

## DEVELOPING MIDDLE SCHOOL AND HIGH SCHOOL TEACHERS' UNDERSTANDING OF INQUIRY-BASED INSTRUCTION

The purpose of this study was to investigate the effectiveness of professional development experiences that were designed to increase middle school and high school teachers' understanding of the nature of inquiry-based instruction. Pre-test and posttest coded responses on an open-ended survey that is based on the essential features of classroom inquiry as defined by the National Research Council (2000) were used to characterize changes in graduate student understanding. The findings indicate that three of the eight students broadened their understanding of inquiry to incorporate multiple types of inquiry. Three of the other students moved to a more student-directed view of inquiry on at least three of the five essential features. The remaining two students showed mixed results. They had some movement toward student-directed, some movement toward teacher-directed, and some unchanged responses. Implications for practice and the possible effects of prior knowledge are addressed.

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Although the National Science Education Standards (NRC, 1995) emphasize inquiry-based instruction, the methods of professional development that are needed to make the standards a reality are still in question. Inquiry-based instruction appears to need a complex set of skills that are mediated by teacher attitudes and beliefs. This paper reports on one component of a mixed method study (Creswell, 2003) that investigates the development of inquiry-based instruction skills by science teachers. This portion of the larger study investigated the effectiveness of professional development experiences that were designed to increase middle school and high school teachers' understanding of the nature of inquiry-based instruction. The following research questions were addressed:

- How does a graduate course designed to develop the inquiry-based instruction skills of middle school and high school teachers affect their understanding of the nature of inquiry-based instruction?
- How do prior experiences influence the development of middle school and high school teachers' understanding of the nature of inquiry-based instruction?

### **Theoretical Underpinnings**

The term "pedagogical content knowledge" (PCK) developed from the work of Shulman (1986). Gess-Newsome (1999) suggests that many models of teacher knowledge now exist and that it is useful to compare these models on a continuum between two basic model viewpoints, the Integrative Model and the Transformative Model. The Integrative Model sees PCK as not a separate kind of knowledge, but as the act of integrating subject matter, pedagogy, and context knowledge bases during teaching. In this model, the teachers draw on these three separate knowledge bases as needed. The Transformative

Model lies at the other extreme of the continuum. This model characterizes PCK as a separate knowledge base that is developed by a synthesis of subject matter, pedagogical, and contextual knowledge. In this model PCK is the only knowledge that impacts the act of teaching. The larger study investigates the development of PCK in a program that provides professional development for under-prepared middle school mathematics and science teachers. This National Science Foundation funded teacher enhancement program is entitled the Mathematics and Science Teacher Enhancement Project (MASTEP.) For science teachers, the program consisted of six graduate level courses that taught science content using reform based methods and provided opportunities for the integration of teacher knowledge bases through integrative tasks (Adams, 2004.) This paper focuses on some of the MASTEP participants who enrolled in a graduate level course concerning inquiry-based instruction. This course is a requirement for our new Master of Education degree in Science Education. This degree was a result of the MASTEP program.

## **Design and Procedure**

### Participants

In this portion of the study, we investigated the development of knowledge about the nature of inquiry-based instruction during a graduate course that focused on inquiry. The second author was a student in the course. However, her data was removed from the analysis. Six of the eight participants in the study were also MASTEP participants prior to taking the class. The remaining two participants began MASTEP coursework after taking the class. Three of the participants are women and five are men. All were experienced teachers except for one who had just finished his induction year. Six of the participants taught in rural schools. Two female teachers taught in an urban setting. All of the participants were middle school teachers except for one ninth-grade teacher. The class met for four weeks in the summer, four days a week for two hours and 40 minutes each day. The course was taught on two campuses via video-conferencing technology. Seven of the graduate students were located at the sending site, and two graduate students (including the second author) were located at the remote site.

### Course Description

The instructor (first author) visited the remote video-conferencing site about once a week. Documents were accessed by participants at both sites through BlackBoard, an electronic classroom software system. Assignments were turned in to the instructor via BlackBoard, and participants and the instructor could communicate by e-mail through this system. The course addressed the M.Ed. Program standards which are aligned with the National Professional Teaching Standards for Early Adolescence Science (NBPTS, 2003a) and Adolescence and Young Adulthood Science Certifications (NBPTS, 2003b).

In addition to understanding the nature of inquiry-based instruction in science, expected course outcomes included preparing teachers to plan, implement, assess, and evaluate inquiry-based instruction. It was the intent of the course designer (first author) to help the teachers think of inquiry-based instruction in a practical way in addition to understanding the theoretical aspects. Therefore student reflection, by individuals and in a group, was an important component of the course. Course assignments included 1) four reflective essays

that addressed specific aspects of inquiry-based instruction; 2) a presentation of an inquiry lesson; 3) a unit plan that incorporated inquiry-based methods, assessed inquiry-based instruction, and engaged students in the processes of the scientific enterprise; 4) a paper that documented the research base for an aspect of inquiry-based instruction that was of personal interest to the participant and that discussed implications for personal practice. Summaries of these papers were presented in class, so that these aspects of inquiry could be shared. A copy of the syllabus is attached at the end of this paper.

The questions asked for the reflective essays included the following:

- What is inquiry-based instruction?
- How should inquiry-based science be assessed?
- What is your story concerning inquiry-based instruction?
- What skills do teachers need to do inquiry-based instruction?

The following inquiry papers were written by participants:

- Why Inquiry-Based Teaching and Learning in the Science Classroom? This paper used NSES and other sources to define inquiry-based instruction, to discuss the implementation of inquiry-based instruction, and to discuss the benefits of inquiry-based instruction. The paper included a personal reflection on practice. (written by Martin)
- How Does a Teacher Assess Students Equitably While Doing Inquiry-Based Science? The focus of the paper was assessment in inquiry-based classrooms and fair use of assessment data. The paper was rooted in issues involved in assessment in personal practice. (written by Bill)
- A Research Question: Does Inquiry-Based Instruction Help Special Education Students Perform Better Academically? This paper arose from personal practice. The focus of the paper was how to facilitate inquiry-based instruction with special populations. The paper included reflection on practice. (Written by Linda)
- What Are the Views of Science Inquiry and Related Issues? Teacher, Student, and Administrator Perspectives The paper reviewed the literature concerning teacher, student, and administrator views of inquiry-based instruction. The participant reported that he chose this topic so that he could understand the point of views of teachers, students, and administrators so that he could best help them understand that inquiry-based instruction is important. (written by Karl)
- Is Classroom Management the Problem with Inquiry-Based Instruction? This participant, who had just finished his first year of teaching and had been using inquiry-based instruction that year, focused on how to manage students who are engaged in inquiry-based instruction. Personal reflection was included. (written by John)
- How Do You Teach Inquiry? This paper by an experienced teacher who had concerns about her implementation of inquiry-based instruction focused on the nature of inquiry-based instruction, effective classroom management techniques in inquiry classrooms, and effective ways to implement inquiry. (written by Sue)
- Can Inquiry-Based Science Instruction be Effective for Students with Learning Disabilities? This paper focused on research concerning the effects of inquiry-

- based instruction for students with learning disabilities and grew out of the participant's personal experiences. (written by Thomas)
- How to Implement Science Inquiry in the Inclusion Classroom: Special Education Students Join the Regular Classroom This participant was piloting a new inclusion policy at her school in the fall and wanted to know what research says about inclusion in inquiry classrooms. She was able to develop guidelines for the fall. (written by Margaret)

Three of the papers focused on inquiry-based instruction in inclusive classrooms. Two papers focused on classroom management issues. One paper focused on assessment in inquiry classrooms; one paper focused on teacher, student, and administrator attitudes toward inquiry; and one paper focused on discussing the rationale and implementation of inquiry-based instruction. Each of the papers focused on an aspect of inquiry-based instruction that was of concern to the participant.

### Procedure

An open-ended survey was developed based on the essential features of classroom inquiry developed by the National Research Council (2000.) The following questions were asked:

1. When students are engaged in inquiry-based instruction, who or what poses the questions that are investigated? Please give an example that illustrates your answer. If there is more than one source of questions, please give an example for each source.
2. When students are engaged in inquiry-based instruction, who or what is the source of data, of data collection procedures, if needed, and of the methods used to analyze the data. Please give an example that illustrates your answer. If there is more than one source of data, collection procedures and analysis, please give an example for each source.
3. When students are engaged in inquiry-based instruction, who or what is the source of explanations concerning the evidence? Please give an example that illustrates your answer. If there is more than one source of explanations, please give an example for each source.
4. When students are engaged in inquiry-based instruction, who or what is the source of connections between explanations and scientific knowledge? Please give an example that illustrates your answer. If there is more than one source of connections, please give an example for each source.
5. When students are engaged in inquiry-based instruction, who or what justifies the form of student communication concerning explanations of results? Please give an example that illustrates your answer. If there is more than one source of justification, please give an example for each source.

The survey was given as a pretest on the first day of class and as a posttest on the last day of class. The students used number codes so that researchers would not be able to identify them during coding. Participant responses were coded on the matrix shown in Table 1. Quotations supporting the coding were written on the coding sheet. Pretest responses were coded question by question first and then posttest responses in the same manner.

The second author coded responses first and then the first author coded responses. Disagreements were very few and resolved by discussion. After coding, fictitious names were assigned each participant.

## Findings

Table 1 summarizes the coded responses by student on both the pretest and the posttest. Three of the students (Martin, Bill, and Linda) broadened their understanding of inquiry to incorporate multiple types of inquiry and explicitly discussed those types in multiple responses. Three of the students (Margaret, Thomas, and Sue) moved to a more student-directed view of inquiry on at least three of the five essential features. The remaining two students (Karl and John) showed mixed results. They had some movement toward student-directed, some movement toward teacher-directed and some unchanged responses.

### Martin, Bill, and Linda

When deciding to use this matrix to assess changes in participant understanding of inquiry, we hoped to map changes from less student-directed to more student-directed. The finding that at the posttest these participants recognized that the amount of student-direction depends on the type of inquiry in which the students are engaged was quite unexpected. Bill and Linda demonstrated this understanding on every posttest response. Martin demonstrated it on three of the five posttest responses. It appears that this view is more informed than simply seeing a shift from less student-directed to more student-directed. Certainly the different types of inquiry were discussed explicitly in class, so it is difficult to assess the internalization of these ideas in these students from the posttest alone. The names given for the types of inquiry are the names we discussed in class: structured, guided, and open. However, these participants are all experienced MASTEP participants and have been teaching using inquiry in their classroom. In addition, Martin and Bill are currently conducting an action research project on teaching inquiry in their classroom.

### Margaret, Thomas, and Sue

Sue is an experienced MASTEP participant. Although on the pretest Sue did not respond to Question 4 and her response to Question 5 was difficult to classify, her responses on the posttest moved toward more student-directed on Questions 1, 2, and 3.

Margaret is an experienced MASTEP participant. Margaret shifted to a more student-directed view for each question except for Question 2: Learner gives priority to evidence in responding to questions. On this response she moved to a multiple view, similar to answering in terms of the type of inquiry, but did not label the types. Margaret responded as follows to Question 2:

Teachers are the source of data or guiding to data: books, videos, internet, etc. The teacher guides the students, but the students are individuals that will analyze in different ways. For this reason the students are what drives the teachers to

include many different data sources & the students are in charge of analyzing the data. (Underlining by participant)

Thomas had not been a MASTEP participant before the inquiry course. Thomas moved toward more student directed on Questions 3, 4, and 5. He remained unchanged on Question 1 and moved toward less student directed on Question 2.

#### Karl and John

Karl is an experienced MASTEP participant. Karl already seemed to understand inquiry as being fairly student-directed on the pretest. He remained unchanged on Questions 4 and 5 and moved slightly toward more student-directed on Question 1 and 2 and slightly less student directed on Question 3.

John had not been a MASTEP participant before the inquiry course. He had just completed his first year of teaching. He had learned about inquiry and experienced learning science as inquiry during his teacher preparation. His responses are difficult to interpret. He had a high because his posttest results move more toward student-directed on Question 3 and less student-directed on Questions 2, 4, and 5. The posttest response on Question 1 seemed divided. He stated, “The question can come from student; however, I think it comes from the instructor. Like, How come water skippers do not fall into the water they are on?” It is possible that since he has just finished his first year of teaching, he was still sorting out all kinds of ideas about teaching in addition to trying to formulate an understanding of inquiry-based instruction. His lack of teaching experience may have affected his ability to relate inquiry to classroom experiences.

*Table 1 Coding of Pretest and Posttest Student Responses for Essential Features of Classroom Inquiry (Adapted from NRC, 2000, p. 29)*

Essential Feature	More _____ Amount of Learner Self-Direction _____ Less			
1. Learner engages in scientifically oriented questions	Learner poses a question	Learner selects among questions, poses new questions	Learner sharpens or clarifies question provided by teacher, materials, or other source	Learner engages in question provided by teacher, materials, or other source
Margaret	Post	Pre		Pre
Martin*	Pre & Post	Post	Post	Pre & Post
Thomas		Pre	Post	Pre
Bill*	Pre & Post	Post	Pre & Post	Post
Sue	Post			Pre
Karl	Post	Pre		
Linda*	Pre & Post	Post	Post	Pre & Post
John	Pre & Post			Post

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Essential Feature	More _____ Amount of Learner Self-Direction _____ Less			
2. Learner gives priority to evidence in responding to questions	Learner determines what constitutes evidence and collects it	Learner directed to collect certain data	Learner given data and asked to analyze	Learner given data and told how to analyze
Margaret	Post	Post	Post	Pre & Post
Martin*	Pre & Post	Post	Post	Post
Thomas	Pre	Post		Pre
Bill*	Pre & Post	Post	Post	Post
Sue		Post		Pre
Karl	Post	Pre		
Linda*	Pre & Post	Post	Post	Post
John	Pre	Post		

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Essential Feature	More _____ Amount of Learner Self-Direction _____ Less			
3. Learner formulates explanations from evidence	Learner formulates explanation after summarizing evidence	Learner guided in process of formulating explanations from evidence	Learner given possible ways to use evidence to formulate explanations	Learner provided with evidence
Margaret	Post			Pre
Martin*	Pre & Post	Post	Post	Post
Thomas	Post	Pre		
Bill*	Pre & Post	Post	Post	Post
Sue	Post		Pre	
Karl	Pre	Post		
Linda*	Post	Pre & Post	Post	Post
John	Post	Pre		

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Essential Feature	More _____ Amount of Learner Self-Direction _____ Less			
4. Learner connects explanations to scientific knowledge	Learner independently examines other resources and forms the links to explanations	Learner directed toward areas and sources of scientific knowledge	Learner given possible connections	(No Description)
Margaret	Post	Pre		
Martin		Post	Pre	
Thomas	Post		Pre	
Bill*	Post	Pre & Post	Post	
Sue**				
Karl		Pre & Post		
Linda*	Post	Pre & Post	Post	
John		Pre	Post	

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Essential Feature	More _____ Amount of Learner Self-Direction _____ Less			
5. Learner communicates and justifies explanations	Learner forms reasonable and logical argument to communicate explanations	Learner coached in the development of communication	Learner provided broad guidelines to sharpen communication	Learner given steps and procedures for communication
Margaret	Post			Pre
Martin	Pre			Post
Thomas	Post			Pre
Bill*	Post	Pre & Post	Post	Post
Sue**				Post
Karl	Pre & Post			
Linda*	Post	Post	Post	Pre & Post
John			Pre	Post

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\*Student response on posttest indicated that different types of inquiry could be classified in each of the categories.

\*\*Some student responses were blank or were not able to be coded in these categories.

## Implications

Some of the participants (Martin, Bill and Linda) seemed to develop fairly sophisticated views about the amount of student-direction in different types of inquiries. Other participants (Margaret, Thomas, and Sue) in general moved more toward student-directed inquiries. One of the participants (Karl) already saw inquiry as being student-directed and primarily maintained his view. The final participant (John) seemed to be still struggling with his understanding of inquiry. However, that seems understandable since he just completed his first year of teaching. The course did seem to be effective in moving participants toward a more complete understanding of inquiry-based instruction. We suspect that the important aspects of the courses included the participants:

- Presenting and critiquing inquiry lessons;
- Reflecting on questions concerning inquiry and relating the reflection to their own practice;
- Writing unit plans that incorporated inquiry-based methods, assessed inquiry-based instruction, and engaged students in the processes of the scientific enterprise;
- Researching and writing on an aspect of inquiry that interested them; and
- Presenting their research summaries in class.

However, another factor that cannot be underestimated is that six out of the eight participants had experienced at least four MASTEP courses that taught science content using inquiry-based instruction. Those experiences coupled with an inquiry course that focuses on inquiry pedagogy and relates these concepts to the participants' own experiences as students and teachers seems to be a powerful way of increasing the participants' understanding of inquiry-based instruction.

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## References

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**Northeastern State University**  
College of Science and Health Professions  
Department of Natural Sciences  
Tahlequah and Broken Arrow Campuses

**INSTRUCTOR:**

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**Office Hours:** MTWTh: 8:00 am -9:00 am; 12:00 noon -1:00 pm and by appointment at other times.

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**Blackboard Course Resources:** Available at [www.nsuok.edu](http://www.nsuok.edu)

**COURSE TITLE AND NUMBER:**

SCI 5513 – Inquiry Based Instruction in Science Education

Section 0297 SH 204

Section 0302 BA B225

**CLASS DAY & TIME:**

MTWTh 9:00- 11:40 am

MTWTh 9:00- 11:40 am

**PREREQUISITES:**

Graduate Student status.

**CATALOG DESCRIPTION OF COURSE:**

Designed for middle school and high school science teachers, this course will focus on the methods, benefits, assessment, underlying theoretical frameworks, and implementation of inquiry-based science instruction in middle school and high school.

**PROGRAM STANDARDS FOR THE M. ED. IN SCIENCE EDUCATION**

**For Teachers of Students ages 11-15**

**I. Understanding Students**

Accomplished science teachers know how early adolescent learners grow and develop, actively come to know their students as individuals, and draw on this knowledge and their relationships with students to determine the students' understanding of science as well as their individual learning backgrounds.

**II. Knowledge of Science**

Accomplished science teachers have a broad and current knowledge of science and science education, along with in-depth knowledge of one of the subfields of science, on which they draw to set appropriate learning goals with their students

**III. Instructional Resources**

Accomplished science teachers select and adapt instructional resources, including technology, laboratory, and community resources, and create their own resources to support active student explorations of science.

**IV. Engagement**

Accomplished science teachers stimulate interest in science and technology and elicit their students' sustained participation in learning activities.

**V. Learning Environment**

Accomplished science teachers create safe and supportive learning environments that foster high expectations for the success of all students and in which students experience the values inherent in the practice of science.

**VI. Equitable Participation**

Accomplished science teachers take steps to ensure that all students, including those from groups that historically have not been encouraged to enter the world of science, participate in the study of science.

**VII. Science Inquiry**

Accomplished science teachers involve students in inquiries that challenge them and help them construct an understanding of nature and technology.

**VIII. Fundamental Understandings**

Accomplished science teachers use a variety of instructional strategies to expand students' understanding of the

major ideas of science.

#### **IX. Contexts of Science**

Accomplished science teachers create opportunities for students to examine a variety of contexts of science, including its history, reciprocal relationships with technology, ties to mathematics, and impact on society, so students make connections across disciplines of science and into other subjects.

#### **X. Assessment**

Accomplished science teachers assess student learning through a variety of means that align with stated learning goals.

#### **XI. Family and Community Outreach**

Accomplished science teachers proactively work with families and communities to serve the best interests of each student.

#### **XII. Contributing to the Profession**

Accomplished science teachers contribute to the quality of their colleagues' practice, the instructional program of the school, and the work of the larger professional community.

#### **XIII. Reflective Practice**

Accomplished science teachers constantly analyze, evaluate, and strengthen their practice in order to improve the quality of their students' learning experiences.

### **For Teachers of Students ages 14-18+**

#### **I. Understanding Students**

Accomplished Adolescence and Young Adulthood/Science teachers know how students learn, know their students as individuals, and determine students' understandings of science as well as their individual learning backgrounds

#### **II. Understanding Science**

Accomplished Adolescence and Young Adulthood/Science teachers have a broad and current knowledge of science and science education, along with in-depth knowledge of one of the subfields of science, which they use to set important appropriate learning goals.

#### **III. Understanding Science Teaching**

Accomplished Adolescence and Young Adulthood/Science teachers employ a deliberately sequenced variety of research-driven instructional strategies and select, adapt, and create instructional resources to support active student learning.

#### **IV. Engaging the Science Learner**

Accomplished Adolescence and Young Adulthood/Science teachers spark student interest in science and promote active and sustained learning, so all students achieve meaningful and demonstrate growth toward learning goals.

#### **V. Sustaining a Learning Environment**

Accomplished Adolescence and Young Adulthood/Science teachers create safe, supportive, and stimulating learning environments that foster high expectations for each student's successful science learning and in which students experience and incorporate the values inherent in the practice of science.

#### **VI. Promoting Diversity, Equity, and Fairness**

Accomplished Adolescence and Young Adulthood/Science teachers ensure that all students, including those from groups that have historically not been encouraged to enter the world of science and that experience ongoing barriers, succeed in the study of science and understand the importance and relevance of science.

#### **VII. Fostering Science Inquiry**

Accomplished Adolescence and Young Adulthood/Science teachers engage student in active exploration to develop the mental operations and habits of mind that are essential to advancing strong content knowledge and scientific literacy.

#### **VIII. Making Connections in Science**

Accomplished Adolescence and Young Adulthood/Science create opportunities for students to examine the human contexts of science, including its history, reciprocal relationship with technology, ties to mathematics, and impacts on society, so that students make connections across disciplines of science, among other subject areas and their lives.

#### **IX. Assessing for Results**

Accomplished Adolescence and Young Adulthood/Science teachers employ multiple, ongoing methods that are fair and accurate to analyze the progress of individual students in light of well-defined learning goals, and their students achieve meaningful and demonstrate gains in the learning of science. Teachers clearly communicate these gains to appropriate audiences.

## **X. Reflecting on Teaching and Learning**

Accomplished Adolescence and Young Adulthood/Science teachers continually analyze, evaluate, and strengthen their practice to improve the quality of their students' learning experiences.

## **XI. Developing Collegiality and Leadership**

Accomplished Adolescence and Young Adulthood/Science teachers contribute to the quality of the practice of their colleagues, to the instructional program of the school, and to the work of the larger professional community.

## **XII. Connecting with Families and the Community**

Accomplished Adolescence and Young Adulthood/Science teachers proactively work with families and communities to serve the best interests of each student.

### **MAJOR GOALS:**

The goal of this course is to enable master's candidates to plan, implement, and assess inquiry-based science instruction. After completion of this course, the student will be able to:

- A. Demonstrate knowledge and understanding of effective classroom inquiry-based instruction;
- B. Discuss the research base concerning inquiry-based instruction;
- C. Demonstrate knowledge concerning the nature of science and scientific explanations;
- D. Discuss effective methods of planning, implementing, and assessing inquiry-based instruction;
- E. Reflect upon instruction in a meaningful manner; and
- F. Use laboratory equipment commonly found in the middle school or high school classroom in a safe and reliable manner.

### **EXPECTED COURSE OUTCOMES:**

Understanding the nature of inquiry based instruction in science is essential for all teachers of science. In addition, teachers of science need to be able to plan, implement, assess and evaluate inquiry-based instruction. Outcomes of this course include the following:

- A. Discuss important aspects of the nature of science and the nature of scientific explanations.
- B. Discuss important aspects of inquiry-based instruction and the variety of ways it might be implemented in the science classroom.
- C. Write a Unit Plan that incorporates inquiry-based methods, assess inquiry based instruction; utilizes a variety of instructional strategies, teaches fundamental concepts of science, promotes student engagement, is relevant to a diverse group of students, fosters high expectations for all students, engages students in the processes of the scientific enterprise, and encourages students to examine the many contexts of science.
- D. Implement an inquiry demonstration lesson.
- E. Reflect on the practice of teaching.
- F. Write a paper concerning the research base of inquiry-based instruction using APA format.
- G. Discuss safety issues in middle school and high school classrooms.

Note that a video of a lesson from the Unit Plan will be made during the capstone experience.

### **INSTRUCTIONAL MATERIALS:**

Resources will be made available on BlackBoard and through NSU Library Services.

### **PROCEDURES:**

The course will be simultaneously taught utilizing face-to-face instruction at the Tahlequah campus and video conferencing at the Broken Arrow campus. There will be a technical assistant at both sites so that the instructor and students will have help with the technology if needed. The technical assistant will help facilitate student presentations. If the remote site cannot receive instruction, a video of the class session will be made available to students. The video may be checked out from the Center for Teaching and Learning for two weeks after the technical difficulty. Information concerning class cancellations due to inclement weather will be communicated through Blackboard in addition to university announcements. A proctor at the Broken Arrow site will give the mid-term and the final at the same time that the assessments are being given in Tahlequah. The dates and times are given below under Tentative Midterm and Final Schedule. In addition, Blackboard on-line resources will be used to enhance communication and provide equitable access to classroom materials, Internet resources, and instructor feedback. Students will need to access materials prior to class. The next week's classroom materials will be available on-line by Wednesday of the proceeding week. Assignments will be delivered to the instructor via the Blackboard digital drop box. A courier will deliver objects that are needed for group work. The instructor will be

available by phone during office hours, by e-mail, by FAX, and in person during office hours and during the assessment of students as they teach their three lessons at their Pre II Internship school site. The expected course outcomes will be realized through a variety of instructional strategies. Those strategies include, but are not limited to, the following: inquiries, group activities, student presentations, class discussions, and lecture. Student attendance will be taken daily and interaction with students at both sites will be maintained throughout the class session. The instructor also will integrate appropriate multi-media technology including videoconferencing technologies, Blackboard Internet resources, Smart Board technology, and links to on-line resources such as Oklahoma PASS objectives, National Science Education Standards, Project 2061, the National Science Teacher Association, and other science teacher resources.

Course content:

Inquiry-Based Instruction and the Standards  
 Methods of Inquiry-Based Instruction  
 Assessment of Inquiry  
 Inquiry Theory Base  
 The Nature of Science  
 The Nature of Scientific Explanations  
 Safety Issues  
**Final**

Graded Work	Percentage of Final Grade
Reflective Essays (As Assigned)	20%
Inquiry Paper (Due June 23 <sup>rd</sup> )	20%
Unit Plan (Due June 27 <sup>th</sup> )	20%
Inquiry Demonstration Lesson (June 27 <sup>th</sup> -29 <sup>th</sup> )	20%
Final (June 30 <sup>th</sup> )	20%
<b>Total</b>	<b>100%</b>

The final letter grade is based on the scale of:

90 - 100%	A
80 - 89%	B
70 - 79%	C
60 - 69%	D
<60%	F

**Attendance:** Regular attendance is important for success in class. A significant portion of the content is available only through in-class activities, discussions, and lectures. Daily assignments that facilitate student learning may be given. Attendance will be taken daily.

**Make-up Final:** A make-up final will be given to students who miss the final due to illness, family crisis, or extraordinary circumstance. The make-up final must be taken within one week of the original final.

**Internet Resources:** Course notes, assignments, handouts, Internet resources, PowerPoint presentations used for lecture and class discussions, and other resources will need to be downloaded or accessed through Blackboard. In addition, course assignments will be turned in through the Blackboard digital drop box and the instructor will contact students through the Blackboard e-mail system. Students will need to access Blackboard (<http://www.nsuok.edu>) and their e-mail accounts regularly. The instructor also maintains a web site at <http://arapaho.nsuok.edu/~adams001/>

**Out-of-Class Assignments:** In order for students to receive credit for graded assignments, work must be left in the digital drop box in Blackboard on or before the due date. Assignments may be turned in by e-mail attachment or FAX if necessary. Late assignments are not accepted, except under extraordinary circumstance. Students are expected to do their own work. Plagiarism will result in a zero on the assignment and may result in expulsion from the program.

**PORTFOLIO ASSIGNMENTS**

The Inquiry Paper and the Unit Plan are portfolio assignments. In addition, the assessment of the Demonstration Inquiry Lesson and the video of the master’s candidate teaching a lesson from the Unit Plan during their capstone experience will also become part of the portfolio.

**EVALUATION OF THE COURSE AND INSTRUCTOR:**

At the conclusion of the semester, the students will have an opportunity to evaluate their instructor and the course. This will be done anonymously and will be used as a means to improve instruction and course content. The suggestions, comments and/or criticisms from students will be taken seriously and hopefully will contribute to the improvement of the course and NSU’s education program.

**STUDENTS WITH DISABILITIES:**

If any member of the class feels that he/she has a disability and needs special accommodations of any nature whatsoever, the instructor will work with you and the University's Office of Student Affairs to provide reasonable accommodations to ensure that you have a fair opportunity to perform in this class. Please advise the instructor of such disability and the desired accommodations at the first class attended.

**INCLEMENT WEATHER / DISASTER POLICY:**

The following are basic premises for the inclement weather policy at Northeastern State University:

1. Classes are expected to be held if at all possible.
2. It is the student's responsibility to receive the information when weather is questionable.
3. Neither students nor faculty are expected to risk life or limb.
4. Faculty members are obligated to hold classes if the University is not closed, unless the faculty member is unable to get to campus.

***Policy:*** During times of inclement weather, decisions concerning day classes will be made by 6:00 a.m. in order for the media to be notified and for students to receive the announcement before they leave home. Decisions concerning night classes will be made by 3:00 p.m.

The following media will be notified regarding closing of the campus:

**Radio Stations:**

KRMG 740 AM	Tulsa
KAYI107 FM	Tulsa
KTLQ 1350 AM	Tahlequah
KEOK 102 FM	Tahlequah
KBIX1490 AM	Muskogee
KMMY 97 FM	Muskogee
KVOO 1170 AM	Tulsa

**Television Stations:**

KJRH Channel 2	Tulsa
KOTV Channel 6	Tulsa
KTUL Channel 8	Tulsa
KFSM Channel 5	Fort Smith
Cable Channel 96	Tahlequah