PH.D. PROGRAM
MATHEMATICS EDUCATION

STUDENT HANDBOOK

AY2014-2015
### TABLE OF CONTENTS

I. INTRODUCTION .................................................................................................................6

II. PURPOSE AND GOALS .....................................................................................................8
   II.A. Program Link with Campus Mission Priorities .........................................................8
   II.B. Program Purpose......................................................................................................8
   II.C. Learning Objectives: Knowledge and Skills to be Acquired by Program
         Graduates ..................................................................................................................9
   II.D. Strategies for Assessing Graduates’ Skills and Ongoing Program Quality and
         Effectiveness .............................................................................................................11
      II.D.1. Student e-Portfolios .........................................................................................11
   II.E. Benchmarks to Determine the Accomplishment of Program Goals ......................11
      II.E.1. Faculty ...............................................................................................................11
      II.E.2. Students ...........................................................................................................11
      II.E.3. Research and Scholarship ...............................................................................12
      II.E.4. Program of Study ............................................................................................12
      II.E.5. Resources ..........................................................................................................12

III. PROGRAM OF STUDY ....................................................................................................14
   III.A. Description of the Curriculum ...............................................................................14
   III.B. Academic Integrity and Subject Area Coverage ......................................................14
   III.C. Course Sequencing .................................................................................................15
      III.C.1. Year 1 ..............................................................................................................19
      III.C.2. Year 2 ..............................................................................................................19
        Semester one .............................................................................................................19
        Semester two ............................................................................................................19
      III.C.3. Qualifying Examination Process ..................................................................20
      III.C.4. Year 3 ..............................................................................................................21
        Dissertation Research ..............................................................................................22
      III.C.5. Year 4 ..............................................................................................................22
   III.D. Course Descriptions ...............................................................................................22
   III.E. Dissertation .............................................................................................................28
      III.E.1. Dissertation Committee .................................................................................29
      III.E.2. Dissertation Proposal ...................................................................................30
      III.E.3. The Dissertation ............................................................................................32
      III.E.4. Dissertation Defense ......................................................................................32
      III.E.5. Human Subjects ............................................................................................34
   III.F. Graduation Requirements .......................................................................................36

IV. FINANCIAL SUPPORT AND ASSISTANTSHIPS ..........................................................37
   IV.A. Information Concerning Financial Aid ...................................................................37
   IV.B. Research and Teaching Assistantships .................................................................37

V. ADMISSION REQUIREMENTS ....................................................................................39
I. INTRODUCTION

This handbook provides important information about the Ph.D. program in Mathematics Education. It includes policies and procedures established by and specific to the program.

It is designed to supplement the University of Massachusetts Dartmouth (UMassD) Graduate Catalog that contains material related to student rights, academic policies, registration, tuition, fees, financial aid, campus facilities, and course offerings. A full listing of UMassD graduate requirements can be found in the Graduate Catalog. Students are responsible for being familiar with these requirements. Rules and procedures pertaining to the code of student conduct, confidentiality of academic records, resolution of problems, human subjects protection, faculty conduct, and student governance are not reproduced in this handbook.

This handbook is not a contract. While every effort is made to ensure the accuracy of the information in this handbook, the program reserves the right to make changes.
II. PURPOSE AND GOALS

II.A. Program Link with Campus Mission Priorities

The goals and purposes of the Ph.D. in Mathematics Education are firmly in line with the mission of the University: “The University of Massachusetts Dartmouth distinguishes itself as a vibrant public university actively engaged in personalized teaching and innovative research, and acting as an intellectual catalyst for regional and global economic, social, and cultural development.” It advances the university’s mission by creating an environment to conduct research through collaboration with industry, research and academic institutions, and practitioners of innovative mathematics education research at the national and international level, and by using best teaching practices in educating its students.

II.B. Program Purpose

The primary aim of the doctoral program is to produce stewards of the discipline, as defined by The Carnegie Foundation for the Advancement of Teaching (see http://classifications.carnegiefoundation.org/) in its Initiative on the Doctorate: “to educate and prepare those to whom we can entrust the vigor, quality, and integrity of the field.” (Walker, Golde, Jones, Bueschel & Hutchings 2008, p. 2)\(^1\) Moreover, its explicit interdisciplinary approach, that has deep connections nationally and internationally and reflects cutting-edge technological innovations in program delivery, is intended to address specific challenges identified by the Carnegie Initiative (Walker et al., 2008). These challenges involve new technologies in “altering and accelerating the way new knowledge is shared and developed” (p. 2), a vision of a global marketplace for scholarship, and recognition that “much of the most important, path-breaking intellectual work going on today occurs in the borderlands between fields, blurring boundaries and challenging traditional disciplinary definitions” (p. 2). Our program pays particular attention to how curricular and research components can be integrated systematically to connect students’ learning to faculty scholarship and thereby provide authentic learning experiences that produce graduates with strong research skills. We are guided by a metaphor of apprenticeship as a “theory of learning and a set of practices that are widely relevant” (p. 91); the activity of apprenticing encompasses and strengthens all curricular and research components of the doctoral program.

The Ph.D. in Mathematics Education builds on the success of existing research programs at UMass Dartmouth, particularly those situated in the Kaput Center for Research and Innovation in STEM Education (hereafter noted as the Kaput Center). Our program and the Kaput Center share common goals and approaches. Much more than a collection of projects, the Kaput Center is an intellectual community that fosters “intellectual risk taking, creativity, and entrepreneurship” (see Walker et al., 2008, p. 11) and, in the spirit of the Carnegie Initiative’s formation of scholars, offers incubation through which a doctoral program can provide “real partnerships between faculty and students, habits of respect for and interest in one another’s work, and the lively exchange of ideas in which new knowledge is formed and transformed” (p. 11).

The innovative research of the Math Ed faculty within the Kaput Center provides core strength for the program and establishes its uniqueness in comparison with other doctoral programs in the Commonwealth of Massachusetts and beyond.

The research interests of the Math Ed faculty cover grades K-20 and a wide range of contemporary issues in mathematics education: Algebraic thinking grades K-20, improving mathematics teaching through district-wide collaboration, integrating technological innovations (e.g., wireless connectivity and haptic devices) in K-12 mathematics classrooms and its impact on participation and motivation, developing proof-based reasoning from elementary through undergraduate classrooms, undergraduate mathematics education especially in Calculus, Analysis and Geometry, evolution of symbol use and symbolic thinking in mathematics, theories of mathematical learning and teaching from multi-disciplinary perspectives, teacher knowledge and professional development in the middle grades, efficacy studies and diffusion of innovation. A majority of these interests are being explored through projects funded by the National Science Foundation and the U.S. Department of Education.

Mathematics education is critical in a global economy for which understanding the technical sciences is an essential currency. The doctoral program in Mathematics Education at UMass Dartmouth offers innovative answers to critical needs in teaching and learning mathematics by providing future mathematics educators with the educational infrastructure and advanced research training to become leaders in the field of mathematics education.

II.C. Learning Objectives: Knowledge and Skills to be Developed by Program Graduates
The program is designed to attract and educate students of diverse backgrounds for employment in a variety of educational and scientific institutions, industries, and federal agencies. It focuses on interdisciplinary perspectives within mathematics education research. Our graduates will be highly competitive in today’s marketplace for educational scholars within a wide range of employment classifications. Furthermore, our Ph.D. students and candidates will enjoy multiple opportunities for enhancing traditional scholarly training through participation in such practical academic endeavors as publishing and organizing lectures and colloquia.

The doctoral program will provide students with the knowledge and skills to

a. re-construct, appropriate, and develop knowledge of the field of mathematics education;

b. explore different approaches that emerge from the study of the research literature in the field of mathematics education and related disciplines; and

c. write original research that represents their own contribution to knowledge.

Graduates of the program will produce original research reflecting deep social and cultural commitments. It is expected that they will become independent, creative thinkers. The Ph.D. program is designed to build the intellectual skills that our graduates will need to utilize new and future technologies and communication infrastructures and to develop these into knowledge environments. In so doing, graduates will formulate and design solutions to complex educational problems in our world today. The PhD program aims to offer a global education.

The Ph.D. in Mathematics Education is also designed to create a focused track of study over 4 years to build skills in the following critical areas:

a. the nature of scientific inquiry in mathematics education and related disciplines;

b. appropriate methods of research design regarding data collection and analysis, particularly focused on contemporary qualitative and quantitative methods (e.g., HLM, discourse analysis, micro-analytical video analysis)

c. the production of new researchable questions, especially on the boundaries of particular disciplines (e.g., learning sciences), and

d. the ability to design and conduct a research study with unique findings to advance the field of mathematics education.

This experience will involve a continual and iterative research process beginning in the first year of study that culminates in a Ph.D. dissertation at the end of 4 years.
II.D. Strategies for Assessing Graduates’ Skills and Ongoing Program Quality and Effectiveness

The program employs the following three strategies to ensure effective delivery:

a. Student e-Portfolios;
b. Faculty Evaluation and Assessment Procedures; and
c. Internal and External Advisory Councils;

II.D.1. Student e-Portfolios

Students will construct e-Portfolios of their learning experiences across the course of the program as determined by the Graduate Committee. Students will upload assessments of individual courses and end-of-year program evaluations based on expected learning outcomes of the program. Students will also upload extramural activities such as papers or presentations that they have developed with or without the support of faculty, as well as other artifacts that they count as evidence of their learning. Faculty, the Chair of the department, the Dean of College of Arts and Sciences, the Associate Provost for Graduate Studies and other evaluators, will assess the resulting reflections and artifacts.

II.E. Benchmarks to Determine the Accomplishment of Program Goals

Benchmarks designed to determine accomplishment of program goals are designed around 5 key areas: Faculty; Students; Research; Program of Study; and Resources. Indicators for each of these areas include the following:

II.E.1. Faculty

- Faculty members meet the requirement of the institution for graduate education with all faculty members holding a relevant doctorate in STEM Education.
- Faculty members conceptualize and implement productive programs of research and scholarship.
- Faculty members design and deliver high quality instruction synergistically linked to current research as well as their own particular research programs.
- Faculty members create an environment in which mentoring, socialization of students, and the existence of a community of scholars is evident.

II.E.2. Students

- Students are selected from a pool of highly qualified applicants in accordance with admission criteria consistent with those of the institution.
- Students actively develop research skills and knowledge of the field to prepare them as “stewards of the discipline.”
- Students develop an expertise of scholarship through participation in authentic learning experiences.
II.E.3. Research and Scholarship
- Research is an explicit component of the mission of the institution and a core feature of the program design.
- Strong research programs, developed over a number of years and now facilitated through the Kaput Center, exist to support the goals of the program.
- Faculty will maintain a level of scholarly productivity commensurate with the needs of the program.

II.E.4. Program of Study
- The program of study reflects the interdisciplinary nature of mathematics education, drawing on multiple fields of knowledge to strengthen scholarship.
- Core content is provided through an approach that integrates curriculum and research activity.
- Student scholarship is developed through progressive research experiences based on collaborations with faculty at the host institution as well as partner institutions.

II.E.5. Resources
- Faculty resources will be added to maintain the program and accomplish its goals.
- Technical and support services are available and accessible to faculty and students.
- Library and database resources are available to support the program.
- Space and equipment (e.g., computers; seminar rooms; study and social areas) are available to students.

Data on these indicators will be periodically collected and reviewed to assess needs for program improvement.
III. PROGRAM OF STUDY

III.A. Description of the Curriculum

The program includes a series of foundational required courses supplemented by specific electives. In particular, students will complete 72 credits that include 18 credits of introductory coursework to develop their knowledge of research tools, methodologies and theories in mathematics education research, 18 credits of preparatory coursework to refine and focus students’ understanding of the research process and theory building, and 36 hours of advanced doctoral coursework including dissertation research (24 hours).

The Ph.D. in Mathematics Education falls into three distinct phases:
1. Introduction Phase for introducing mathematics education research,
2. Preparation Phase for advancement to advanced doctoral status, and
3. Production Phase of advanced courses and final dissertation.

At an appropriate level, all courses feature authentic learning experiences in research institutions and projects, and an interactive thinking/writing process to develop cutting-edge research and discovery as part of the student’s experience. Research scholarship thus pervades the curriculum, uniting theory and practice. Technology is also embedded throughout: wherever possible, courses will be blended with a variety of delivery methods, including on-line video seminars, iTunesU/Podcasting, and active use of Blogs and Wikis, as part of the regular mode of sharing and learning content and expressing evolving ideas in and around coursework. A central Blog/Wiki will be available for students to interact and share their ongoing work outside of classes.

Because of the program’s central focus on the development of research scholarship, specific attention is given to the development of research ethics, including appropriate acknowledgement of sources, proper protocols for conducting research on human subjects, understanding the process of Institutional Review Board (IRB) approval and institutional certification for conducting research (i.e., CITI certification).

III.B. Academic Integrity and Subject Area Coverage

Academic integrity of the program is maintained through the administration of a strong, connected program of coursework and research experiences that reflect the demands of the field of mathematics education. In particular, the program includes relevant, focused coursework that addresses foundational issues in mathematics education. A focus on the development of research skills and practices is threaded
throughout this coursework to support students’ transition from the practice of research skills with supervision to independent mastery of research scholarship. In particular, students will be mentored through the Introductory and Preparatory Phases of the program (Years 1 and 2) in the practices of research and will demonstrate their skills in successful completion of the qualifying examination. Years 3 and 4 are designed to support increasing autonomy in students’ ability to design and implement a research study, culminating in the dissertation.

The program’s faculty are leaders in the field of mathematics education, and through their established research programs and international connections with researchers through the Kaput Center present a program that not only addresses contemporary issues but also relevant research paradigms and methodologies appropriate for complex questions in the field today.

III.C. Course Sequencing

Figure 1 offers a schematic outline of how the program can be completed by a full-time student in 4 years. For each element, we describe the individual components and rationale. In summary, students will complete 72 credits that include:

a. 18 credits of introductory coursework to develop students’ knowledge of research tools, methodologies and theories;
b. 18 credits of preparatory coursework to refine and focus students’ understanding of the research process; and
c. 36 hours of doctoral work (12 hours of doctoral coursework and 24 hours of dissertation research advising to support and guide the production of the final dissertation).

While the program is intended to be a four-year program students are permitted to complete their requirements in up to six years. Requests for extensions will be considered on a case-by-case basis consistent with the rules and regulations for graduate study at UMass Dartmouth.
<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Introduction)</td>
<td>Introduction to Qualitative Methods (MTE 650) – 3 cr.</td>
<td>Theories of Mathematical Learning (MTE 653) – 3 cr.</td>
</tr>
<tr>
<td></td>
<td>Introduction to Quantitative Methods (MTE 651) – 3 cr.</td>
<td>Research Seminar – Capstone Course (MTE 654) – 3 cr.</td>
</tr>
<tr>
<td>Total</td>
<td>9 credits</td>
<td>9 credits</td>
</tr>
<tr>
<td>2 (Preparation)</td>
<td>3 Topics in Mathematics Education Research (MTE 660-679) – 9 cr.</td>
<td>Research Seminar – Capstone Course (MTE 681) – 3 cr.</td>
</tr>
<tr>
<td></td>
<td>This can include 6 credits of MTE 680 (Internship)</td>
<td>Developing Research Skills Pt. 2 (MTE 682) – 3 cr.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualifying Exams</td>
</tr>
<tr>
<td></td>
<td>Authentic Learning - Internship (MTE680) – 3-9 cr.</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9 credits (average)</td>
<td>9 credits (average)</td>
</tr>
<tr>
<td>3 (Production)</td>
<td>2 Advanced Doctoral Courses from MTE 750-769 – 6 cr.</td>
<td>2 Advanced Doctoral Courses from MTE 750-769 – 6 cr.</td>
</tr>
<tr>
<td></td>
<td>Select Dissertation Committee Chair</td>
<td>Dissertation Proposal Defense (end-of-year)</td>
</tr>
<tr>
<td>Total</td>
<td>9 credits</td>
<td>9 credits</td>
</tr>
<tr>
<td></td>
<td>Final Oral Defense (end-of-year)</td>
<td>Final Oral Defense (end-of-year)</td>
</tr>
<tr>
<td>Total</td>
<td>9 credits</td>
<td>9 credits</td>
</tr>
<tr>
<td>Grand Total</td>
<td>36 credits</td>
<td>36 credits</td>
</tr>
</tbody>
</table>
Figure 1. Program of study

Year 1 requires core courses to be successfully completed; there is no variation in the offerings.

Year 2 allows for some choice of topics within the courses outlined below (subject to courses offered). Additionally, there is some flexibility in when students can take their internship (MTE 680) in Year 2. In particular, the internship can be completed in the Fall or Spring semester, extended throughout Fall and Spring and/or summer, or entirely during the summer. Decisions about this aspect of the internship will depend on the nature of the internship, including particularly whether the student wants to travel out-of-state or be part of an International Exchange project or whether the internship is best facilitated by a long-term field experience. An essential criterion is that the internship reflects at least a compulsory 3-credit course extending to a 6-credit option (i.e., in addition counts for one elective) or 9-credit option (i.e., in addition counts as 2 electives). The 9-credit option will be allowed in exceptional circumstances where the student has a strong background in research prior to beginning the program or has shown a promising research record as a doctoral student. Internships will be flexibly scheduled on a case-by-case basis in coordination with the faculty advisor and Department Chair, with the representative course (MTE 680) being offered all year round. The variable course option will be designated by different course sections, i.e., MTE 680-01 = 3 credit option, MTE 680-02 = 6 credit option and MTE 680-03 = 9 credit option.

An extended internship (MTE 780) can be taken in Years 3-4 as advanced doctoral coursework with the same options of 3-9 credits (i.e., count as 1-3 courses). Students who wish to follow this track are expected to closely align their dissertation project with the purpose of the internship (e.g., while working at a Center elsewhere they are collecting data for the dissertation). Approval of such an internship is at the discretion of the Graduate Program Director and Department Chair.

As part of the required coursework (specifically, MTE 655, 682 and, depending on the student’s focus, MTE 680), students will be expected to design and complete a preliminary research study during Years 1 and 2. This requirement will necessarily relate closely to content and skills addressed in coursework in Years 1 and 2, which will be part of the qualifiers. This is likely to be part of a research project conducted at the Kaput Center or through one of its associates, or students may start their own research project in educational settings (informal and formal). The study should reflect the student’s synthesis of knowledge gleaned from coursework during the Introductory and Preparatory phases and concerning the nature and process of research, the use of
appropriate methodologies, the application of relevant theories of learning, and the development of scholarly writing skills.

Upon satisfactory completion of the 36 credits designated in Years 1 and 2, students are eligible to take the qualifying examination to enter the Production Phase of the doctoral program. Students may apply for a Masters of Science (MS) degree through the University Registrar’s office upon successful completion of the coursework for Years 1 and 2. Successful completion of coursework requires that the student have a cumulative GPA not less than 3.0. Students who fail to pass the qualifying examinations are offered one opportunity for remediation. Following the successful completion of the qualifying examination for the Preparation Phase, along with the successful completion of any additional coursework to address deficiencies identified in the student’s admission to the program, the student will start advanced doctoral coursework and the dissertation.

Students who enter the program with a bachelor’s degree will complete the entire course sequence. “Advanced Standing” can be given to applicants who enter with an advanced degree in an appropriate background (e.g., MS/MA in Mathematics Education, Mathematics, or a related social or technical science). Advanced Standing may exempt the student from up to 24 credits of first and second year courses. This decision is based upon sufficient evidence of courses or experiences completed prior to applying to the program. As such, a designation of Advanced Standing or waiver of courses within Years 1 and 2 is rare. A decision to recommend Advanced Standing or to require additional coursework to address background deficiencies is made along with other admissions decisions by the Graduate Committee. Advanced Standing must be approved by the Graduate Program Director, the Department Chair, the Dean of the College of Arts and Sciences, and the Associate Provost for Graduate Studies.

Advising is important, and students interrelate closely with faculty at all levels of study. Students are assigned to or may select a faculty member in the first 2 years to advise them on their research experiences that culminate in the qualifying examination. More than one faculty member can thus serve an introductory student, and the faculty member(s) may be different than the student’s Dissertation Committee Chair selected for the Production phase for Years 3-4. Work in the first two years will develop a student’s potential to conduct research and the skills necessary to complete his/her final dissertation. This is assessed in the qualifying examination. At the Production stage in Years 3-4, a student will choose one faculty member as his/her Dissertation Committee

---

1 Additionally, students with provisional acceptance into the program will also be required to complete any additional coursework, identified in their official notification of admission, prior to entering the Production Phase.
Chair for the remainder of the program (this faculty member will be the instructor of record for Dissertation Research MTE 772 to that student).

The following courses will be required for completion of the program.

**III.C.1. Year 1**

*6 core requirements*

- MTE 650 – Introduction to Qualitative Methods
- MTE 651 – Introduction to Quantitative Methods
- MTE 652 – Introduction to Mathematics Education Research
- MTE 653 – Theories of Mathematical Learning
- MTE 654 – Research Seminar
- MTE 655 – Developing Research Skills Part 1

**III.C.2. Year 2**

**Semester one**

*Students will be offered three topics courses from the following list*

- MTE 615 – Interdisciplinary Colloquium Series in STEM Education Part I
- MTE 661 – Research on Mathematics Teacher Education Part 1
- MTE 662 – Research on Mathematics Teacher Education Part 2
- MTE 663 – Developing & Implementing STEM Curriculum
- MTE 666 – Frameworks for Research Analysis
- MTE 667 – Research in Elementary Grade Mathematics
- MTE 669 – Research in Undergraduate Mathematics Education
- MTE 670 – Development of Theory
- MTE 690 – Special Topics

**Semester two**

- MTE 680 – Authentic Learning (Internship)
- MTE 681 – Research Seminar
- MTE 682 – Developing Research Skills Part 2

The program will offer two core mathematics courses to students admitted conditionally based on a deficiency in their mathematical preparation.

- MTE 520 – Advanced Mathematical Thinking Part I
- MTE 521 – Advanced Mathematical Thinking Part II
These courses focus on the development of smart mathematical knowledge that develops students’ understanding of the use and application of this knowledge in mathematics education. The courses will address a K-20 approach to the following essential topics in mathematics:

(1) Algebraic Thinking
(2) Mathematics of Change and Variation
(3) Mathematical Proof
(4) Geometric Reasoning
(5) Discrete Structures
(6) Number Theory
(7) Mathematical Problem Solving

Students admitted conditionally based on a mathematics deficiency will be required to take one or both of these courses in addition to existing program course requirements.

Additionally, students who have no K-16 teaching experience will be advised to complete a teaching internship.

Any identified deficiencies regarding admission requirements will be met prior to entering the advanced doctoral phase of the program (Production Phase).

III.C.3. Qualifying Examination Process
The Qualifying Examination Process should demonstrate the skill set that the student has developed through the Introductory and Preparatory Phases of the doctoral program.

Students are eligible for the qualifying examination process upon satisfactory completion of the 36 credit hours of coursework (with no incomplete grades) designated for Years 1 and 2. The process involves compiling the following portfolio of work and submitting it to the Graduate Committee for evaluation:

1. submission of an 8000-word paper, based on the student’s research study completed during Years 1 and/or 2, to the Graduate Committee for evaluation along the lines of the skill sets developed in the student’s coursework;
2. submission of a proposal to present a research paper (not poster or discussion group) to a national or international conference or submission of a paper to a journal for publication;
3. an oral presentation of the student’s research study (e.g. in the Kaput Center or
department seminar series); and
4. satisfactory evaluation in a final examination. This examination is comprised of a set of questions from five key areas: Theory, Methodology, Learning, Teaching, and Electives. Students will answer a subset of the candidate questions within a 48-hour window.

Upon approval of successful completion of these criteria by the Graduate Committee, the Graduate Program Director certifies to the Office of Graduate Studies and Admissions that the student has satisfactorily completed the Qualifying Examination.

Successful completion of Qualifying Examination\(^3\) admits the student to candidacy for the Ph.D. degree and enables the student to begin formal work on the dissertation.

**III.C.4. Year 3**

During the Production Phase, students will continue their doctoral training through advanced coursework. In addition, they will conduct Dissertation Research with a faculty member. During Year 3, dissertation research is expected to focus on conducting a full literature review, framing the main issues and guiding points of the study, and collecting research data. It is expected that the student will also complete the preliminary writing phase of the dissertation in preparation for the proposal defense at the end of Year 3. It is expected that the student will keep the selected faculty advisor through the completion of the Ph.D. Dissertation during Years 3 & 4. During the third year, the student will identify a Dissertation defense committee and chair (assumed to be their main faculty advisor), and complete the defense of the Dissertation proposal at the end of Year 3 after all coursework is completed. (See also section III.E. Dissertation).

During Year 3, students will complete 4 advanced doctoral courses from the following list:

- MTE 715 – Interdisciplinary Colloquium Series in STEM Education Part II
- MTE 750 – Analyzing Participation and Engagement in Mathematics Classrooms
- MTE 751 – Contemporary Issues in K-8 Classrooms
- MTE 752 – Thinking and Learning in Mathematics/Science
- MTE 753 – Research on Proof and Reasoning in Mathematics
- MTE 757 – STEM Education Reform in a Political Context
- MTE 770 – Advanced Authentic Learning (Internship)

\(^3\) Students with provisional admission into the program will be expected to have completed any specified additional preparation before advancing to the Production Phase.
MTE 795 – Independent Study
MTE 796 – Directed Study

Dissertation Research
While many students’ dissertation research will be supervised by a member of the core faculty from the Department of STEM Education & Teacher Development, faculty from other departments or institutions can be included as members of the dissertation committees (if approved by the Graduate Program Director in consultation with the PhD Committee, the Department Chair and the Dean of the School). The use of an external faculty member can provide an authentic learning experience that converges lines of research and coursework to enrich the project and experience of the student.

A student’s dissertation is expected but not required to build on his/her work completed in the preliminary years, relying on research skills developed particularly in courses MTE 655/682 (Developing Research Skills Parts 1 & 2) and research projects completed in MTE 654/681 (Research Seminar 1 & 2).

MTE 772 (Dissertation Research) permits a student to receive 6 credits of instruction to assist in the completion of his or her research study and the writing of the final dissertation.

III.C.5. Year 4
Students will be expected to work primarily on their final dissertation, through registration in MTE 772 (Dissertation Research). This course permits a student to receive 18 credits of instruction to assist in the completion of his or her research study and the writing of the final dissertation. Students will also complete any remaining required advanced doctoral courses if they were not completed in Year 3.

The final oral defense examination will be completed at the end of Year 4 on submission of the final dissertation.

III.D. Course Descriptions
All courses are 3 credits each unless otherwise stated.

MTE 615 – Interdisciplinary Colloquium Series in STEM Education I
Presentations made in the Kaput Center’s Interdisciplinary Colloquium Series provide a wide variety of perspectives on foundational issues in educational research. Over the
course of one year a coherent synthesis of the themes presented in these talks and the related scholarly work of each speaker will be developed.

**MTE 650 – Introduction to Qualitative Methods**
This course examines qualitative research methods applied to mathematics education research. Students will learn about qualitative research design, including techniques for collecting and analyzing qualitative data, and ethical considerations for conducting research with human subjects. Students will develop a researchable topic in mathematics education, select and implement an appropriate qualitative research design, and analyze and interpret qualitative data. Results of the project will be written in a final report using APA format and will be presented orally.

**MTE 651 – Introduction to Quantitative Methods**
This course integrates research design, data analysis, data interpretation, and APA format report writing across the two dominant paradigms in contemporary psychology. The course includes the use of the SPSS statistical software for univariate parametric and some non-parametric models. The course contains a strong experiential component to prepare students for thesis writing.

**MTE 652 – Introduction to Mathematics Education Research**
This course will introduce Ph.D. students to fundamental problems pertaining to mathematics education that have been instrumental to constitute and define it as a research field. Students will be introduced to important ideas in the field and why these ideas are significant in defining the activity of research in mathematics education. The study of how these theoretical and pragmatic problems have been approached by a community of researchers will help students understand, in broad terms, the nature of research in the field and, at the same time, offer a panorama of new areas of inquiry that are presently being transformed into research programs.

**MTE 653 – Theories of Mathematical Learning**
This course will examine contemporary theories of learning psychologies and their applications to research in mathematics education. The course is intended to help students understand ways of knowing and how this drives research. Particular attention will be given to enabling students to situate their research in relevant theoretical frameworks and understand the implications of theoretical frameworks on research design.

**MTE 654 – Research Seminar**
This is a capstone course designed to synthesize critical research processes, theories of learning, and current research themes in mathematics education to which students are
introduced in their first year. From this synthesis, students are expected to select and refine a researchable topic for their pilot study to be conducted during the Introductory and Preparatory phases of the doctoral program (Years 1 and 2). The course will also give explicit attention to ethics in research, including appropriate forms of acknowledgment in the use of existing research and proper protocols and procedures for conducting research on human subjects.

**MTE 655 – Developing Research Skills Part 1**
This course will focus on building the skill set necessary to conduct research for the dissertation, most likely focused on background fundamental issues in mathematics education research. It will build exploration, analysis and writing skills. Students will learn the skills to give shape to their thinking. In particular, during this course, students will be expected to identify a problem for which they will conduct pre-pilot study in preparation for the pilot study to be conducted during the Introductory and Preparatory phases of the program.

**MTE 661 – Research on Mathematics Teacher Education Part 1**
This course will introduce students to research on pre-service and in-service teacher learning and teacher education. It will critically examine the research base concerning contemporary learning theories and their application to teacher learning. It will also study current effective forms of teacher professional development and pre-service education and the research supporting these approaches. Students will critique competitive grants funding research on teacher learning and professional development as a way to learn about current trends and to develop grant-writing skills.

**MTE 662 – Research on Mathematics Teacher Education Part 2**
This course extends the concepts studied in MTE661 through applied research in an authentic teacher learning setting. To initiate this, students will write a mock grant proposal to conduct original research with teachers. The proposal should reflect clear connections to the research base studied in MTE661 as well as the research skills being developed during Years 1 and 2. It will be refined through critique by student review panels prior to implementation of the study. After implementation of the study, students will analyze their findings, prepare a written analysis for peer review, and present their findings to the class.

**MTE 663 – Developing & Implementing STEM Curriculum**
This course focuses on analyzing grades K-16 curriculum, intentions for students’ learning outcomes, associated pedagogical styles and integration. Students will examine existing reform and basal curricula texts, and the development of new activities and activity structures that replace or transform existing texts based upon present
mathematics education theory and new technologies. Students will also be introduced
to issues behind curricula reform and integration focusing on fidelity of
implementation.

**MTE 666 – Frameworks for Research Analysis**
This course focuses on the development of a specific set of research tools relevant to the
study of mathematical reasoning in a variety of contexts, including the analysis of
mathematical discourse, gesture, flow of interaction, and learning outcomes such as
pre-post tests of content. Attention will be spent connecting research methods to
theoretical frameworks and practical outcomes of analysis. Students will be expected to
produce a specific analysis of some classroom data.

**MTE 667 – Research in Elementary Grade Mathematics**
This course examines current research on issues of teaching and learning elementary
grades mathematics. It will focus on central research questions and findings in the field,
research designs framing this work, and relevant theories of learning and their
application in the research base. While particular focus will be given to early algebraic
thinking, the course will overview significant areas of research and their connections to
current educational reforms. In addition, students will be expected to conduct a
research project on children’s mathematical thinking in a specific area of research (e.g.,
early algebra, fractional thinking). The design, implementation, and analysis of the
study should reflect the student’s understanding of core components of research being
developed in Years 1 and 2.

**MTE 669 – Research in Undergraduate Mathematics Education**
This course examines current research on issues of teaching and learning
undergraduate mathematics. It will focus on central research questions and findings in
the field, research designs framing this work, and relevant theories of learning and their
application in the research base. While particular focus will be given to advanced
mathematical thinking, the course will overview significant areas of research and their
connections to current educational reforms. In addition, participants in the course will
be expected to conduct a research project on undergraduate student’s mathematical
thinking in a specific area of research. The design, implementation, and analysis of the
study should reflect the student’s understanding of core components of research being
developed in Years 1 and 2.

**MTE 670 – Development of Theory**
This course will enable students to understand a theory as an artifact to generate
interpretations of research problems and their data. It intends to develop the skills
necessary to delineate answers to carefully chosen aspects of research questions, from
alternative theoretical views with respect to the one originally used to investigate the problem in question. The course will offer students the opportunity to display their actual understanding of the main streams of the discipline as well as some basic methods and techniques conducive to research.

**MTE 680 – Authentic Learning (Internship)**
This course will be conducted at the Kaput Center or at a national or international research institution. Students will be mentored by an Adjunct Research Associate at the host institute to develop research skills through activities such as data collection and analysis and to enhance awareness of the complexities of educational research. Host institutions will provide a “mentor” who is an Adjunct Research Associate of the Kaput Center. The operation of the Kaput Center assures this would be a suitable mentor to apprentice a student in the field of research. It is expected that, while the course would be the administrative responsibility of a Math Ed faculty member, the mentor at the affiliated institution would be the main instructor. An assigned Math Ed faculty member, as the instructor of record, will monitor the progress of the student through consultation with the mentor. The time spent by a student at the mentoring institute will be negotiated based on the geographical location and will be consistent with a 3 credit-hour course.

**MTE 681 – Research Seminar**
This is a second capstone course aimed at preparing a student for their qualifying exams by synthesizing the lessons learned by the authentic learning experience and focusing research questions in preparation for their advanced coursework. In addition, the course will focus on formal writing both for grant applications, scholarly articles and the dissertation.

**MTE 682 – Developing Research Skills Part 2**
This course aims to synthesize prior coursework/research experience, focusing on methods and research questions, in preparation for students’ main research project in Year 3. It also focuses on the development of skills to defend one’s work and preparation for the written component of the student’s qualifying exams. Students will develop essential experience/skills in designing research, reading research critically, writing scholarly work, and developing proposals for research funding. Students will give oral presentations on their research topics and plan of study for peer review.

**MTE 690 – Special Topics**
Course focuses on a topic not included in the regular offerings of the department. The specific topic is stated when the course is scheduled. May be repeated with change of
content. This course satisfies 600-level Elective requirements for the Mathematics Education Ph.D.

**MTE 715 - Interdisciplinary Colloquium Series in STEM Education II**

Presentations made in the Kaput Center’s Interdisciplinary Colloquium Series provide a wide variety of perspectives on foundational issues in educational research. Over the course of one year a coherent synthesis of the themes presented in these talks and the related scholarly work of each speaker will be developed.

**MTE 750 – Participation & Motivation in the Classroom**

Various models used to analyze how people participate in classrooms and the intersecting role of motivation. We will draw on the field of linguistics in particular linguistic anthropology, gesture and discourse analysis to categorize how students and teachers demonstrate their participation and motivation through speech and physical actions.

**MTE 751 – Contemporary Issues in K-8 Classrooms**

Students will study recent advances in the teaching and learning of mathematics to elementary and middle school students. Areas to be covered will typically include: development of children’s mathematical reasoning in K-8; current research in the development of children’s algebraic thinking; recent research on ratio, proportion and fractions learning; student and teacher understanding of geometry and measurement; technology use in elementary mathematics; teacher professional development; and school implementation and effecting policy.

**MTE 752 – Thinking and Learning in Mathematics/Science**

Advanced doctoral course on deep examination of particular concepts in mathematics/science. The course focuses on mathematics/science content, epistemological obstacles related to learning, and the pedagogical strategies to enhance student thinking about concepts. Students will be deeply engaged in content and situating their thinking through the analysis and synthesis of existing literature on learning. Students will conduct or participate in a project by exploring and synthesizing the epistemological development, the research on student thinking, and effective pedagogical approaches about a given mathematics/science concept.

**MTE 753 – Research on Proof and Reasoning in Mathematics**

This course will critically examine the research base on proof and reasoning across grades K-16. It will explore epistemological issues of the nature of proof and the role and meaning of proof as it evolves across grades K-16 and as it has emerged historically. To support the ongoing development of critical reading and scholarly
writing skills, the student will write a synthesis of the research base focusing on a specific aspect of proof and reasoning and will present their synthesis orally.

**MTE 757 – STEM Education Reform in a Political Context**  
Advanced doctoral course on the influence of political agendas and the design and implementation of curricula. Areas to be covered will typically include: the development of the content standards; historical perspectives on STEM education; and politically motivated reports that have shaped mathematics and science education.

**MTE 770 – Advanced Authentic Learning (Internship)**  
An internship conducted at a local research institution, the Kaput Center or at an institution out of state or internationally. Students will be mentored by an adjunct research associate at the host institute to develop their research skills in the field including data collection and analysis, and enhancing their awareness of the complexities of educational research.

**MTE 772 – Dissertation Research (24 credits)**  
This course sequence focuses on conducting a full literature review, framing the main issues and guiding points of the student’s dissertation research, and collecting appropriate research data. It is expected that the student will also complete the preliminary writing phase of the dissertation in preparation for the proposal defense at the end of Year 3. The preliminary writing phase (essentially, the first several chapters of the dissertation) will focus on theoretical perspectives, relevant research framing the study, and preliminary data analysis from the student’s fieldwork.

**MTE 795 – Independent Study**  
Study under the supervision of a faculty member in an area not otherwise part of the discipline’s course offerings. Conditions and hours to be arranged.

**MTE 796 – Directed Study**  
Study under the supervision of a faculty member in an area covered in a regular course not currently being offered. Conditions and hours to be arranged.

**III.E. Dissertation**  
The Ph.D. dissertation is an original body of work in which the candidate demonstrates an in-depth understanding of a substantive area in mathematics education. The dissertation demonstrates the candidate’s ability to effectively incorporate theoretical, conceptual, and methodological tools in a line of inquiry that produces a new, scholarly contribution to research in mathematics education.
While dissertation planning begins early in the Ph.D. Program, normally the dissertation process begins after the student has passed the qualifying examination and has been admitted to the Production Phase.

**III.E.1. Dissertation Committee**

The Ph.D. candidate selects a dissertation committee and chair. The candidate must submit the name of the Dissertation Committee Chair to the Graduate Program Director and the Ph.D. Committee for review and approval upon completion of the qualifying examination. The candidate, in consultation with the Dissertation Committee Chair, selects the committee members, elicits their willingness to serve, and submits their names to the Graduate Program Director and the Ph.D. Committee prior to completion of the first semester of coursework after completing the Qualifying Exam (Year 3, Semester 1). The committee must have a minimum of three (3) and no more than five (5) members. At least two (2) members should be faculty from the Ph.D. Committee in the Department of STEM Education & Teacher Development.

The Dissertation Committee Chair is a member of the University of Massachusetts Dartmouth Department of STEM Ed & Teacher Development who serves as the research mentor of the candidate. A faculty member may serve as an advisor on a student’s dissertation study as long as she or he:

- Is full-time faculty in the Department of STEM Education and Teacher Development or otherwise affiliated with the Department;
- Holds a terminal degree in a field related to STEM Education; and
- Is research active within the standards of the department.

The Chair guides the candidate in research and funding processes as well as University protocols for research and scholarship. The Dissertation Committee Chair has expertise in the area of the candidate’s research.

While many students’ dissertation research will be supervised by a member of the core faculty from the Department of STEM Education & Teacher Development, faculty from other departments or institutions can be included as members of the dissertation committees (if approved by the Graduate Program Director in consultation with the PhD Committee, the Department Chair and the Dean of the School). The use of an external faculty member can provide an authentic learning experience that converges lines of research and coursework to enrich the project and experience of the student.
The other members of the dissertation committee function as content or methods experts and assist the candidate in producing substantive research that makes a contribution to the field.

III.E.2. Dissertation Proposal
The research proposal defense is expected to be completed by the end of Year 3, that is, the first year following completion of the Qualifying Exam.

The dissertation proposal defense is an opportunity for the candidate to receive feedback from members of the committee. Proposal defenses are similar to dissertation defenses, but there are a few key differences. As with all parts of the dissertation process, preparation for the defense should be done in consultation with the Dissertation Committee Chair. The guidelines below outline the process for the Dissertation Proposal Defense:

- The Dissertation Committee Chair is responsible for determining when a proposal is ready for committee review
- The committee must receive a draft of the proposal 3 weeks prior to the defense.
- Committee members should forward their questions to the full committee (including the chair) 72 hours in advance of the proposal defense
- Committee members are expected to attend the proposal defense (virtually or in person)
- Outcomes of the defense can be (1) approve; (2) approve with minor changes; (3) action deferred pending major revisions; or (4) disapprove
- The proposal defense may be open to the entire department at the candidate's discretion
  - If members of the department are invited, they are observers only. The committee and the candidate are the only speakers in the defense.
- The candidate will present for 15-20 minutes. This presentation should primarily focus on the research questions and methods, but should touch on other important aspects of the proposal.
- The chair will negotiate the questioning structure with the committee members. A typical structure would be to provide each member of the committee with 15-20 minutes to ask questions and add another 15-20 minutes for general committee discussion at the end. Another common structure might be spend 15-20 minutes on each of the major sections of the proposal with time allotted at the end for overall discussion.
- The committee will typically reserve about 30 minutes for deliberation at the end of the defense. During this time, the meeting will be closed with the candidate
and any observers leaving the room. Upon completion of this discussion, only the candidate will rejoin the committee for discussion of his or her next steps.

In the case of approval with minor revisions, the candidate need only resubmit the revised proposal to the Dissertation Committee Chair and any other specified committee members. Once approved, the chair forwards a copy of the proposal to the Graduate Program Director with a letter stating that all minor revisions have been satisfactorily completed. This will be circulated to the Graduate Committee and Department Chair by the GPD.

In the case of major revisions, the candidate must resubmit the proposal to all committee members. The candidate must complete both minor and major revisions within three months. In the case of a rejection, the committee will meet with the candidate and decide how to proceed.

All dissertation work should follow the format of the *American Psychological Association Manual for Publication, 6th Ed.* and the relevant University guidelines in *Requirements for Theses and Dissertations* available at http://www.umassd.edu/graduate/administration.cfm. Although the length of the proposal will vary with the candidate and the topic, the proposal must include the following elements:

a. cover page;
b. table of contents;
c. 300-400 word abstract;
d. introduction that clearly states the problem, establishes its significance, and states the research questions to be examined;
e. critical review of the literature that synthesizes the current research on the problem, explores related bodies of knowledge that contribute to the understanding of the problem, and explores the theoretical framework of the study;
f. thorough description of the methodology including research design, a description of the study population and sample, a plan to access the study population, human subjects considerations, data collection methods, and the plan for data analysis;
g. work plan that identifies needed resources, indicates how they will be obtained, and presents a realistic time line for data collection and analysis;
h. references; and
i. appendices with informed consent letters and instruments.
III.E.3. The Dissertation
The candidate works closely with the chair and other appropriate committee members throughout the data collection, data analysis and final writing phases of the dissertation. The candidate should expect repeated iterations of the dissertation to accommodate the Dissertation Committee Chair’s and members’ input and guidance.

The dissertation contains all of the elements listed under Dissertation Proposal above. In addition, the methods section is revised to report the actual protocol for data collection and analysis. The following content areas are added to the dissertation manuscript:

a. Findings
b. Identify new and/or confirmed knowledge
c. Relate this new knowledge to the research question(s), theoretical framework and previous literature discussed earlier in the paper
d. Identify limitations of the data/study
e. Summarize the findings
f. Discuss implications of these findings for mathematics education, specifically as these implications relate to the dissertation’s focus area
g. Identify further research questions that arise in this study.

III.E.3.a Guidelines for the Inclusion of Media in Dissertations
The dissertation can include any kinds of multimedia materials provided the following two conditions are met:
1. the use of any data must be within IRB restrictions as described by the approved consent form the candidate asked participants to sign and
2. the materials must supplement a written explanation. That is, the multimedia element(s) provide addition modes of presentation, not the sole presentation of materials. Students may include dynamic examples and/or video clips of their work, but those are used in addition to written explanations.

Standard APA guidelines for directing the reader to multimedia materials will be used in the final (printed) document in place of hyperlinks until such time that the library can support electronic dissertations. Such supplemental materials will be added to the written document per the university’s guidelines for such materials outlined in the Thesis/Dissertation Guidelines.

III.E.4. Dissertation Defense
The dissertation defense is an important milestone in one’s doctoral career. Students are expected to work closely with their Dissertation Committee Chair not only in the
development of the dissertation but also in the preparation of the dissertation defense. The following guidelines are offered as a means to provide transparency for the process.

- The Dissertation Committee Chair is responsible for determining when a dissertation is ready for defense. The Dissertation Committee Chair will schedule the defense.
- The committee must receive a draft of the proposal 3 weeks prior to the defense.
- Committee members should forward their questions to the full committee (including the chair) 72 hours in advance of the proposal defense.
- Committee members are expected to attend the dissertation defense.
- The candidate may bring the dissertation document to the defense.
- Dissertation defenses are open to the public. This is a UMass Dartmouth policy.
- The dissertation defense is typically two-hours long, though this may vary in the case of larger committees. Extensions, however, should be the exception and not the norm.
- The candidate will present the dissertation study for members of the committee and the public. The presentation portion of the defense will last 15-20 minutes.
  - It should focus primarily on the research questions and main findings.
  - The student is welcome to use any multimedia elements allowed by IRB during that presentation time, but should be encouraged to keep such materials brief to stay within the allotted time. The multimedia should be used to support the main findings and or set-up the main findings.
- There will be a question and answer period for members of the committee to ask questions of the candidate. This will be moderated by the Dissertation Committee Chair.
- Members of the public, including other students in the department, will be allowed to ask questions in the dissertation defense during a 15-minute window that is moderated by the Dissertation Committee Chair. This window of discussion will follow the presentation of the dissertation by the candidate and the formal questioning by the candidate’s committee.
- Once the public questioning session has ended, the candidate and the public will be asked to leave the room. The committee will then deliberate to generate a recommendation. There are four possible recommendations: 1) approve; 2) approve subject to minor changes; 3) action deferred pending major revisions; and 4) disapprove. During this deliberation, the Dissertation Committee Chair will take notes on any changes that need to be made to the dissertation. Once feedback is decided upon, the candidate is called back into the room to hear the results, which are delivered with the entire committee present.
- The Dissertation Committee Chair will take primary responsibility for explaining necessary revisions (or other decisions) to the candidate.
When the committee “approves subject to minor changes”, the Dissertation Committee Chair can take full responsibility for overseeing that the requested corrections are made and the committee does not need to re-read the dissertation. In such a case, edits should be completed within two weeks.

In the case of more substantial edits are requested (“action deferred pending major revisions”), committee members may opt to reread all or portions of the dissertation to ensure their points have been adequately addressed. Such revisions will be completed on a timeline agreed to by the candidate and the Dissertation Committee Chair.

Once the dissertation has been accepted, the Dissertation Committee Chair forwards copies of the dissertation cover sheet to the Graduate Program Director and the candidate should prepare three copies of the dissertation for binding and microfilming according to the Requirements for Theses & Dissertations
(http://www1.umassd.edu/graduate/currents/thesis_guide.pdf)

The dissertation manuscript must conform to Requirements for Theses & Dissertations at the University of Massachusetts Dartmouth:
http://www1.umassd.edu/graduate/currents/thesis_guide.pdf

Publication Manual of the American Psychological Association, 6th Ed. is the required format for organization, tables, illustrations and references.

It is the student’s responsibility to pay particular attention to deadlines and the timing of the dissertation defense to allow enough time for a completed manuscript to be filed prior to Commencement exercises.

### III.E.5. Human Subjects

The university’s Institutional Review Board (IRB) must review all research and research-related activity proposed by any member of the UMassD community that involves human subjects in any way. This requirement is based upon the University’s assurance given to the federal Department of Health and Human Services that UMD researchers—faculty, students, administrators, staff—are aware of and follow all federal rules and regulations concerning the protection of human subjects in research as contained in the Code of Federal Regulations, Title 45, Part 46 (45 CFR 46). In addition, the Federal code requires that all researchers be trained and certified in the assessment

---

4 Students can complete an IRB waiver with their professor to collect data involving human subjects for a class project that will not be published.
of risk, informed consent, and research involving special populations such as children or prisoners. All students are required to complete Collaborative Institutional Training Initiative (CITI) certification (www.citiprogram.org).

Graduate students in our program need to be aware of the issues related to collecting data on human subjects, protection of participants rights, ethics, informed consent and the overall process of IRB approval progressively through our program. A typical approach would be:

**Year 1**
- Be presented with issues related to collecting data on human subjects in methodology courses.
- Complete a class-project form in at least one of their classes and in particular the Capstone course. This will allow students to construct a consent form for use with human subjects and collect data but not have to go through IRB approval.

**Year 2**
- Continue to collect data for educational purposes.
- Build on pre-existing datasets. This will allow students to complete part of the IRB Application Form utilizing data from an IRB-approved dataset under a faculty advisor.

**Years 3 & 4**
- Complete a full IRB application as part of writing their dissertation. This should be done after the proposal is successfully defended. At this stage many of the sections of the IRB application will be easy for the student to complete, e.g., background and significance of project, methodology and analytical framework. These are often underdeveloped early on for the student.

Students do not have to initiate a novel human subjects project requiring data collection in their first two years (Introduction and Preparation phases) of the program. There are plenty of opportunities for students to do their own original research using existing datasets/projects through the Kaput Center and external partnerships on already IRB-approved projects. Research using existing datasets might require exemption approval though. If a student is using a dataset from a currently approved active project then the PI should submit an amendment to add the student to the project and if the proposal does not capture the student’s activities then the amendment should also update the proposal to include the student’s research activities. If a student is using a dataset from a non-active but previously approved IRB project then the student should submit an
application for exempt pre-existing data analysis. This process utilizes the standard IRB application form and proposal form but many questions are not applicable. Relevant questions to be addressed focus on inserting: a new hypothesis, new title, new PI, a brief outline of background and significance, a brief outline of analytical method, and a clear indication of where the dataset was obtained naming the faculty advisor. NB. Significant differences would necessitate the student PI to obtain re-consent of participants. Because of the complexity involved in doing such a task the collection of a new dataset would be advised. The Director of the Office of Institutional Compliance will review both procedures in an expeditious manner. PIs will receive a letter to be used as necessary.

Both Capstone projects will need to be original research and not be a subsidiary of other research projects conducted by the program faculty or through internship collaborations with other institutions.

Human participant projects completed for class projects should utilize a "class project" form. Class project forms can only be utilized in a class under guidance and approval from the professor/instructor. Class projects can only qualify as class projects if they are done for class credit under the direction of a faculty member. Class project forms require a signature from the faculty member instructing the class. Students cannot follow this process on their own.

All forms and information about human participants can be obtained from the Office of Institutional Compliance or online at: http://www.atmc.umassd.edu/institutional_compliance/irb.cfm. If a student wishes to disseminate data obtained for a class project later on, the student should submit an IRB exemption application for the analysis of pre-existing data. All exemptions must be approved prior to dissemination.

III.F. Graduation Requirements

Successful completion of the program of study will be to complete all required coursework (including any additional required coursework identified as part of the student’s admission into the program) with a GPA of 3.0 or higher, complete the qualifying examination, defend a dissertation proposal to the satisfaction of the student’s dissertation committee, defend a final dissertation to the satisfaction of the student’s dissertation committee, and obtain approval of the dissertation for library submission.
IV. FINANCIAL SUPPORT AND ASSISTANTSHIPS

IV.A. Information Concerning Financial Aid

Students should consult with the Financial Aid Office regarding their eligibility for need-based assistance. Effort is made to secure financial support for students enrolled in the program.

See also the Graduate Catalog or the Office of Graduate Studies and Admission website http://www.umassd.edu/graduate/administration.cfm for more information. To qualify for any University assistantships, students must be in good academic standing, with a GPA of at least 3.0.

IV.B. Research and Teaching Assistantships

There are graduate research and teaching assistantships available for full-time students. Students are strongly encouraged to apply for these assistantships to develop critical research and teaching skills. The Kaput Center has a strong history of funded research to support research assistantships. Please contact the Director of the Kaput Center for more information. Additionally, qualified students are eligible to serve as instructors in the Department of STEM Education & Teacher Development or other departments. For more information, contact the Department Chair.
V. ADMISSION REQUIREMENTS

V.A. Admission Criteria

Students are admitted to the Ph.D. program based on the analysis of a comprehensive set of measures used to determine their readiness for doctoral study. While admission is into the doctoral program (not into a master’s level program), students may apply for a Masters of Science (MS) degree through the University Registrar’s office in the progression towards completion of the doctorate.

Prospective students will meet the following criteria for admission into the program:

a. A minimum overall GPA of 3.0 in all post-secondary education. Students will be required to submit transcripts from all post-secondary institutions.
b. Acceptable scores on the Graduate Record Examination.
c. Where applicable, a minimum TOEFL score of 500 (paper version) or 213 (computer version)

Criteria for admission are based on providing evidence of ability and motivation to succeed in a mathematics education research program, with potential to make a scholarly contribution to the field. As a field of research, mathematics education draws on an eclectic blend of disciplines. As such, the Ph.D. program is intentionally designed to be inclusive of applicants with diverse backgrounds of academic preparation in the technical and social sciences. It is anticipated that this diversity will enrich not only the overall experience of all doctoral students in the program, but the potential contribution students can make to mathematics education research. It is preferred that an applicant holds an appropriate Master’s Degree for admission into the program.

This diversity notwithstanding, any perceived deficiencies in the applicant’s previous course work that should be addressed by additional pre-requisite preparation will be determined by the Graduate Program Director in consultation with the Graduate Committee and stated along with the official notification of admission. Students will be expected to meet any program deficiencies before qualifying for the Production Phase (Advanced Doctoral Phase).

V.B. Application to the Program

In addition to meeting the criteria for admission, applicants will be expected to submit the following as part of their application process:
- Completed UMass Dartmouth application form
- A letter of intent addressing two issues:
  i. Applicant’s qualifications and motivation for application to the program, including personal and career goals. This should discuss recent research and development experience and any publications, formal presentations, grants, or patents in which the applicant has been involved.
  ii. An outline of potential research interests and potential connections to faculty work.
- Current resume
- Official transcripts of all post-secondary education
- Official scores on the Graduate Record Examination. Information about the test and about the locations of test centers is available from:
  
  Educational Testing Service  
  Box 6000, Princeton  
  New Jersey, 08541-6000  
  tel. 609 771-7670 voice/TDD/text: 609-734-9362  
  www.gre.org

- Three letters of recommendation from individuals familiar with the applicant’s academic ability and potential to conduct research at the doctoral level.

The application process can be completed online at [http://www.umassd.edu/graduate/](http://www.umassd.edu/graduate/).

**V.C. Application Review Process**

The Graduate Program Director in consultation with the Graduate Committee will determine a recommendation for admission. The recommendation will then be reviewed by the Associate Provost for Graduate Studies, who confers official admission of all graduate students to UMass Dartmouth.
VI. ACADEMIC PROGRESS

VI.A. Academic Advising

Upon entering the program, each student is assigned a faculty member to serve as his or her program advisor. The role of the program advisor involves monitoring the student’s course of study and ensuring appropriate coursework and program benchmarks are completed. While the student’s Dissertation Committee Chair might also serve as his or her program advisor, these advising roles represent two distinct purposes.

VI.B. Academic Review

At the end of each semester, the Graduate Program Director and the Graduate Committee will review each student’s transcript and assess the adequacy of each student’s progress in achieving program objectives.

If a student is not performing to the program requirements, the student will be placed on probation and the Graduate Committee will prescribe a course of action to be completed in order for the student to return to good standing in the program. The Graduate Program Director will inform the student in writing that she/he is not meeting program requirements and will indicate what the committee prescribes as corrective action. A copy of this correspondence will be in the student’s file.

VI.C. Electives

Students may take doctoral level courses at other universities with the approval of the program advisor and Graduate Program Director. The student must make the request in writing and submit a copy of the course syllabus. Only 6 credits from other universities may be applied to this program.

VI.D. Full-time Status

Full-time students are expected to take eighteen (18) credit hours per year. Full-time continuous students should complete all their course work in four years of study.

Any student who wishes to register for more than the maximum credit load must secure written permission from the program advisor, Graduate Program Director and Department Chair.
VI.E. Grades

All students are required to receive a cumulative GPA of 3.0 or higher in order to remain in the program. A student who has attempted at least 9 hours and who has not earned the minimum GPA will be referred to the Graduate Committee. Failure to achieve the minimum GPA through re-taking the course or remedial work will result in dismissal from the program.

VI.F. Incomplete

The program does not support use of the Incomplete (I) grade but rather the In Progress (IP) grade and then only in extreme circumstances and programmatic needs.

These include:
1. An unexpected circumstance such as a medical leave or call for public service
2. The need to complete a course across several semesters or the summer. Such courses presently include (but are not limited to) MTE680/770 Authentic Learning (Internship), MTE615/715 Colloquium Series, MTE654/681 Research Seminar (Capstone Project), and MTE 772 Dissertation Research.

Requests related to item (1) should be submitted to the Instructor and copies to the Chair of the department with supporting evidence as soon as the case is relevant. The Ph.D. Program requires that the student and faculty member complete a written contract that specifies the in progress work and an agreed upon time frame for completion. Both the student and the faculty member must sign the form and retain a copy. A third copy is filed with the Graduate Program Director.

In most cases, in progress work from one semester should be finished before the start of the subsequent semester except for the dissertation. Students with in progress work in more than one course will not be allowed to enroll in additional courses until all in progress work has been completed.

Students must complete course work identified in the program of study for Years 1 and 2 prior to the qualifying exam.

VI.G. Independent Study

Students may complete an independent study to fulfill required or elective credits. Independent study credits vary from 1 to 3 credits depending on the scope of the project. The independent study should consist of study and work at the doctoral level with a specified written product. The faculty member who agrees to work with the
student in independent study must be a recognized expert in the content area. The student and faculty member must agree to the number of credits, scope of the work and the amount of supervision required (for example, weekly or biweekly meetings). The Graduate Program Director and Department Chair must approve a written agreement—signed by the student and the faculty member—with copies retained by each.

VI.H. Leave of Absence

Leaves of Absence are granted for extenuating circumstances such as call to service and serious illness. A student seeking a leave of absence (LOA) must petition the Graduate Program Director. An approved LOA does not extend the statute of limitations for degree completion by the length of the leave. The University requires that each matriculated graduate student must maintain continuous registration until the degree has been formally awarded. If the student does not register for courses or dissertation credits during any semester, the student must pay a fee per semester to maintain continuous registration.

VI.I. Statute of Limitations

Students must make satisfactory progress toward completion of a degree within the Statute of Limitations for the degree. Each Mathematics Education Ph.D. student is expected to complete all degree requirements within six (6) calendar years. The Graduate Committee on a case-by-case basis will review any requests for extensions. The Statute of Limitations will reflect the need for additional time for program completion by those students accepted into the program with additional provisions.

VI.J. Transfer Credit Policy

Students who have completed graduate course work at other accredited institutions may request to transfer those credits towards the completion of the degree requirements. Up to the equivalent of six (6) credits from courses that meet the following requirements may be considered for transfer: 1) the student received a grade of B or higher; 2) the courses have not been used to fulfill requirements for another degree; and 3) the course credit must have been earned no more than six (6) years prior to the student’s matriculation.

All transfers require recommendation by the program advisor and approval by the Graduate Program Director on a standard form.
VI.K. Waiver Policy

A student may seek a waiver from a required course in the Program if he or she has completed a course with substantially equivalent content at another institution or an equivalent educational experience. A maximum of twelve (12) credit hours may be waived. Waivers do not replace credits required to complete the program at UMass Dartmouth. Students will be required to complete alternative courses (e.g., electives) to fulfill the credit-requirement of the program.

Course waivers will be decided on a case-by-case basis, through negotiation between the student seeking the waiver and the faculty member who teaches the course. All waived courses require approval of the faculty member, the program advisor and the Graduate Program Director on a standard form.

Appeal of a denied waiver may be made to the Department Ph.D. Committee.
VII. COMMUNICATION WITH STUDENTS

Program information will be communicated to students by email and on-site mailboxes. Students will receive an UMassD e-mail account upon matriculation. This is the e-mail address that will be used to contact students with important information. Students keep their UMassD e-mail account for life.

Additionally, information about the program is available at:

http://www.umassd.edu/mathedphd

and

http://www.kaputcenter.umassd.edu/Ph.D./

University of Massachusetts Dartmouth. (n.d.). *2010-11 Graduate catalogue.* Available at http://www.umassd.edu/catalog/