Master of Science
in Applied Science Education

Student Handbook

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Welcome to Michigan Tech University's
Master of Science Program in Applied Science Education

Department of Cognitive and Learning Sciences
Mission Statement

To prepare quality educators who enrich the lives of all learners through their application of disciplinary content, pedagogy, and technology and their dedication to life-long learning, reflection, leadership, and collaboration in the classroom, school, and community.

MS-ASE Program Overview

The Master of Science in Applied Science Education (MS-ASE) degree is designed to meet the needs of secondary science and mathematics teachers who want to: 1) improve their knowledge and application of science and/or mathematics in the classroom, 2) continue their professional development, and 3) accomplish the goals of national and state curriculum standards.

This program offers a graduate degree for in-service secondary mathematics and science teachers that promotes professional development within their discipline and addresses classroom and students' needs. Through their coursework, graduate students will develop an advanced ability to improve mathematics and science instruction in grades 6-12 by including student-centered practices contextualized in real world applications. This emphasis is a priority in both state and national standards for secondary mathematics and science education. Through their research, students will demonstrate the ability to study the effects of instructional improvements.

Admission
Admission to the MS-ASE program is selective. Applications are reviewed by at least three members of the graduate faculty in Michigan Tech's Division of Teacher Education. Applicants must meet the following minimum requirements for admission to the program:
● Bachelor's degree or equivalent from an accredited institution
● Current teaching certification for grades 6-12 mathematics or science
● Minimum of 1 year secondary school (grades 6-12) teaching experience
● Currently teaching science or mathematics
● Minimum 2.75 GPA in last two years of undergraduate work
● References that provide support for preparedness to engage in graduate study

To Apply: http://www.mtu.edu/gradschool/admissions/apply/

Advising
An advisor will be assigned to you by the Division of Teacher Education upon admission into the program. However, you are encouraged to choose your own advisor at any time. You must choose a graduate faculty member from MTU's Division of Teacher Education, who will advise you on course selection and choice of research topic, and who will supervise the research experience. The advisor is an important factor in the graduate student's timely and successful completion of the program of study. Students are encouraged to select an advisor whose work best aligns to their own interests.

Once you contact an advisor and they agree to work with you, you should complete the Advisor and Committee Recommendation form that can be found at:
http://www.mtu.edu/gradschool/administration/academics/timeline/report/.
This form needs to be submitted to the Graduate Director, Shari Stockero (stockero@mtu.edu). Although the form will ask if you want to appoint a committee, this is not required until you are preparing your research proposal.

The heart of graduate study lies in the student-advisor mentoring relationship. Most importantly, your advisor will be your primary contact as you complete your prospectus and research report. He/she will assist you in choosing and communicating with your committee, distributing drafts of your report, and scheduling meetings and your final presentation. We recognize the need for flexibility in choosing an advisor and committee. Any questions concerning choosing an advisor or committee members may be directed to the Graduate Director or to your assigned or chosen advisor.

Possible advisors from the Department of Cognitive and Learning Sciences graduate faculty are listed below. Information about their research can be found at:
http://www.mtu.edu/cls/department/faculty-staff/faculty/

Dr. Emily Dare   eadare@mtu.edu
Dr. Joshua Ellis   ellisj@mtu.edu
Dr. Kedmon Hungwe   khungwe@mtu.edu
Dr. Amy Lark   amlark@mtu.edu
Dr. Shari Stockero   stockero@mtu.edu

Graduate Committee
Each student's research project is supervised and evaluated by a graduate committee; you will select this committee in consultation with your advisor. This committee is typically chosen at the start of a student's research project (1-2 semesters before program completion). The committee consists of your advisor, who serves as chair, plus 2-3 other graduate faculty. Your committee serves as the evaluators for your oral examination and provides input and critique for your graduate research proposal and report.

Responsible Conduct of Research Requirement
All graduate students are required to complete the Basic Responsible Conduct of Research Training either by attending orientation or completing an online training course their first semester.
http://www.mtu.edu/gradschool/administration/academics/timeline/report/

Michigan Tech also requires all students who started Spring 2013 or later to complete the Advanced Responsible Conduct of Research Training by their third semester.
http://www.mtu.edu/gradschool/administration/academics/timeline/report/

Summary of Program Requirements

All work required for the MS-ASE degree (30 credits) must be completed within five calendar years of the first enrollment in the degree program. It is expected, however, that most students can complete the requirements in three years. Michigan Tech policy requires that students must be enrolled in a course each fall and spring semester until completion of your degree. If you cannot enroll in a class during a given semester for any reason, you should enroll in *UN5951: Graduate Status--Maintenance of Continuous Enrollment*. Failure to enroll in this course may result in readmission fees.

Once admitted to the program, you will establish an individual degree program in consultation with your advisor. All grades must be B (3.0 on 4.0 scale) or better in the required education core courses and applied science core courses. The student must maintain a cumulative grade point average of 3.0 or better.

The URL below shows a detailed timeline of items that you need to complete in order to obtain a MS degree at Michigan Technological University. It is your responsibility to submit all forms on time, so we recommend that you carefully review this timeline at the start and throughout your program of study. http://www.mtu.edu/gradschool/administration/academics/timeline/report/

Course Requirements

Education Core Courses, 6 credits
Offered as online courses during the academic year

ED 5700	Introduction to Education Research	2 credits
ED 5730	STEM Learning Materials	2 credits
ED 5740	Designing Education Research	2 credits

Applied Science Core Courses, 12 credits
Offered on a rotating basis as intensive on-campus 2-week institutes during the summer.
Required:
ENG 5100 The Engineering Process   4 credits

Take two of the following three:

ENG 5200 Engineering Applications in the Physical Sciences	4 credits
ENG 5300 Engineering Applications in the Earth Sciences	4 credits
ENG 5400 Engineering Applications in the Life Sciences	4 credits

Applied Internship-Educators, 3-6 credits*
ED 5800- The internship is an industry or research experience doing applied science or mathematics, or engaging in STEM or STEM education research. See additional information in the Applied Internship section of this handbook.

Graduate Research in Education, 2 credits (variable to 6 credits)
ED 5900- Enrollment in this course is mandatory at the time of completion and presentation of the report to your committee. ED 5900 can be taken at a rate of 1 credit per semester if needed in order to maintain continuous enrollment. See additional information in the Graduate Research Report section of this handbook.

Elective Science/Math Education, Mathematics and/or Science Courses, 4-7 credits*
Only credits approved by the department will be accepted. Most Michigan Tech summer professional development courses (advertised each spring on the CLS website) can be applied as electives.

> *Between the internship and elective credits, students must complete a total of 10 credits. For example, one 3-credit internship and a total of 7 elective credits would suffice.

Course Descriptions

Education Courses

ED 5700 Introduction to Education Research, 2 credits
In-depth study of education research methods pertaining to classroom practice, curriculum standards, and program evaluation. Action research methods are emphasized. Offered online during fall semester.

ED 5730 STEM Learning Materials, 2 credits
Examination of learning materials that enable inquiry-based learning as prescribed by state and national standards. Assessment techniques to measure this type of learning will be considered. Offered online during spring semester.

ED 5740 Designing Education Research, 2 credits
Course focuses on designing a research project for the MSASE program. Emphasis on motivating a study, developing research questions, conducting a literature review, and selecting appropriate research methodology. Should be taken within one year of beginning research project. Offered online during fall semester.

Applied Science Core Courses

ENG 5100 The Engineering Process, 4 credits
The course introduces the engineering problem solving and design processes. Students will learn about the engineering profession and will complete a design/build/test project. Offered as an intensive institute during the summer.

ENG 5200 Engineering Applications in the Physical Sciences, 4 credits
This course focuses on how engineers use principles from the physical sciences to solve problems and design systems. Key concepts will be linked to the Michigan Curriculum Frameworks for precollege education. Offered as an intensive institute during the summer.

ENG 5300 Engineering Applications in the Earth Sciences, 4 credits
This course focuses on how engineers use principles from the Earth sciences to solve problems and design systems. Key concepts will be linked to the Michigan Curriculum Frameworks for precollege education. Offered as an intensive institute during the summer.

ENG5400 Engineering Applications in the Life Sciences, 4 credits
This course focuses on linking engineering technologies to the biological sciences. Participants will visit labs and field sites at Michigan Tech to observe and participate in current research. Topics covered include biofuels, environmental restoration, environmental toxins, and ecosystems. Offered as an intensive institute during the summer.

Applied Internship

The internship, ED 5800, is intended to emphasize the application of engineering and science principles in a "real-world" setting. Internships can be arranged with government agencies, industries, or with university scientists or engineers engaged in research. The purpose is to observe and participate in the activities of practicing scientists and engineers and to use that understanding to inform your classroom teaching.

It is expected that the internship can, in some way, relate to your instruction. A 3-credit internship requires 120-150 hours of activity at the internship site (approximately 40 work-hours per credit-hour). Most students complete a 3-credit internship, but additional credits may be earned, for example by completing work that leads to a presentation, a report, or a publication. The additional credit will be determined with your advisor. Internships can be completed during one summer or semester, or can be spread over a longer period of time. ED 5800 can be taken at a rate of 1 credit (40 hours) per semester if needed in order to maintain continuous enrollment. You should work with your advisor to identify the internship.

Internship Prospectus. During the semester prior to enrollment in the internship, you will need to complete a prospectus outlining your intended internship. The prospectus should describe the purpose of the internship, proposed activities, and a timeline for completion. It should also identify how the internship may relate to the final Graduate Research Report or will inform your own classroom instruction. The prospectus should be approximately 1,000 words in length and should be submitted to your advisor for approval at least two months before the internship is to begin. Department permission to enroll in ED 5800 will be granted only after the prospectus is approved by your advisor.

Requirements. Interns must document their internship activities with a log or journal of activities. Submission of those documents, along with a final internship report, to their advisor at the conclusion of the internship is necessary before credit can be granted.

Graduate Research Report

The graduate research report is the culminating product of your work in the Master's Program. It should represent your ability to understand key ideas related to applied science and mathematics from the coursework and/or internship, to apply these ideas to the classroom, to measure the effectiveness of efforts to improve instruction, and to document all of this in both written and oral formats.

You must devote adequate time in the preparation and documentation of your research; remember that the product represents university scholarship in its best form. MS-ASE research report papers will become a permanent part of the MTU library collection, examples of which can be found on our website. Future students may draw on these reports for their inspiration.

Students generally enroll in ED 5900 (Graduate Research in Education) during the semesters they are working on and presenting their research. You may enroll in the course for one credit at a time (for example, in a semester you are conducting the research and the semester you present your work), but a total of two credits are needed for degree completion. ***University policy requires that you must be enrolled for tuition paying credit in the semester you present your research.***

Research Report General Process and Timeline

Degree Schedule. By the time you begin your research project, you should have submitted the Degree Schedule which can be found at:
http://www.mtu.edu/gradschool/administration/academics/forms-deadlines/

Committee Selection (if not completed previously). When you are ready to begin your research project, you should coordinate with your advisor to select 2-3 other faculty members to serve as members of your committee. Once you have identified your committee, you should submit the Advisor and Committee Recommendation form that can be found at:
http://www.mtu.edu/gradschool/administration/academics/timeline/report/.

Identifying a Problem. The first step in the research process is the selection of a problem in an area that typically involves both the application of the completed MS-ASE coursework and the MS-ASE internship. This topic should be selected alongside your advisor. Some possibilities are:
- Creation or major modification of an instructional unit based on MS-ASE coursework or the internship, classroom implementation of that unit, and subsequent evaluation to determine the success of the unit.
- Detailed analysis of student learning/misconceptions subsequent to instruction on relevant MS-ASE content or processes.
- Creation and testing of new classroom materials derived from experiences in the internship and/or MS-ASE coursework.
- Mentoring work with other teachers to help them better understand how science and engineering function. This would include evaluation of the success of such mentoring and any products of this mentoring process.

Research Proposal. After you have identified a problem, you must write a proposal that clearly communicates your plan for the report to your advisor and committee. The purpose of the proposal is to describe what you propose to accomplish in the report and how you intend to do so. Once your advisor approves your proposal, you will send the document to the members of your committee and schedule a meeting with the entire committee to discuss their recommendations or comments. You should not begin collecting data without approval from your advisor, committee, and Michigan Tech's Institutional Review Board (IRB) office, if required.

Human Subjects Approval. Most MS-ASE studies require IRB approval due to the nature of education research, which demands human subjects. Consult with your advisor about this process. This will generally be done before or at the same time your prospectus is being written. You MUST have IRB approval before collecting any classroom data.

Content. Once your advisor and committee have approved your proposal and you have IRB approval you may proceed with the project. Generally the final written report of this work will include:

- Introduction/Rationale
- Background research (literature review) that places your activities in the context of published educational research
- Research design and methods
- Presentation of your data, analysis, and findings (quantitative or qualitative)
- Discussion and interpretation of your findings
- Conclusions and implications of the research, including suggestions for further study
- References

Report Format. The report is generally 40-60 pages long (plus front matter, references and appendices). The current report guidelines (including templates) can be found at:
http://www.mtu.edu/gradschool/administration/academics/report/

Style. The required format is that of the American Psychological Association (APA) Publication Manual (see, for example, https://owl.english.purdue.edu/owl/resource/560/01/).

Research Presentation

Once your report has been approved by your advisor, you will present the research to your graduate committee in an oral examination, either in person or through videoconferencing. Faculty and students will be invited to attend.

At least two weeks prior to the examination, complete the **Pre-Defense Form,** http://www.mtu.edu/gradschool/administration/academics/forms-deadlines/ in consultation with your committee. This names your examining committee and schedules your oral examination; you should work with your advisor and committee to find a mutually agreeable time for the examination. At least two weeks prior to your oral examination, distribute readable copies of the thesis/report to your committee.

Take your **Report on Final Oral Examination form** to the exam for signatures. http://www.mtu.edu/gradschool/administration/academics/forms-deadlines/

The presentation of your research will normally take 30-45 minutes. It should include an introduction to the problem, a discussion of your methodology and how your study relates to the relevant literature, presentation of conclusions, and implications of the study. Discussion and questions will follow. Non-committee members will then be excused and the committee may have additional questions or discussion to raise with you in a closed-door session. Following this, the committee will deliberate and determine if the examination and report satisfy the requirements of

the program.

Your advisor/department may retain your Report on Final Oral Examination form for up to two weeks following the defense while you make changes as directed by the committee; research grades are not final until the form is submitted to the Graduate School Office. Note: At the time of your oral examination you must be enrolled in ED 5900.

Submission of Final Document

Make corrections to your report as indicated by your committee and to the satisfaction of your advisor. Submit an electronic copy of the final report to the Graduate School Office. A copy will also be kept in the Department of Cognitive & Learning Sciences. Please make electronic copies available to the committee if they wish to have them. For an additional charge, you may have a copy bound for your own use.

University Policies and Requirements

Continuous Enrollment

Continuous enrollment throughout the academic year (both fall and spring semesters) is required until the end of the semester in which you complete all your degree requirements. If you wish to remain active in the graduate program you must be enrolled each semester in either a regular course, the internship (ED 5800), a research course (ED 5900), or one of three courses approved to facilitate continuous enrollment (UN 5951, UN 5952, and UN 5953). Use the **Continuous Enrollment Course Form** to enroll in a UN course:
http://www.mtu.edu/gradschool/administration/academics/forms-deadlines/

If you do not maintain active status, your enrollment will be considered inactive and you will have to apply for re-admission to regain active status. There is a fee associated with re-admission.

Because the core applied science courses and many of the appropriate elective courses are offered only during the summer, the graduate school has agreed to waive the continuous enrollment course fee for up to 3 semesters for MS-ASE students. **However, you still must register for one of the three continuing enrollment courses** for each fall and spring semester that you are not enrolled in another course. For assistance or questions, contact the Division of Teacher Education.
Note: To facilitate continuous enrollment while you are working on your research project, you may enroll in ED 5900 for 1 credit per semester. Discuss this option with your advisor.

Registering and Avoiding Late Fees

Michigan Tech requires that you be registered for classes and that your tuition and fees be paid in full *five days before the beginning of each semester*. Keep informed about the deadline for registration and payment in order to avoid a bill for late payment. Students with unpaid bills will be automatically dropped from their classes and will only be able to register by contacting the Office of Student Records and Registration.

Graduate School Requirements

All graduate students should review the graduate school requirements for completion of graduate school activities and submission of key documents. It is your responsibility to meet all graduate school requirements, so this timeline should be reviewed periodically.
http://www.mtu.edu/gradschool/administration/academics/timeline/report/

Transfer Credits

A limited number of graduate course credits from other colleges or universities, taken within 5 years prior to admission to the MS-ASE program, may be accepted for graduate credit at Michigan Tech. A request for transfer credit must be made during the student's first semester in the program. Transfer of credits taken after enrollment at MTU must be approved in advance of course registration. Courses intended primarily for undergraduates are not transferable. The number of credits accepted depends on an evaluation by the department and the dean of the Graduate School. The total of transfer credits may not exceed one-half of the non-research course credits.

Credit Definition

Academic advancement by students is measured in terms of semester-hour credits or simply credits. One credit should average three to four hours of a student's time per week for one semester. Depending on course requirements, these hours may all be spent in the classroom or laboratory or may be divided between home study and class or laboratory.

Time Limit

All work required for the Master of Science degree must be completed within five calendar years of the first enrollment in the degree program.

Graduation

When you have completed your degree requirements, you can usually receive a certification letter immediately. Your transcript will indicate degree granted by the 4th week of the next semester. Your diploma will be mailed to you about 90 days after the term ends. Leave a valid address with the Graduate School.

Be sure the Graduate School and your advisor are aware of your commencement plans at the beginning of the commencement semester. If you wish to participate in the commencement ceremony, the final copy of your report must be filed with the Graduate School several weeks in advance. Please check with Graduate School Office regarding this deadline.