# MSSE Program Assessment Guide

Summer 2020

This document contains the following:



## MSSE Program Description

MSSE is an intercollege, interdisciplinary effort. Online graduate courses are offered during the fall semester, spring semester, and summer session and delivered by asynchronous, computer-mediated communication. Montana-based field and lab graduate courses are offered during the summer session.

The program of study may begin with online courses in any semester or summer campus field/lab science courses at the MSU-Bozeman campus. Study continues with online courses that students take from their homes or workplaces and ends with a final campus visit for presentation of the results of a personalized science education capstone project. Thirty semester credits are required for the degree. Students typically will complete the degree in two or three years.

In addition to completing a group of core courses (14 credits total) which includes the 3-credit capstone course, students develop interdisciplinary combinations of science courses (12 credits minimum) from offerings in biology, chemistry, earth science, microbiology, plant sciences, physics, and other related areas. The final 4 credits in the 30-credit program are electives selected from education and/or science courses.

Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. Each student seeking the degree is advised by a three-person faculty committee, and programs are designed taking into account the student's background, interests, and career goals.

Features of the MSSE Program include the following:

- Designed for science educators by experienced science, science education, engineering, and mathematics faculty with the collaboration of outstanding classroom teachers
- Coursework delivered primarily online, offering flexibility for working educators
- On-campus summer experiences that vary in length from one day to two weeks (five credit minimum, includes 3-credit capstone course)
- Emphasizes Next Generation Science Standards
- Customized capstone experience
- Interdisciplinary program with a large selection of science content courses

- Self-paced program with a 6-year window to complete all coursework

**Program Learning Outcomes**

1. *Science Education as an art/discipline*. MSSE students will demonstrate an understanding of the discipline of science education and its role in contributing to our understanding of teaching science.
2. *Science Content*. MSSE students will demonstrate an understanding of at least two science content disciplines through successful completion of courses in those disciplines.
3. *Written Communication*. MSSE students will demonstrate master level writing practices, formats and effective written communication through course assignments and the Capstone paper. Note: writing is included in nearly all courses, but not specifically assessed other than in the context of the specific assignments.
4. *Research*. MSSE students will formulate a research question using either their classroom as a lab or a science-related topic and conduct a research project based on the action research model. Note: elements of research are included in many courses, but not specifically assessed other than in the context of the specific assignments.
5. *Oral Communication*. MSSE students will demonstrate the ability to present material orally in an organized and effective manner by sharing the results of their Capstone project. Note: Due to the online nature of the Program, oral assessment in courses is generally not used. There are some students who submit podcasts or oral presentations as part of assignments. Many of the field study courses utlize oral assessments. These have been indicated on the following chart.

| Courses (* required Core Education Course) | Learning Outcomes |
|---|---|

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| MSSE 501 Teaching Science Inquiry* | X | | | | |
| MSSE 502 Emerging Technology & The Science Classroom | X | | | | |
| MSSE 503 Integrating Literature into the Science Classroom | X | | | | |
| MSSE 504 Formative Assessment in Science Education* | X | | | | |
| MSSE 505 Foundations of Action Research* | X | | X | X | |
| MSSE 506 Crime Scene Investigators | X | | | | |
| MSSE 507 Capstone Data Analysis | X | | | X | |
| MSSE 508 Statistics Boot Camp for Capstone Projects | X | | | X | |
| MSSE 509 Implementing Action Research* | X | | X | X | |
| MSSE 518 Master Teaching Strategies | X | | | | |
| MSSE 536 Construction of Curriculum | X | | | | |
| MSSE 537 Contemporary Issues in Science Education | X | | | | |
| MSSE 575 Capstone Paper and Symposium in Science Education | X | | X | X | X |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| BIOE 516 Terrestrial Ecology of the Northern Rocky Mountains | | X | | | |
| BIOE 519 Biology of Riparian Zones and Wetlands | | X | | | |
| BIOE 520 Understanding & Managing Animal Biodiversity in Yellowstone National Park | | X | | | X |
| BIOE 522 Birds of Prey of the Greater Yellowstone Ecosystem | | X | | | X |
| BIOE 523 Wildlife Ecology of the Northern Rocky Mountains | | X | | | X |
| BIOE 593 Alpine Ecology | | X | X | X | X |
| BIOE 595 Marine Ecosystems for Teachers | | X | | | |
| BIOE 596 Land Use Issues in the Greater Yellowstone Ecosystem | | X | | | X |
| BIOE 597 Ecology of Trout Stream | | X | | | X |
| BIOE 599 Advanced Ecology | | X | X | X | X |
| BIOH 586 AP Biology for Teachers: Big Ideas Approach | | X | X | | |
| BIOH 595 Anatomy & Physiology | | X | | | |
| CHMY 506 Integrating Computers in Laboratory Instruction | | X | | | X |
| CHMY 587 Exploring Chemistry | | X | | | |
| CHMY 593 Special Topics: Equilibrium, Thermodynamics, & Kinetics | | X | | | |
| CHMY 594 Science Lab Safety and Risk Management | | X | | | X |
| CHMY 595 Chemistry of the Environment: Water, Air, Earth | | X | | | |
| CHMY 595 Chemistry of the Environment: Water, Air, Earth | | X | | | |
| CHMY 597 Exploring Biochemistry | | X | | | |
| CHMY 598 Exploring Biochemistry II: Metabolism | | X | | | |
| CHMY 599 An Atoms-First Primer for AP/IB Chemistry Teachers | | X | | | |
| CSCI 581 Computer Science in the Classroom: Computational Thinking for Teachers | | X | | | |
| CSCI 582 Computer Science in the Classroom: The Joy and Beauty of Data | | X | | | |
| ERTH 516 Northern Rocky Mountain Geology | | X | | | X |
| ERTH 519 Watershed Hydrology for Teachers | | X | | | |
| ERTH 594 Geology Seminar: Geology of Earthquakes | | X | | | |
| ERTH 595 Historical Geology | | X | X | | |
| ERTH 596 Geology of Glacier National Park | | X | X | | X |
| ERTH 597 Vertebrate Paleontology for Teachers | | X | | | X |
| GEO 521 Dinosaur Paleontology I | | X | | | X |
| Courses (* required Core Education Course) | Learning Outcomes | | | | |

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| GEO 522 Dinosaur Paleontology II | | X | | | X |
| GEO 585 Mineralogy for Teachers | | X | | | X |
| ECIV 562 Snow and Avalanche Physics for Science Educators | | X | X | | |
| EELE 508 Solar Cell Basics for Science Teachers | | X | | | X |
| EGEN 511 Engineering Methods for Teachers | | X | X | | X |
| EELE 591 Introduction to Logic Circuits for Teachers | | X | | | |
| LRES 557 Thermal Biology in Yellowstone National Park | | X | | | |
| LRES 569 Ecology of Invasive Plants in the Greater Yellowstone Ecosystem | | X | | | |
| LRES 586 Lake Ecology | | X | | | |
| MB 533 Current Topics in Microbiology | | X | | | |
| MB 538 Cell and Molecular Biology | | X | | | |
| MB 539 Infection and Immunity | | X | | | |
| MB 541 Microbial Genetics | | X | | | |
| PHSX 585 Physics by Inquiry: Electric Circuits | | X | | | X |
| PHSX 586 Physics by Inquiry: Heat and Temperature | | X | | | XX |
| PHSX 587 Physics by Inquiry: Optics | | X | | | X |
| PHSX 595 Teaching Mechanics Using Research-Based Curriculum | | X | | | |
| PHSX 596 Teaching Electricity and Magnetism Using Research-Based Curriculum | | X | | | |
| PHSX 597 Physics of Renewable Energy | | X | | | |
| PSPP 547 Biomimicry: The Technology of Biology | | X | X | | |
| PSPP 548 Flowering Plants of the Northern Rocky Mountains | | X | | | X |
| PSPP 549 Plants, People, and Health | | X | | | X |

**Methods for Annual Data Collection**

Direct measures:
• The final Capstone research paper. Upon graduation, the paper is archived in the MSU library based on meeting IRB and MSU graduate writing formatting requirements.
• Defense of the Capstone paper. This takes the form of a public presentation and private oral defense of the research paper.
• End of course exams in science content courses that are calculated in final grades.
• End of course projects specifically related to classroom instruction. These take the form of lesson plans, unit plans and other instructional techniques incorporating the science content from individual courses. Assessment scores of these projects are calculated in final grades.

Indirect measures:
• Campus Lab online course evaluations (Appendix A)
• Qualtrex field course evaluations (Appendix B)
• Graduate Exit Survey (Appendix C)

**Timeframe for Collecting and Analyzing Data**

Data is collected throughout the year using the following techniques:
• End of course Campus Lab online evaluations of all courses are reviewed by the MSSE Director at the end of every semester.
• Qualtrex field study course evaluations are reviewed by the MSSE Director. At the Director's discretion, private conversations about the course evaluations take place.
• The Capstone Observation Reports are submitted by graduate candidates during Capstone Week (Appendix D).
• The Graduate Exit Survey is administered to all graduates at the end of the summer session.

**Use of Assessment Data**

• At the Director's discretion, private conversations with instructors about the course evaluations take place. These discussions often result in adjustments to course content, delivery, and interaction with students.
• Qualtrex field study course evaluations are analyzed and shared with the MSSE staff at the end of the summer session. The evaluation results drive changes and adjustments to field study courses, office support for field courses such as rental cars, food, accommodations and more.
• The Capstone Symposium Evaluations are analyzed by the MSSE office team and used to inform changes to the Symposium process.
• The Graduate Exit Survey results are analyzed and reviewed by the MSSE office team and used to make changes to the Program.
• The results of the Graduate Exit Survey are shared with core instructors at the annual Core Instructors Retreat in January as preparations are being made for the upcoming Science Symposium. The evaluation results drive changes to the Symposium, advertising and recruiting efforts, changes to the Program and more.
• The results of the Graduate Exit Survey are shared with the MSSE Advisory Team.

Appendix A

## Sample Campus Lab Online Survey Questions

Evaluation Questions

- Describe the frequency of your instructor's teaching procedures.
    - Displayed a personal interest in students and their learning
    - Found ways to help students answer their own questions
    - Demonstrated the importance and significance of the subject matter
    - Made it clear how each topic fit into the course
    - Explained course material clearly and concisely
    - Introduced stimulating ideas about the subject
    - Inspired students to set and achieve goals which really challenged them
- Describe your attitudes and behavior in this course.
    - As a rule, I put forth more effort than other students on academic work.
    - My background prepared me well for this course's requirements.
    - I really wanted to take this course regardless of who taught it.
    - Overall, I rate this instructor an excellent teacher.
    - Overall, I rate this course as excellent.
- Comments

Appendix B

## MSSE Campus Course Survey

Q1 The course instructor demonstrated solid mastery of the subject matter.

Q2 The goals and work requirements of the course were made clear.

Q3 The coursework requirements were realistic for the amount of credit earned.

Q4 The course grading system was made clear.

Q5 The content of the course was interesting to me.

Q6 The course instructor's availability for assistance met my needs as a student.

Q7 Interactions with the course instructor helped me understand the course material better.

Q8 Interactions with other participants helped me understand the course material better.

Q9 The textbooks(s) and/or materials used in this course met my needs as a learner.

Q10 This course increased my knowledge of the subject.

Q11 This course furthered my knowledge of resources in the subject area.

Q12 This course seemed to be designed with my professional needs in mind.

Q13 This course improved my professional skills in this subject area.

Q14 This course helped me to network with other professionals.

Q15 I would recommend this course to my colleagues.

Q16 Please comment on the effectiveness of any textbooks and/or materials used in the course. What was it you used? Did you feel it was necessary? Would you recommend for or against its use? Why?

Q17 What aspects of this course worked well to enhance your learning? Why do you think this?

Q18 What aspects of this course didn't work very well to enhance your learning? Why do you think this?

Q19 In terms of your overall professional development, what have you gained from this course?

Q20 How could the course have been a more effective experience for you?

Q21 Please provide any additional comments you have regarding your course experience.

Appendix C

**MSSE Graduate Exit Survey**

---

Q1 To what extent did the field study courses utilize the unique environments of Montana and the Greater Yellowstone Ecosystem?

Q2 To what extent did the field study and/or laboratory courses provide you with experiences demonstrating scientific and research principles?

Q3 To what extend did your knowledge and understanding of scientific subject areas change?

Q4 To what extend did your reflective techniques of your practice as an educator change?

Q5 To what extent did your knowledge of instructional skills and strategies change?

Q6 To what extent did the MSSE Program provide a safe, positive, supportive yet challenging learning environment?

Q7 To what extent did your awareness of commonalities and interrelationships among various science disciplines, applied sciences, and engineering change?

Q8 To what extent did your ability to communicate research-based scientific knowledge and science/engineering practices change?

Q9 To what extent did you change as a teacher-researcher through exposure to and engagement in emerging science education research?

Q10 To what extent do you feel a member of a cadre of science teacher leaders who can actively participate in the systemic reform of science education at community, state, regional, national, and international levels?

Q11 What were three highlights of the MSSE Program for you

Q12 What suggestions would you have for the MSSE Program?

Q13 How was your experience with your science reader? If you feel comfortable, please share the name of your reader.

Q14 Is there anything else you'd like the program to know

---

Appendix D

**Capstone Observation Report Form**

---

Q1 Observer Name:

_____

Q2 Presenter Name:

_____

Q3 Presentation Date:

▼ Monday, July 1st (2) ... Friday, July 5th (5)

Q4 Presentation Time:

▼ 7 am (1) ... 6 pm (12)

Q5 Title of Presentation:

_____

Q6 Brief Summary of Findings:

Q7 Personal Significance of Peer's Work (What did you take away from this project?):

Q9 Additional Comments:

Appendix E

## Core Education Course Descriptions and Final Assignment Rubrics

### MSSE 501Teaching Science Inquiry

### Course Description

The Teaching Inquiry through Science & Engineering Practices course is designed for science teachers as a professional development tool to increase the effectiveness of teaching science inquiry skills to their students. Inquiry means asking questions. As teachers, we need to get out of the habit of being the ones to ask questions. This responsibility should be shifted to the students. The teachers' role then becomes one of guide and co-investigator. This course provides strategies to help achieve this shift from "sage on the stage" to "guide on the side." This course is applicable for all instructional/learning settings including classrooms, zoos, museums, planetariums, etc.

### Learner Outcomes

At the end of the course, students will:

• Identify and define the inquiry science instructional model.
• Identify, implement and report on inquiry teaching strategies such as the 5E instructional model, case studies, conceptual change and misconceptions.
• Identify and define the constructivist learning theory.
• Participate as a learner in a long-term inquiry project.
• Analyze, synthesize and reflect on inquiry teaching strategies in weekly discussions with colleagues.

The required texts for the course are either

• Inquiry Within: Grades 3-8, 3rd Edition, Douglas Llewllyn, ISBN: 9781452299280 or
• Teaching High School Science Through Inquiry and Argumentation 2nd Edition, Douglas Llewllyn, ISBN 978-1-4522-4445-7

### Final Inquiry Investigation Standards Rubric

| CATEGORY | STANDARD |
|---|---|
| *Phenomena Event | The inquiry investigation includes a phenomena event |
| *Misconceptions & Conceptual Change Model Framework | All potential misconception related to the inquiry investigation have been identified and a solid conceptual change framework is in place. |

| | |
|---|---|
| *Nature of Science | Nature of Science components have been identified |
| *Science and Engineering Practices & Crosscutting Concepts | The identification of science and engineering practices/crosscutting concepts as they relate to the inquiry investigation are clearly identified. |
| *Sense Making and Discourse | Reflection on sense making and discourse was included. |
| *Becoming an Inquiry Teacher** | Identification of placement on Llewllyn's 5 steps from the article included. Can be incorporated into the Reflection Component |
| Preparation (including writing) | The inquiry investigation design is thorough and writing meets the MSSE requirements |
| Content | Shows a full understanding of the topic and is inquiry-based. |

* These indicate section headings to be addressed. In addition, a BACKGROUND or INTRODUCTION should be included to begin the narrative. Specially address EACH component in the rubric (eg. do not imply the use of Science & Engineering Practices, state the ones you used)

** Read the Becoming an inquiry teacher article and in the Reflection Component, identify on which of the four steps you believe you are now. Also reflect on ways you incorporated *sense making* and *discourse* into your project.

Scoring:
All standards met and exceeded 100%
All standards met 95%
1 standard not met 85%
2 standards not met 75%
3 standards not met 65%
4 standards not met 55%
5 or more standards not met 50%

# MSSE 504 Formative Assessment in Science Education

## Course Description

The purpose of this course is to investigate how assessment, evaluation and measurement can be used to understand and improve students' learning. To accomplish this goal, course participants will regularly be introduced to new classroom assessment techniques, pilot selected techniques in their classrooms, write analyses of the strategies, then share the results with other course participants on-line. Trying and adapting new assessment strategies is one particular strength of this course. In addition, emphasis will be placed on evaluation analysis...making sense of what was reported through measurements. The course readings emphasize the importance of gathering assessment data well before chapter tests and exams. That way students and instructors have the time needed to make mid-course corrections when key concepts are not well understood.

Another regular feature of the course will be readings accompanied by on-line discussion. Each week we will read and discuss selections from the course
texts. Participants in the course will serve as a Discussion Facilitator at some point during the course. It is the philosophy of the instructor that discussion is learner- centered, allowing online students the opportunity to construct their own understanding and learning. As such, I will monitor discussion and provide correction and direction as needed, but you won't see me participating personally in discussion every week. You are certainly encouraged to message me personally if you have pressing questions that arise in discussion.

## Learner Outcomes

At the end of the course, students will:

• Define formative assessment specific to science education

• Create, implement and report on numerous formative assessment strategies specific to science education

• Provide effective formative feedback to students
• Use formative assessment results to make meaningful instructional changes

• Demonstrate understanding of formative assessment through content knowledge, reasoning, skills, dispositions and skills.

Examples of Student Learning Outcomes include the following:

Knowledge--factual: Dates of wars/important documents; subject specific

vocabulary; muscle groups, organs of the body

Knowledge--procedural: How to use the writing process; how to set up a science investigation; how to apply a formula to solve a problem; how to focus a microscope

Reasoning: Analyze and solve word problems; compare science processes; evaluate positions on ethical science issues

Skills: Reading aloud with fluency; manipulating science equipment; giving a public presentation,

Products: Writing samples; artistic products; making a model; graph; science fair project; building a telescope

Dispositions: Attitudes, interests, motivation, academic self-concept

**Sample Assessment Assignment Rubric**

BACKGROUND INFORMATION (this is what is used as the section title...all caps, centered)

Standards to be addressed:

** Why did you choose the CAT selected for this assignment AND How does this CAT fit your long range teaching goals from the TGI and the current needs in your class?
** Why did you select this class for the CAT?
** What is the class currently doing?
** Include general "demographics" of your class: the name, city and state of your school, the number of students in your school and the class you selected, the class "climate," school "culture," ethnic diversity, academic ability of your students, etc....enough to give the reader a good "feel" of the class. Be sure to include any citations for the demographic information from sources such as school websites, city_data.com, etc. Personal communication from an administrator works here, too
** Describe the assessment you used in detail, don't just name it. What did you do? How many questions did it have? Describe your process for scoring the responses for the analysis section. If you created a handout for the students, include that in an appendix appropriately labeled and referenced in the narrative.
** What did you ask the students to do when you implemented the CAT AND how did they react to the exercise?

You may use the same background information from one assignment to another, making the appropriate tweaks to keep each current.

ANALYSIS

Standards to be addressed:

** Analysis of the data, including summary of patterns and actual excerpts from student work that illustrate each pattern.
** Use a table or chart if the data lends itself to this reporting strategy. (Be sure to check out the table hints page.) You need to discuss the data BEFORE you include any tables or charts along with the text. Only use tables or charts if it helps explain the data better. Never include raw data

anywhere in the paper.
** Address not only patterns and trends, but also outliers.

Begin the analysis section something like this:

The results of the Muddiest Point assessment indicated that 75% of the students were most confused about the difference between high and low pressure and moving air (*N*=34). One student said, "I get that air pressure keeps the water in the upside down cup, but I don't see why cause I don't know where the high/low pressure is." Twenty percent of the students indicated that their muddiest point was related to lift. One student said, "I don't understand why the airplane wing goes up if the air on top is moving faster."

Notes:

- Identify the instrument in the 1st sentence.
- Include data in the 1st sentence.
- Include the sample size in the 1st sentence that data is given and then ONLY in the title of graphs and figures.
- Include student quotes, if available, as evidence for the claims being made.
- Report ONLY the facts, no reflection in this section...save it for the Values and Claims section.
- Use digits and the percent sign in sentences (45%) and begin sentences with words (Forty-five percent).
- Try to put only one student quote in each sentence. It devalues the power of the statement when it's placed in a list of quotes.
- Analysis will be heavily emphasized in this course. We will be focusing on analysis during every assignment.

CLOSING THE LOOP

Standards to be addressed:

** How did you "close the loop" in the SHORT TERM? What did you say to your students regarding what you learned from their responses? How did you share the CAT results with your students? How can your students and you use this information to improve learning?

CLAIMS, EVIDENCE, REASONING REFLECTION

Standards to be addressed:

** Reflect on the use of this assessment. Answer questions such as
  * Did the assessment go as planned?
  * What might you do differently?
  * How did this assessment impact your TEACHING or assessment practices?
  * You may have included some reflection in your paper, but really focus on it here.
** What did you learn from this CAT that can help you present similar topics more effectively at

some later point? Provide one or more ways that you will improve this CAT the next time you use it. State your reasons and give examples of the change(s) contemplated.

The paper will also be scored using the following:

Writing Component Rubric

Standards to be addressed:

• Writing is clear, coherent, and unambiguous. It includes all required elements and communicates effectively to the intended audience. The writing is free of grammatical, spelling and other errors.

Do not include a title page. Do not reference the CAT book since it's the text for the course, unless you are using a direct quote.

For assessment assignments, use the following formatting:

Chapter title = The name of the Assessment. For example: Muddiest Point
Use the following level 1 headings:
• Demographics
• Assessment description
• Data Analysis
• Closing the Loop
• Values and Claims

If figures or tables are used, include alt text
Complete an accessibility check before submission

Formatting: There are numerous formatting specifics that you'll learn through the process of writing the CATs. They are listed and examples are provided on the Writing Expectations pages. At a minimum, be sure to start with the following basics:

Set the document margins to 1.5" left and 1" the rest of the way
Set the font to Times New Roman, size 12 font
Use the above categories (Background Information, etc) as section headings and follow the proper formatting guidelines: all capital letters & centered
Double space all paragraphs, including the space BETWEEN paragraphs
Titles are considered first level headings and are all capital letters, centered, with double spacing afterward
No bolding in the paper at all
No name on your paper, only in the file name when it's saved
Use proper formatting for tables and figures. See the MSSE Writing Workbook for specific examples

Scoring: All standards met and exceeded: 100%
All standards met: 95%
1 standard not met: 85%
2 standards not met: 75%
3 standards not met: 65%
4 or more standards not met: 50%

Standards are based on the stage of the process. For examples, the standard may be lower earlier in the course than later...it is expected that continual growth is being made.

Any assignment below full standards met may be resubmitted for a score of 90%.

# MSSE 505 Introduction to Action Research

## Course Description

The purpose of this course is to assist students in learning the conceptual underpinnings of action research in science education as they relate specifically to curriculum, teaching, and learning of science at the middle and high school levels. As a result of this course, students will be able to practice practical and applied classroom research. The course emphasizes a constructivist philosophy in an applied educational setting. The emphasis is on the teacher as inquirer, actively engaged in the construction of new knowledge about science education through the action research process.

## Learner Outcomes

At the end of the course, students will:

• define the nature of science education research, especially how it is related to classroom-based inquiry
• analyzing conceptual and methodological aspects of a variety of science action research
• analyzing the relation of specific action research to the effectiveness of classroom instruction and local practice
• developing an understanding of the science teacher as an active producer of research-based knowledge
• complete required Institutional Review Board (IRB) Training, and
• designing and write a personal action research project plan.

At the completion of the course, each student will have completed an ACTION RESEARCH PROJECT PROPOSAL that includes a focus statement, a literature review (conceptual framework), a description of the proposed treatment, and data collection strategies. In most cases, this proposal will be implemented during the EDCI 509 course during the fall semester following EDCI 505.

## Action Research Proposal Rubric

Category Standard

Introduction: The introduction clearly provides the necessary information for the reader. This includes the school, city, state, description of the class, what the class is studying, etc. Include the project focus question or statement.

Conceptual Framework: The conceptual framework clearly related to the focus question. A thorough review of the literature was presented.

Data Analysis Strategies List: The proposed data analysis strategies are clearly listed. There is clear connection between the focus question and the strategies.

Paper Organization: The flow of the paper was logical. Sections were well organized. Important elements were included.

Writing: Virtually no grammatical, spelling or punctuation errors. All formatting was done correctly. Minimal revision was necessary.

For this assignment, please include a TITLE PAGE, but no additional formatter. Don't forget the references section for the conceptual framework. The final paper needs to be in the master template and must include subheadings in all chapters for ADA compliance. Please check accessibility in Word and include alt text for images, tables and figures.

Chapter 1 Introduction and Background
- Level 1 heading: Context of the Study
- Level 1 heading: Focus Statement/Question

Chapter 2 Conceptual Framework
- Level 1 heading: Up to 5-6 headings based on the theme title from the literature

Chapter 3 Methodology
- Level 1 heading: List of Possible Data Collection Strategies

Scoring:
All standards met and exceeded 100%
All standards met: 95%
1 standard not met: 88%
2 standards not met: 85%
3 standards not met: 75%
4 or more standards not met: 50%

**MSSE 509 Implementing Action Research**

**Course Description**

This course is the second in a two-part series of studies in Action Research offered in the intercollege Masters of Science in Science Education (MSSE) Degree. As such, it will help students implement their action research as it relates specifically to science teaching, learning and curriculum in middle and high school classrooms. This course will help the student to effectively complete a practical and applied classroom research project, which if the student and his/her graduate committee agree, could be the basis for the capstone experience in their graduate program.

The course emphasizes a constructivist philosophy in education. The emphasis is on the teacher as inquirer, actively engaged in the construction of new knowledge about science education.

**Learner Outcomes**

**At the end of the course, students will:**

• Write a draft action research project for future implementation
• complete an application for the Capstone project for IRB approval
• design an electronic poster describing your action research-based project to be shared with your Project Director
• communicate extensively with teachers who have similar interests
• apply the action research process to professional staff development plans
• engage in an on-going discussion with your Project Advisor regarding your action research and subsequent capstone project

**Final Action Research Draft Rubric**

| Criteria | Quality | | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| A properly formatted Title page, Copyright page, Dedication/Acknowledgements (optional), Table of Contents, List of Tables, List of Figures and Abstract pages included. Use placeholders as | Pages included | | | Pages not included |

| | | | | |
|---|---|---|---|---|
| needed. Follow the ETD Master Template formatting. | | | | |
| The AR project has an Introduction and Background section that includes an Area of Focus statement, with a clear, concise focus question. | Introduction/ Focus statement and question are extremely well written | Introduction/ Focus statement and question are evident | Introduction/ Focus statement and question are presented, but missing elements and/or questions remain | Introduction/ Focus statement and question are poorly written or missing |
| The AR project contains solid examples of a Conceptual Framework in a thorough literature review | Clear, precise literature review is evident | Good literature review presented | Literature review presented, but obvious background information is missing or undeveloped | Very little literature review is presented or those presented are clearly wrong |
| The project contains a description of the data collection Methodology. This also includes a discussion of the treatment (what you did differently). | Clear, precise methodology is presented | Good background information on methodology is presented | Some background methodology is presented, but not strongly supported | Very little or no methodology is presented |
| The project contains an Analysis chapter placeholder page. This can either be the analysis assignment or just the title page. | | | | |

| | | | | |
|---|---|---|---|---|
| The project contains a Claims, Evidence & Reasoning chapter placeholder page | | | | |
| The project contains a References section | Clear, precise References section presented | Good example of References section | Some References section evident, but obvious errors | No References section presented |

In addition, the project should adhere to all standards of "scholarly work." This would include a table of contents, graphs, figures, charts, appendices, etc. Be sure to use a consistent citation format such as APA style.
Final rubric score: _____
4--Completed AR project with significant insight, clear concise writing, demonstrated clear understanding and use of action research concepts
3--Completed AR project with minor errors in insight, writing or action research concepts
2--Submitted AR project with errors in writing, application or interpretation of action research concepts and/or lack of reflection/insight
1--Submitted AR project with major errors in action research concepts, little or no reflection, insight, application of action research concepts and/or writing
0--Did not submit AR project…results in course failure

The project will contain the following elements:

Title Page
Copyright Page
Dedication/Acknowledgements (optional)
Table of Contents
Introduction and Background
Conceptual Framework
Methodology
Analysis chapter placeholder page
Claim, Evidence, Reasoning chapter placeholder page
References Cited
Appendix

# MSSE 518 Master Teaching Strategies for Science Teachers

## Course Description

Becoming a master teacher is a process. Once a teacher is comfortable with the content being taught and the overall curriculum, the focus can shift to instructional strategies. This course will engage students in discussions and practice regarding the construction, use and reporting of numerous master instructional techniques. The emphasis of the course is on classroom instruction with the intent of informing and improving the effectiveness of one's instruction. A classroom or teaching setting such as museum, planetarium, zoo, outdoor school in which to complete the required instructional "assignments" is absolutely necessary.

## Learner Outcomes

At the end of the course, students will:

• Identify and define teaching models specific to science teaching.
• Identify, implement and report on numerous teaching strategies specific to science teaching by using them in their classrooms.
• Report on the effectiveness of chosen teaching strategies implemented in the student's classroom.
• Participate as a learner in a gamification learning environment and report on the effectiveness of the strategy.
• Analyze, synthesize and reflect on teaching strategies in weekly discussions with colleagues.

Text: The text for this course is *Models of Teaching*, 7th Edition, Bruce Joyce, Marsha Weil, with Emily Calhoun, Pearson Publishing.

## Lesson Reflection Rubric

Use the following when creating the lesson reflection assignments. Feel free to adjust/adapt as necessary if you choose to do an alternative assignment, but try to address the general points listed here. Think of these as sections of the paper: Background, Lesson Overview and Reflection.

BACKGROUND INFORMATION Standards

Describe the lesson and explain why you choose this particular learning cycle activity.
Why did you select this class?
What is the class currently studying?
Include general demographics of your class: the name, city and state of your school, the number of students in your school and the class you selected, the class climate, school culture, ethnic diversity, academic ability of your students, etc....enough to give the reader a good feel of the class.

OVERVIEW OF THE LESSON Standards

A brief description of the implementation of the lesson.

CLAIM, EVIDENCE, REASONING standards

Did the lesson go as planned?
What might you do differently next time?
How did this teaching strategy impact your TEACHING?
What did you learn from this strategy that can help you present similar topics more effectively at some later point? ** Provide one or more ways that you will improve this strategy the next time you use it.
** State your reasons and give examples of the change(s) contemplated.

---

Remember, this is a graduate level course and the writing must be graduate level quality. Extensive guidance is provided in the Writing Expectations on the Help Pages. Please review these before submitting your written assignments.

---

ASSIGNMENT FORMATTING/WRITING Standard

At a minimum, the following formatting guidelines are required
• Double spacing
• Times New Roman font size 12
• Proper headings
• Proper page margins See the MSSE Narrative Template for more guidance.

# MSSE 536 Construction of Science Curriculum

## Course Description

In this course we will study some general functions of curriculum in schools, including theories about developing, aligning and auditing curriculum. Keep in mind that the course will not be comprehensive in coverage, but rather is an overview with frequent side-trips to consider some topics in greater depth.

In the historical and theoretical portion of the course, you may feel overwhelmed by names and facts. Remember our purpose is to understand how these earlier beliefs and practices have shaped what we do in schools. We want to learn from previous efforts and understand the present context of science education curriculum. An effort will be made to consider emerging issues influencing science education, including, but not limited to the TIMSS Study and The Next Generation Science Standards.

## Learner Outcomes

**At the end of the course, students will:**

• Demonstrate competency through written assignments an understanding of philosophical, historical, and social influences that influence the construction of curriculum.
• Create a curriculum document that includes, but is not limited to the following:

• A curriculum map
• A curriculum plan based on best practices in curriculum development
• A reflection of the created curriculum identifying strengths and weaknesses of the

curriculum
• Demonstrate through written assignments the ability to write at a masters degree level.
• Demonstrate through online discussions and weekly discussion rubric submissions competency in engaging in rigorous, professional exchange of content.
• Make connections between the readings and what is occurring in classrooms.

## FINAL PROJECT ASSESSMENT RUBRIC

5--Completed final assignment with significant insight, clear concise writing, clear understanding and use of science and curriculum concepts. Assignment included an introduction, the curriculum, the gap analysis, big picture and a conclusion, with all subset components addressed.
4--Completed final assignment with minor errors in insight, writing or science and curriculum concepts. Assignment included an introduction, the curriculum, the gap analysis, big picture and a conclusion, with all subset components addressed.
3--Submitted final assignment with errors in writing, application or interpretation of science and curriculum concepts and/or lack of reflection/insight. Assignment included an introduction, the curriculum, the gap analysis, big picture and a conclusion, with all subset components addressed.

2--Submitted final assignment with major errors in science and/or curriculum concepts, little or no reflection, insight, little or no application of science and curriculum concepts. One or more of the following was missing or incomplete: an introduction, the curriculum, the gap analysis, big picture and a conclusion, and/or subset components
0--Did not submit homework

This final assignment is weighted for a total of 300 possible points.

The project should include
An INTRODUCTION stating the direction of your reform, theories and/or ideas that guided your work.
The CURRICULUM you developed with specific references to the Next Generation Science Standards. Be sure to specify the grade level of the curriculum and include a discussion of the learning progression continuum. This is what we studied in Weeks 2 & 3
The GAP ANALYSIS document from Week 4.
Evidence that you have considered Making a Plan, Setting Targets & Timelines and have thought BIG PICTURE about units, learning materials and assessments from Week 5.
A CONCLUSION that explains your goals for the curriculum.

Use the capitalized terms above as the section headings of your paper. Be sure to include any barriers you see to your new-found knowledge and understanding about curriculum and curriculum development.

# MSSE 575 Capstone Paper and Symposium in Science Education

## Course Description

Each Master of Science in Science Education (MSSE) student, with the cooperation of her or his graduate committee, identifies and completes a science education capstone project. Each project is designed to provide experience and information that aids our understanding of science teaching-learning or science curriculum. The capstone project topic is identified during the student's graduate program and relates to science education in the student's educational setting, linking multiple courses in the student's program of study in both the core and science content areas.

The results of each student's capstone project are summarized in a written, professional paper completed by May of the summer of planned completion of the Capstone Project. In addition, during the final summer session of the graduate program each student presents the capstone project to his/her committee, classmates, and other interested persons at the *Symposium in Science Education*.

## Learner Outcomes

**At the end of the course, students will:**

• Complete the implementation of a personalized capstone project
|• Successfully write a professional paper as approved by the project advisor and science reader
• Present the capstone project to a group of peers and other interested MSU staff and faculty
• Attend the presentations of peers, reflect in writing on the work of peers in light of his/her own practice, and provide feedback to peers on presentations attended
• Complete all participation requirement of the D2L Capstone Preparation Forum and maintain contact with project advisors

Capstone Paper Rubric Updated: May 2020

| | |
|---|---|
| OVERALL<br>(Included in 505 & 509 paper without page numbers in TOC) | Meets Expectations |
| Front matter includes cover page & table of contents. The abstract includes brief description of the project, participants and results. | Complete and thorough. |
| Formatting follows APA, capstone guidelines and ETD template. | No formatting mistakes. |
| INTRODUCTION<br>(Draft included in 505, revised in 509) | Meets Expectations |
| Clearly describes the school and teaching context. | Complete and thorough. |
| States the purpose and rationale of the project. | Purpose and rationale is complete and thorough. |

| | |
|---|---|
| Includes research questions. | Research questions include evaluation of student learning, student perceptions of the intervention, and other impacts. |
| CONCEPTUAL FRAMEWORK<br>(Completed in 505) | Meets Expectations |
| Review of the literature includes a brief introductory paragraph and conclusion. | Introduction provides an overview of the section. Conclusion briefly summarizes the key points of the literature. |
| Includes a synthesis of peer-reviewed research from multiple perspectives. | Includes more than 10 citations, at least 10 are from peer-reviewed sources. |
| Review of literature is well organized by themes. | Organized around themes with appropriate section headings and clearly connected to the purpose of the study. |
| METHODOLOGY<br>(Not assessed in 505, completed in 509) | Meets Expectations |
| Introduction | Introduction briefly summarizes the purpose of the project and paraphrases the research questions. |
| Participants | Includes information on total number of participants, demographics, and grouping information. Includes information to determine the appropriateness of a comparison group. Includes a statement that the project has been approved by IRB. |
| Intervention | Clearly described and includes appropriate tables or figures to illustrate the intervention. |
| Data Collection | Strategies are clearly described, match research questions, and include a mix of qualitative and quantitative measures. Student interviews are included. |
| Triangulation Matrix | The triangulation matrix clearly identifies multiple data sources for each research question. |
| ANALYSIS<br>(Assessed at symposium) | Meets Expectations |

| | |
|---|---|
| Claims provided for each research question. | At least one claim is clearly articulated for each research question. |
| Evidence from data supports the claims. | Evidence from multiple sources used to support each claim. |
| Qualitative data synthesized into themes. | Themes are synthesized from patterns in qualitative data. Example quotes or participant responses are used to support each theme. |
| Figures and tables used appropriately. | Figures and tables are appropriate, easy to read, and formatted correctly. |
| CLAIM EVIDENCE AND REASONING (Assessed at symposium) | Meets Expectations |
| Identifies major findings of the project. | Claims from the DATA AND ANALYSIS section is synthesized into 2-3 major findings. |
| Describes the values of the study. | Clearly describes the value of the study on teaching practices, student learning, etc |
| Describes the impact of the action research process on the researcher. | Reflection by the researcher on the impact of the project on their personal growth through the action research process. This completes the action research cycle. |