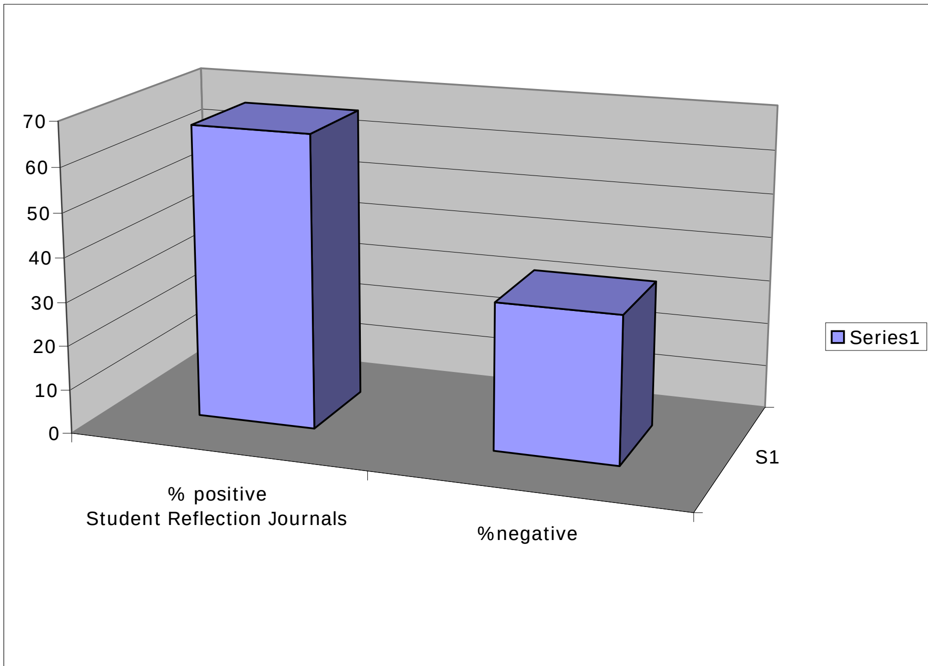

Figure 3: Unit Three – Cooperative Groups. Comments from student reflective journals were 67.67% positive.

The teacher/researcher's reflective journal recorded some difficulties in groups managing their responsibilities. Difficulties were evident when an individual student had not completed their job for the group. Other group members were aggravated and either helped the individual complete the job, or took on the responsibility to meet group deadlines. The teacher/researcher was often required to offer group problem solving strategies.

Summary of All Three Methods and Student Survey

Upon completion of all three units students were asked to fill out a Likert style survey (Appendix A). The survey had questions regarding the three methods each unit embodied and asked students to rate their preferences based on to what extent they were interested in participating in that type of learning activity. Results of the survey can be seen in Figure 4 below. Points were totaled in each category. Differentiation teaching methods scored a total of 157 points. Unit two designed around a strong story line placed second with 141 points. Cooperative group teaching methods received a total of 128 points.

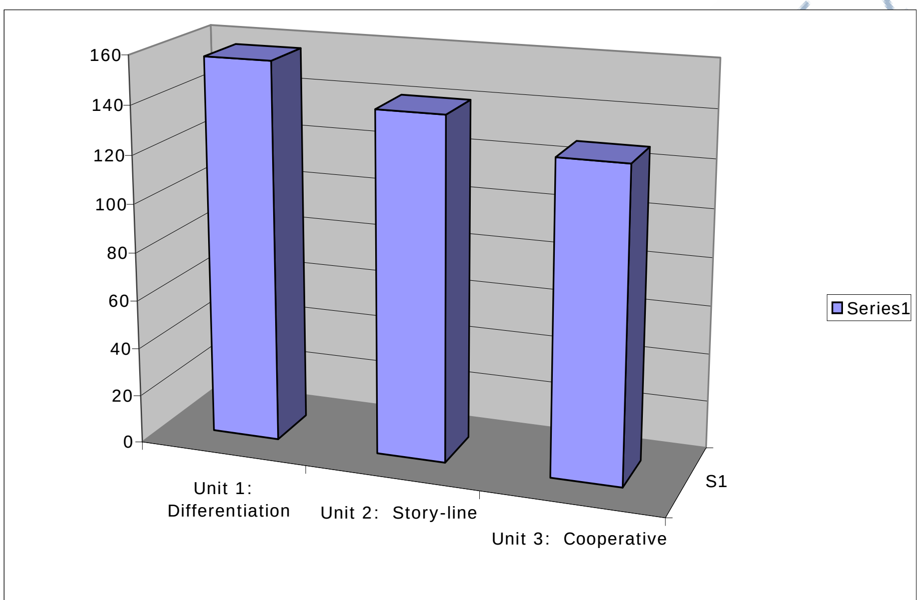

Figure 4: Survey Results.

Comparing the survey results to the non-participant observations and teacher/researcher journal some patterns begin to emerge. The non-participant observations revealed that on-task behavior was fairly high for both of the first two units taught. However, it is questionable whether or not a 15% difference is significant in this research. The class size was only nine students and of those, four were included in the observation data by the non-participant observer. In the short and relatively few observations conducted, another minute and a half of on-task behavior would account for the observed difference. Analyzing once again the charts in Figure 1 and 2 it is noteworthy that in both charts student number three was off-task slightly more than the other students. Statistically, there are so few students in this class that one change can have a large effect on the overall data. Reviewing the comments by the non-participant observer and from the teacher/researcher's reflective journal it becomes evident that the students understood their assignments and were enthusiastically completing them in both units. Students embraced the responsibility of choosing assignments to work on in unit one, and eventually completed the required number of assignments. The only difficulty or frustration on the teacher's side was when students would start another assignment before finishing the first one. Students also completed and related well to the assignments in unit two. They seem to enjoy the family aspect of some of the assignments (Appendix C).

These results are consistent with the literature reviewed as a part of this research. Burton suggested that middle school science instruction take a thematic approach integrating science with other subjects and making connections to students daily lives (1996). After studying the Trends in International Mathematics and Science video study (TIMSS), Roth and Garnier suggested teachers create a more coherent content storyline in their lessons identifying one main learning goal and selecting activities that are matched to that learning goal (2006). Both of the first two units taught have one or more of these suggestions naturally incorporated into them.

Unit three scored slightly lower marks in the comments made by students in their reflective journals and in the final student survey of teaching methods. It is not appropriate to compare the percentages in Figure 3 to those of Figure 1 and 2 because they are measurements of different qualities. The charts in Figures 1 and 2 report on-task versus off-task behavior of students. The chart in Figure 3 reports positive and negative comments made by students about the unit. However, it is noteworthy that cooperative group work was less liked and more difficult for students to complete in general. This research did not attempt to analyze the reason for this. Initially, students were excited about working with a group to complete assignments. Timing is a huge factor in meeting group responsibilities. When one member of a group was late in completing their task it would potentially cause aggravating consequences. When groups were continually required to complete assignments together for this short unit with the same group, problem solving became a necessary task. Maybe this is part of the nature of working with middle school students. Unit three also scored lowest in the final student survey for this class.

Conclusion

Action research seeks to identify information that helps the researcher understand how their particular school or classroom operates (Gay, Mills & Airasian, 2006). The goal of this research project was to determine how middle school students in general, and Native Alaskan students specifically, best learn science concepts and standards. It is clear from the observations and data gathered in this research that all of the teaching methods tested had a valuable impact on the students. The units designed with differentiation and a strong story line had more of a positive impact on the students. Cooperative learning was beneficial and should continue to be utilized. Based on the data gathered the researcher believes that combining all three methods into each new unit would be beneficial and perhaps highlight the best of each.

Suggestions For Further Study

This research provided useful information and an organized method for obtaining it. This model could be replicated and other methods could be tested and observed. One suggestion that may address the issue of teaching Native Alaskan students better would be to test methods specifically designed for Native Alaskan students. In the literature review for this research it was discovered that the Alaska Rural Systemic Initiative, as part of the current reform movements associated with the No Child Left Behind Act of 2001, has designed and promoted a hands-on, inquiry based teaching style for Alaska's rural students (Barnhardt, Hill & Kawagley, 2006). It would be interesting to test this method on the student population studied in this research. It would require a commitment from several core teachers and the administration in order to plan field trips and large group activities outdoors.

References

Adams, L., Busch, J., Craw, P. (2006). Observing snow. *Alaska Native Knowledge Network, University of Alaska.* Retrieved Feb. 28, 2007 from http://www.ankn.uaf.edu/NPE/ansme.html

Barnhardt, R., Hill, F., Kawagley, O. (2006). *Alaska Rural Systemic Initiative: Final Report Phase II, 2000-2005.* University of Alaska. National Science Foundation.

Burton, L.D. (1996). *How teachers teach: Seventh and eighth grade science instruction in the USA.* Presented at the annual conference of the National Science Teachers Association (St. Louis, MO, March 31, 1996). ERIC Document Reproduction Service ED398055

Carolan, J. Guinn, A. (2007). Differentiation: Lessons from master teachers. *Educational Leadership, 64*(5), 44-47.

Cotton, S.E. (1984). Alaska's Molly Hootch case: High schools and the village voice. *Educational Research Quarterly*, 8(4). Retrieved Feb. 28, 2007 from http://www.alaskool.org/native_ed/law/mhootch_erq.html#top

Gay, L. R., Mills, G., Airasian, P., (2006). *Educational research: Competencies for analysis and applications.* Pearson, Merril, Prentice Hall. Upper Saddle River, New Jersey

Gonzales, P., Guzmán, J.C., Partelow, L., Pahlke, E., Jocelyn, L., Kastberg, D., and Williams, T. (2004). *Highlights from the Trends in International Mathematics and Science Study (TIMSS) 2003(NCES 2005-005).* U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved Feb. 28, 2007 from http://nces.ed.gov/timss/

Hiebert, J., Gallimore, R., Garnier, H., Bogard Givvin, K., Hollingsworth, H., Jacobs, J., M. Y. Chui, A., Wearne, D., Smith, M., Kersting, N., Manaster, A., Tseng, E., Etterbeek, W., Manaster, C., Gonzales, P., and Stigler, J. (2003). *Highlights from the TIMSS 1999 video study of eighth-grade mathematics teaching (NCES 2003011).* U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved Feb. 28, 2007 from http://nces.ed.gov/timss/

MacLean, E. A. (2004). *Culture and change for Ieupiat and Yupiks of Alaska.* Institute of Social and Economic Research. Retrieved Feb. 28, 2007 from http://www.alaskool.org/native_ed/articles/EMaclean-CC.htm

McKinney, K. (1993). *Improving math and science teaching: A report on the secretary's conference on improving mathematics and science teaching and instructional resources.* (Report No. PIP-93-1005). Office of Educational Research and Improvement. ERIC Document Reproduction Service No. ED 355 121.

National Research Council. (1996). *National science education standards.* National Academy Press.

Reyhner, J. (2006). American Indian/Alaska native education: An overview. *American Indian Education.* Retrieved Feb. 28, 2007 from http://jan.ucc.nau.edu/~jar/AIE/Ind_Ed.html

Roth, K., Garnier, H. (2006). What science teaching looks like: An international perspective. *Educational Leadership.* *64*(4), *16-23.*

Scott, E. (2004). *Comparing NAEP, TIMSS, and PISA in mathematics and science.* National Center for Education Statistics.

Stephens, S. (2003). *Handbook for culturally responsive science education.* Alaska Native Knowledge Network, Alaska Science Consortium and Alaska Rural Systemic Initiative.

Swisher, K. (1991). *American Indian/Alaska native learning styles, research and practice.* ERIC Document Reproduction Service No. ED335175

Weeks, D. J. (2003). Native and western knowledge: Where minds meet. *Northwest Teacher, 4*(2). *2-5.*

Weeks, D. J., Stepanek, J. (2003). Editor's note: Beginning the conversation . *Northwest Teacher, 4*(2). *1.*

Appendix A: Student Survey

Action Research Survey - Corsetti

Instructions: Read each statement and circle the number that shows to what extent <u>YOU</u> are
1. I like having a choice as to which project I can do to show my learning.
2. I enjoy working in a group.
3. I like to read or hear a good story.
4. I would rather talk to someone while working.
5. I like to figure out the plot of a story.
6. I am more comfortable learning in my own style.
7. If I could choose I would always work in a group.
8. I always prefer to receive instruction in my own learning style.
9. I am very aware of how I learn best.
10. I like to hear stories by my elders.
11. I learn better when working closely with others.
12. I enjoy telling true stories to others.
13. My favorite style of unit was the differentiation unit.
14. My favorite style of unit was the cooperative learning unit.
15. My favorite style of unit was the unit with a strong story-line.
Instructions: Write your score beside each number. Add each <u>Column</u> to determine your style of teaching preference.

Appendix B: Unit One – Differentiation

(DI) Layered Curriculum Lesson Plan Form - Name____________________________

Teacher:	P. Corsetti	
Subject	Science Level 3/4	
Unit of Instruction:	Unit 1 – Life Science: Interactions	
Implementation Dates:		
Standards:	SC.03.21 SC.04.21	Structure & Function of Organisms: The student demonstrates an understanding the structure, function, behavior, development, life cycles, and diversity of living organisms.
	SC.03.22 SC.04.22	Populations & Ecosystems: The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

Curriculum Layers	**Student Unit Learning Activities**	**Pts**	**Ern**
EVERYONE MUST DO ALL OF THESE **CHOOSE ENOUGH OF THE FOLLOWING TO SHOW YOU ARE PROFICIENT/ADVANCED**	0. **Complete the daily journal entries answering the "question of the day"**	75	
	1. Assemble the Unit 1 Portfolio with assignments from below.	50	
	2. Participate in the field trip to North River	50	
1st Layer : Basic knowledge, understanding. The student builds on his/her current level of core information. **Proficient = 55 points** **Advanced = 65 points including one assignment from 3rd layer.** Bloom's Taxonomy: Knowledge	1. Complete a coloring diagram of the parts of an insect.	10	
	2. Create a comic strip with 5 frames of the life cycle of an insect.	10	
	3. Complete a vocabulary sheet.	10	
	4. Complete "Aquatic Macroinvertebrates Quick Key"	10	
	5. Complete "Review Questions" on life cycles	10	
	6. Make a poster about the life cycle of aquatic insects.	10	
	7. Write a poem / song that relates to life cycles.	10	

2nd Layer : Application or manipulation of the information learned in the 1st layer. Problem solving or other higher level thinking tasks. *Proficient = 40 points* *Advanced = 50 points including one assignment from 3rd layer.* Bloom's Taxonomy: Application & Analysis	1. Write a letter to a friend describing your field trip to North River. 2. List in chronological order the most important events in the life cycle of salmon and aquatic insects in North River 3. Describe in writing the life cycle of an organism of your choice. Write 1-2 paragraphs. 4. Create a "Wanted" poster for an aquatic insect. 5. Construct a 10 question quiz on life cycles.	10 10 10 10 10	
3rd Layer : Critical Thinking and Analysis. This layer requires the highest and most complex thought. Bloom's Taxonomy: Synthesis & Evaluation	1. How would it affect the stream environment if a toxin was introduced that affected the larval stage of aquatic macroinvertebrates. Write 1-2 paragraphs 2. How would salmon be affected if aquatic macroinvertebrates were not present? Write 3 paragraphs. 3. Is it legal to dump oil in a stream? What government agency/ies regulates and protects the environment? What happens to someone who pollutes the environment? Write 2-3 paragraphs or taped interview with a governmental official. 4. What happens in a food web when one or more members are absent or in low numbers? Write 2-3 paragraphs. 5. What is an endangered species? Choose an endangered species in our area. Why is it endangered?	10 10 10 10 10	

Appendix C: Unit Two – A Strong Story Line

Strong Story Line - Lesson Plan Form - Name________________________________

Teacher:	P. Corsetti	
Subject	Science Level 3/4	
Unit of Instruction:	Unit 2 - Life Science: Connections and Classifications	
Implementation Dates:		
Standards:	SC.03.2(SC.04.2(	The student demonstrates an understanding of how science explains changes in lif forms over time, including genetics, heredity, and the process of natural selectior
Unit Story Line		**"Every living organism is part of a family."**

Curriculum	**Student Unit Learning Activities**	**Pts**	**Ern**
EVERYONE MUST COMPLETE <u>ALL</u> ASSIGNMENTS!!!!!	**1. Complete the daily journal entries answering the "question of the day"** 2. Assemble the Unit 2 Portfolio with assignments from below.	75 50	
1st Layer : Basic knowledge, understanding. The student builds on his/her current level of core information. **Proficient = 40 points** **Advanced = 55 points including one assignment from 3rd layer.** Bloom's Taxonomy: Knowledge & Comprehension	1. Complete a diagram of your family tree going back to your great-grandparents. 2. Complete a vocabulary sheet. 3. Complete Review Questions on "taxonomy". 4. Make a poster about the six-kingdom classification system. 5. Write a poem / song that relates to classification	10 10 10 10 10	

2nd Layer : Application or manipulation of the information learned in the 1st layer. Problem solving or other higher level thinking tasks. *Proficient = 40 points* *Advanced = 55 points including one assignment from 3rd layer.* Bloom's Taxonomy: Application & Analysis	1. Write a letter to a friend describing your inherited traits. 2. Complete five practice Punnett Squares. 3. Describe in writing the inheritance of a certain trait starting with the parents. Write 1-2 paragraphs. 4. Create a "Wanted" poster for a specific genetic variation of an organism. 5. Construct a 10 question quiz on genetics.	10 10 10 10 10	
3rd Layer : Critical Thinking and Analysis. This layer requires the highest and most complex thought. Bloom's Taxonomy: Synthesis & Evaluation	1. Does a genetic mutation always create an undesireable outcome? Write 1-2 paragraphs 2. Design a Punnett Square for a dominant and recessive trait for two generations of reproduction. 3. Describe the debate on genetically modified vegetables. What are the benefits? What are the possible risks? Write 2-3 paragraphs. 4. Discuss the moral issue of selecting for traits among offspring? Reference any stories you know about or examples in history. Write 2-3 paragraphs.	10 10 10 10	

Appendix D: Unit Three – Cooperative Groups

Cooperative Learning - Lesson Plan Form - Name______________________________

Teacher:	P. Corsetti	
Subject	Science Level 4	
Unit of Instruction:	Unit 3 - Life Science: Basic Unit of Life-Cells	
Implementation Dates:		
Standards:	SC.04.21	The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

Curriculum	**Student Unit Learning Activities**	**Pts**	**Ern**
EVERYONE MUST COMPLETE ALL OF THE FOLLOWING ASSIGNMENTS WITH THEIR GROUPS!!!!!	**1. Complete the daily journal entries answering the "question of the day"** 2. Assemble a group Unit 3 Portfolio with assignments from below.	75 50	
1st Layer : Basic knowledge, understanding. The student builds on his/her current level of core information. **Proficient = 35 points** **Advanced = 45 points including one assignment from the 3rd layer below.** Bloom's Taxonomy: Knowledge & Comprehension	1. Complete the Lab "Observing Cells" with your group. 2. Complete a vocabulary sheet by "jigsawing". 3. Complete "Review Questions" on cells with your group. Share and check answers with another group. 4. Make a poster or diagram about plant and animal cells.	10 10 10 10	

2nd Layer : Application or manipulation of the information learned in the 1st layer. Problem solving or other higher level thinking tasks. *Proficient = 35 points* *Advanced = 45 points including one assignment from the 3rd layer below.* Bloom's Taxonomy: Application & Analysis	1. Design and construct a model of a cell with your group. 2. Present your model to the class. 3. Describe in writing the process your group went through in choosing how to construct the model. Write 1-2 paragraphs. 4. Construct a 10 question quiz on cells with your group.	10 10 10 10	
3rd Layer : Critical Thinking and Analysis. This layer requires the highest and most complex thought. Bloom's Taxonomy: Synthesis & Evaluation	1. Create a "Who dunnit?" mystery scenario where the reader has to figure out what type of cell is in the story. Describe "cell parts" clues to aid the reader. Write 1-2 paragraphs 2. Research with your group various types of cells and collaborate to write a report. Each member can be responsible for 1-2 cell types. Write 3-4 paragraphs. 3. What happens when a cell does not have all of its parts? Write a story or a skit which demonstrates this. Write 2-3 paragraphs. 4. What is a cancer cell? Research with your group and write a collaborative report. Write 3-4 paragraphs.	10 10 10 10	