

**PROPOSAL FOR THE BS in MATHEMATICS (BSSMED) OFFERED BY
the School of Mathematical and Statistical Sciences: Creation of a
concentration in SECONDARY EDUCATION**

All changes requested to take effect Fall 2011

PROPOSAL CONTACT INFORMATION:

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DEFINITION

These are the minimum requirements for approval. Individual undergraduate concentrations may have additional requirements.

A concentration is a formalized selection of courses within a major.

An undergraduate concentration:

- Requires a minimum of 15 semester hours of which at least 9 semester hours must be upper division. Specialized concentrations (e.g. BIS Concentrations) may have additional or different requirements.
- Is offered by a single unit and is intended exclusively for students pursuing that particular major. If a concentration consists of courses from more than one college the approval of each college Dean is required.

PROPOSAL PROCEDURES CHECKLIST

Before academic units can advertise undergraduate concentrations or include them in their offerings as described in the university catalogs, they must be recommended for approval by the Curriculum and Academic Programs Committee and approved by the Executive Vice President and Provost.

A complete proposal should include:

1. A supporting letter from the chair of the academic unit verifying that:
 - The proposed concentration has been reviewed and has received faculty approval through appropriate governance procedures in the unit.
 - The unit has the resources to support the concentration as presented in the proposal, without impacting core course resources.
2. A supporting letter from the office of the supervising dean verifying that the concentration has been reviewed and has received approval through appropriate governance procedures in the college.
3. A supporting letter from each college/school dean from which individual courses, or the entire concentration, are taken.
4. A statement concerning demand for the program (student/community/market).
5. A description of the requirements for this concentration. Be specific in listing required courses and specify the total minimum number of hours required for the concentration.
 - Are any new courses required? If so, provide course syllabi and Proposal for Curriculum Action forms.
6. A list of the primary faculty participants.
7. A minimum residency requirement: How many hours of the concentration must be ASU credit?
8. Please prepare and attach a Major Map.
9. A completed Appendix document. This information is to be used during the implementation phase to ensure this program appears correctly and completely on Degree Search.
10. Attach other information that will be useful to the review committees and the Office of the Provost.

4. Statement concerning demand for the program (student/community/market)

The recently released *Teacher Education Study in Mathematics* (TEDS-M) points to the disparity in mathematical preparation of secondary school mathematics teachers between the United States and other advanced industrialized countries. One significant source of this difference is that students entering U.S. teacher preparation programs have much poorer mathematical preparation when they enter their programs.

Many research studies in mathematics education point to reasons for the disparity that TEDS-M found. A principle problem in the quality of secondary mathematics teachers' mathematical preparation is that they leave high school with little understanding of the mathematics they studied. This has two ramifications: (1) They are ill-prepared to understand university-level mathematics, and (2) they return to high school having never revisited the ideas of high school mathematics that they never understood in the first place. The result is a vicious cycle—poorly educated high school students return as teachers who have no greater insight into the secondary mathematics curriculum than when they completed high school. They leave high school thinking that mathematics is about memorizing answer-getting procedures, and they return as teachers with the same knowledge and beliefs firmly intact.

Our aim in this proposed Secondary Education concentration of the BS in Mathematics program is to contribute to a long-term solution to this vicious cycle—by focusing on future teachers' mathematical preparation *for teaching secondary school mathematics*. Our contribution is more than a narrow focus on mathematics. It is a broad focus that builds on recent research in the area of *mathematical knowledge for teaching* (MKT). MKT is more than sound mathematical knowledge. It also entails a sound understanding of *students'* mathematics, knowledge of the issues entailed in students' coming to understand significant mathematical ideas, and knowledge of how a teacher can support the growth of students' mathematical understandings with appropriate teaching.

We address students' poor mathematical preparation directly in our proposed program. In MAT 208 students will study core ideas of discrete mathematics that are becoming increasingly common in high school mathematics curricula across the U.S. MAT 207 revisits high school algebra and geometry with a highly conceptual, yet rigorous treatment. It emphasizes meaning, reasoning, and mathematical imagery. MTE 210, which students will take in the same semester as MAT 207, engages math education students in the tutoring of ASU students who are taking precalculus, which is a course that comprises most of high school algebra (with some geometry). At the same time that they are tutoring precalculus students, math education students will participate in a seminar in which they will reflect on the issues of learning high school mathematics. MTE 210 is where math education students are first introduced to the issues of balancing mathematical content with the needs of someone learning it. Math education students will revisit these issues of balancing mathematical content with the needs of someone learning it in MTE 320 (Curriculum and Assessment), MTE 430 (Development of Mathematical Reasoning), and MTE 482 (Methods of Teaching Secondary Math). Appropriate imagery is key to understanding many mathematical ideas. Yet this issue is rarely addressed in secondary mathematics teacher preparation programs. Our proposed program will address it explicitly in MTE 250 (Technology and Mathematical Visualization).

The sequencing of our proposed courses is designed to provide mathematics education students in the revised program with early and ongoing experiences in: (a) inquiry mathematics, (b) issues of learning mathematics meaningfully, and (c) managing the learning of others. Overall, the proposed program will address in a sustained manner the broad issue of what it is like to learn mathematics meaningfully, and it will use that as a basis for both preservice teachers' own mathematical learning and for their thinking about how to facilitate the mathematical learning of others.

5. Description of the requirements for this concentration.

The BS degree in Mathematics with a Concentration in Secondary Education requires the following courses:

MAT 270 (4): Calculus with Analytic Geometry I
MAT 271 (4): Calculus with Analytic Geometry II
MAT 272 (4): Calculus with Analytic Geometry III
MAT 207 (3): Algebra and Geometry in the High School
MAT 208 (3): Discrete Mathematics
MAT 274 (3): Differential Equations OR MAT 3xx OR MAT 4xx OR STP 3xx OR STP 4xx
MAT 300 (3): Mathematical Structures (L)
MAT 310 (3): Introduction to Geometry
MAT 342 (3): Linear Algebra OR MAT 343 (3): Applied Linear Algebra
MAT 371 (3): Advanced Calculus I
MAT 415 (3): Intro to Combinatorics OR MAT 416: Intro to Graph Theory

MAT 443 (3): Introduction to Abstract Algebra OR MAT 445 (3): Theory of Numbers
MAT 4XX (3) or STP 4XX (3)
STP 420 (3): Introductory Applied Statistics

MTE 210 (1): Mentored Tutoring Internship (will be taken by students in lieu of SED 396. This was negotiated with the MLFTC and approved by Erica Mitchell and Kathy Rutowski).

MTE 250 (3): Technology and Mathematical Visualization
MTE 320 (3): Conceptual Foundations of 7-12 Math Curricula & Assessment
MTE 430 (3): The Development of Mathematical Reasoning
MTE 482 (3): Methods of Teaching Math in Secondary Schools

BLE 220 (3): Foundations of SEI
BLE 407 (3): SEI for Secondary

EDP 313 (3): Childhood and Adolescence
SPE 222 (3): Orientation Education of the Exceptional Child
SPE 417 (3): Inclusion Practices at the Secondary Level
SED 322 (3): Classroom Leadership in Secondary Schools
SED 397 (1): Field Experience
SED 496 (1): Field Experience
SED 478 (8): Student Teaching in Secondary Schools
TEL 311 (3): Instruction and Management in the Inclusive Classroom

Total minimum number of hours required for the concentration: 89

Required New Courses

The following new courses are required. Syllabi and new course proposals have been submitted through ACRES.

MAT 207 Algebra and Geometry in the High School (3)
MAT 208 Discrete Mathematics for Secondary Teachers (3)
MTE 210 Mentored Tutoring Internship (1)
MTE 250 Technology and Mathematical Visualization (3)
MTE 320 Conceptual Foundations of 7-12 Mathematics Curricula and Assessment (3)
MTE 430 The Development of Mathematical Thinking (3)

6. A list of the primary faculty participants

Luis Saldanha, SoMSS, luis.saldanha@asu.edu
Pat Thompson, SoMSS, pat.thompson@asu.edu
Fabio Milner, SoMSS, milner@asu.edu
Hal Kierstead, SoMSS, kierstead@math.asu.edu

7. Minimum residency requirement

How many hours of the concentration must be ASU credit? Minimum 30

Course Subject and Title <i>(courses in bold/shading are critical)</i>	Hrs.	Upper Division	Completed Transfer Pathway:		Completed General Education:		Additional Critical Requirement Notes
			<input type="checkbox"/> MAPP <input type="checkbox"/> TAG <input type="checkbox"/> ATP <input type="checkbox"/> None	Transfer Course/Grade	Minimum Grade if Required	<input type="checkbox"/> AGEC <input type="checkbox"/> GETC/CSUGE <input type="checkbox"/> None	
TERM ONE: 0-15 CREDIT HOURS							
MAT 270: Calculus with Analytic Geometry I (MA)	4	<input type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> An SAT, ACT, Accuplacer, or TOEFL score determines placement into first-year composition courses ASU Math Placement Exam score determines placement in Mathematics course Minimum cumulative 2.50 GPA in all critical courses Minimum grade of C required in all MAT and STP classes; grade of B or better strongly correlated with timely graduation All freshmen must pass an academic success course and therefore must enroll in an Academic Success Cluster and/or a First-Year Seminar
ENG 101 and 102: First-Year Composition OR ENG 107 and 108: English for Foreign Students OR ENG 105: Advanced First-Year Composition	3	<input type="checkbox"/>			Grade of C		
Natural Science - Quantitative or General (SQ or SG)	4	<input type="checkbox"/>					
MAT 208: Discrete Mathematics	3	<input type="checkbox"/>			Grade of C		
LIA 194 or MAT 191	1	<input type="checkbox"/>					
TERM TWO: 16-31 CREDIT HOURS							
MAT 271: Calculus with Analytic Geometry II	4	<input type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> Minimum ASU cumulative gpa of 2.5 recommended MTE 210 counts as field experience on ASU campus
ENG 101 or 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or 108: English for Foreign Students	3	<input type="checkbox"/>			Grade of C		
SPE 222: Orientation Education of the Exceptional Child (SB/C)	3	<input type="checkbox"/>			Grade of C		
MAT 207: Algebra and Geometry in the High School	3	<input type="checkbox"/>			Grade of C		
MTE 210: Mentored Tutoring Internship	1				Grade of C		
TERM THREE: 32-47 CREDIT HOURS							
MAT 272: Calculus with Analytic Geometry III	4	<input type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> First-year composition completed by end of term 3 MILESTONE: Submit Intent to Progress form (online)
CLAS Science and Society and Literacy/Critical Inquiry	3	<input type="checkbox"/>			Grade of C		
Social Behavioral Science (SB) or Humanities, Fine Arts & Design (HU)	3						
MTE 250: Technology and Mathematical Visualization	3	<input type="checkbox"/>			Grade of C		
BLE 220: Foundations of SEI	3	<input type="checkbox"/>			Grade of C		
TERM FOUR: 48-63 CREDIT HOURS							
MAT 274 or MAT 3XX, MAT 4XX or STP 4XX	3	<input checked="" type="checkbox"/> or			Grade of C		<ul style="list-style-type: none"> DPS fingerprint clearance card on file with advising office
MTE 320: Conceptual Foundations of 7-12 Math Curricula & Assessment	3	X			Grade of C		
Natural Science Quantitative (SQ)	4	<input type="checkbox"/>					
Humanities, Fine Arts & Design (HU) and Global Awareness (G)	3						
EDP 313: Childhood and Adolescence (SB)	3	<input checked="" type="checkbox"/>			Grade of C		
TERM FIVE: 64-76 CREDIT HOURS							
MAT 342: Linear Algebra or MAT 343: Applied Linear Algebra	3	<input checked="" type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> Must possess valid DPS fingerprint card to participate in Field Experience
MTE 430: The Development of Mathematical Reasoning	3	X			Grade of C		
MAT 310: Introduction to Geometry	3	X <input type="checkbox"/>			Grade of C		
Upper division CLAS Science and Society	3	<input checked="" type="checkbox"/>			Grade of C		
MAT 300: Math Structures	3	<input checked="" type="checkbox"/>			Grade of C		
TERM SIX: 77-92 CREDIT HOURS							
MAT 415: Intro to Combinatorics or MAT 416: Intro to Graph Theory	3	<input checked="" type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> Must possess valid DPS fingerprint card to participate in Field Experience
STP 420: Introductory Applied Statistics (CS)	3	X			Grade of C		
MAT 371: Advanced Calculus I	3	X			Grade of C		
BLE 407: SEI for Secondary	3	<input checked="" type="checkbox"/>			Grade of C		
TEL 311: Instruction and Management in the Inclusive Classroom	3	<input checked="" type="checkbox"/>			Grade of C		
SED 397: Field Experience	1	X			Grade of Y		
TERM SEVEN: 93-108 CREDIT HOURS							
MAT 443: Introduction to Abstract Algebra OR MAT 445: Theory of Numbers	3	<input checked="" type="checkbox"/>			Grade of C		<ul style="list-style-type: none"> Must possess valid DPS fingerprint card to participate in Field Experience
MTE 482: Methods of Teaching Math in Secondary Schools	3	<input checked="" type="checkbox"/>			Grade of C		
SPE 417: Inclusion Practices at the Secondary Level	3	<input checked="" type="checkbox"/>			Grade of C		
SED 322: Classroom Leadership in Secondary Schools	3	X			Grade of C		
SED 496: Field Experience	1	<input type="checkbox"/>			Grade of Y		
Humanities, Fine Arts & Design (HU) and Historical Awareness (H)	3						
TERM EIGHT: 109-120 CREDIT HOURS							
SED 478: Student Teaching in Secondary Schools	8	<input checked="" type="checkbox"/>			Grade of Y		<ul style="list-style-type: none"> Must possess valid DPS fingerprint card to participate in Field Experience
MAT 4XX OR STP 4XX	3	<input checked="" type="checkbox"/>			Grade of C		
Elective	1						

Graduation Requirements Summary:

Total Hours (120 minimum)	Total Hrs at ASU (30 minimum)	Cumulative GPA (minimum 2.0)	Major GPA (2.000 Min.)	Hrs Resident Credit for Academic Recognition (56 minimum)	Total UD Hrs (45 minimum)	Total Comm. College Hrs. (64 maximum)
120	30 minimum	minimum 2.00	minimum 2.00	56 minimum	45 minimum	64 maximum

General University Requirements: Legend

- General Studies Core Requirements:
 - Literacy and Critical Inquiry (L)
 - Mathematical Studies (MA)
 - Computer/Statistics/Quantitative applications (CS)
 - Humanities, Fine Arts, and Design (HU)
 - Social and Behavioral Sciences (SB)
 - Natural Science-Quantitative (SQ)
 - Natural Science-General (SG)
- General Studies Awareness Requirements
 - Cultural Diversity in the US (C)
 - Global Awareness (G)
 - Historical Awareness (H)
- First-Year Composition

The requirements outlined on this major map meet ASU’s graduation requirements for this catalog year and major/concentration; however, certification requirements are determined by the Arizona Department of Education (ADE) and are subject to change. Occasionally, additional courses, which are not outlined on this major map, may be required to obtain certification and/or an Institutional Recommendation. Therefore, Professional Teacher Preparation (PTPP) courses starting in term 5 are subject to change prior to the start of the PTPP. It is highly recommended that you speak with your advisor regarding any updates or changes.

Transfer Students:

Completion of 60 credit hours, a 2.5 transfer and ASU GPA (if applicable), the courses outlined on this major map in terms 1 – 4 must be completed prior to progression into upper division PTPP coursework. Students who are eligible to progress into PTPP must complete an online application at: <http://education.asu.edu/content/progress-professional-teacher-preparation-program>. In addition, possession of a valid DPS fingerprint clearance card is required prior to enrolling in PTPP courses.

9. APPENDIX - PROPOSAL TO ESTABLISH A NEW UNDERGRADUATE CONCENTRATION

(This information is used to populate the Degree Search/catalog website.
Please consider the student audience in creating your text.)

1. Program Description (150 words maximum)

Mathematics is one of the main required topics in high school in all states since it is a crucial component in many disciplines with a strong need for quantification in the analysis of very diverse phenomena, including business and economics, life sciences, physics, engineering, and social sciences. Highly qualified mathematics teachers are in great shortage and in great demand in every state, and this degree concentration is designed to produce them.

The B.S. in mathematics with a concentration in secondary education focuses on coursework related to the mathematics that secondary teachers need as background for their own deep understanding of the discipline as well as the content and methods they will be delivering and using with their own high school students. Students graduating with this concentration will have the recommendation from the ASU Teacher's College to the State of Arizona for High School Mathematics certification.

The B.S. in mathematics with a concentration in secondary education is also intended for students who wish to pursue a graduate degree in mathematics.

2. Contact and Support Information

Office Location (Building & Room): School of Mathematical and Statistical Sciences | PSA 211

Campus Telephone Number: 480-965-7195

Program email address: math@asu.edu

Program website address:

3. Additional Program Description Information

A. Additional program fee required for this program? Yes No

B. Does this program have a second language requirement? Yes No

4. Career Opportunities & Concentrations

Provide a brief description of career opportunities available for this degree program. If program will have concentrations, provide a brief description for each concentration.

Employment/Study opportunities for math majors are found in virtually all sectors of industry, government and education:

- Teaching (e.g., high-school or college teacher).
- Applied math (scientific computing).
- Business (e.g., actuary for bank or insurance company, operations research).
- Engineering, biotechnology, computer, government (e.g., consultant, federal and state organizations).
- Graduate school (mathematics or other fields).
- Medicine.

A course of study in secondary mathematics education is especially advantageous for competitive high school teaching positions. Graduates will have the recommendation for becoming certified and teaching mathematics in public high schools.

Example Careers: Students who complete this degree program may also be prepared for other careers including but not limited to the following:

	*growth	*median salary
Mathematical Science Occupations, All Other	17.57%	\$48,210
Mathematical Science Teachers, Postsecondary	15.12%	\$63,640
Mathematical Technicians	8.48%	\$41,240
Mathematicians	22.48%	\$93,580
Natural Sciences Managers	15.45%	\$114,560
Statisticians	13.07%	\$72,820

5. **Additional Admission Requirements** If applicable list any admission requirements (freshman and/or transfer) that are higher than and/or in addition to the university minimum undergraduate admission requirements.)

6. **Keywords** List all keywords used to search for this program. Keywords should be specific to the proposed program.

Math education, mathematics education, secondary math, secondary mathematics, secondary math teacher, high school math teacher, secondary mathematics teacher, high school mathematics teacher

7. **Advising Committee Code** List the existing advising committee code associated with this degree.

Julie Voller, Director of Academic Services for CLAS, will assign the Academic Advising Code

8. **Minimum Math Requirement** List the minimum math course required to satisfy this degree.

MAT 270 - Calculus w/Analytic Geometry I

9. **Area(s) of Interest**

A. Select one (1) primary Area of Interest from the list below that applies to this program.

- | | |
|--|---|
| <input type="checkbox"/> <u>Architecture, Construction & Design</u> | <input type="checkbox"/> <u>Engineering & Technology</u> |
| <input type="checkbox"/> <u>Artistic Expression & Performance</u> | <input type="checkbox"/> <u>Environmental Issues & Physical Science</u> |
| <input type="checkbox"/> <u>Biological Sciences, Health & Wellness</u> | <input type="checkbox"/> <u>Interdisciplinary Studies</u> |
| <input type="checkbox"/> <u>Business, Management & Economics</u> | <input type="checkbox"/> <u>Languages & Cultures</u> |
| <input type="checkbox"/> <u>Communication & Media</u> | <input type="checkbox"/> <u>Law & Justice</u> |
| <input type="checkbox"/> <u>Computing & Mathematics</u> | <input type="checkbox"/> <u>Social Science, Policies & Issues</u> |
| <input checked="" type="checkbox"/> <u>Education & Teaching</u> | |

B. Select any additional Areas of Interest that apply to this program from the list below.

- | | |
|--|---|
| <input type="checkbox"/> <u>Architecture, Construction & Design</u> | <input type="checkbox"/> <u>Engineering & Technology</u> |
| <input type="checkbox"/> <u>Artistic Expression & Performance</u> | <input type="checkbox"/> <u>Environmental Issues & Physical Science</u> |
| <input type="checkbox"/> <u>Biological Sciences, Health & Wellness</u> | <input type="checkbox"/> <u>Interdisciplinary Studies</u> |
| <input type="checkbox"/> <u>Business, Management & Economics</u> | <input type="checkbox"/> <u>Languages & Cultures</u> |

- Communication & Media
- Computing & Mathematics
- Education & Teaching

- Law & Justice
- Social Science, Policies & Issues

From: [Paul LePore](#)
To: [Elizabeth Hinde](#)
Cc: [Jenny Smith](#); [Sally Hurwitz](#); [Kate Lehman](#)
Subject: Re: Proposed Secondary Education Concentration, BS in Mathematics
Date: Tuesday, June 28, 2011 2:25:36 PM

Thanks!

On Jun 28, 2011, at 2:20 PM, "Elizabeth Hinde" <Elizabeth.Hinde@asu.edu> wrote:

Hello Paul,
As promised, here is my response to the issues raised in #1. Please let me know if you need further details.

1) Audiences: BS in Mathematics is intended for students who major in math and decide they would like to teach high school. The BS in math is also intended for students who wish to pursue a graduate degree in mathematics. The BAE is intended for students who major in secondary education and want to specialize in math. These students often have interests in other areas as well as math, and will provide students with more knowledge of education (I.e., assessment, leadership, classroom management, etc.). The BAE will not provide sufficient coursework to pursue a graduate degree in math.

2) Prerequisites: Prerequisites for the math courses in the BS track are determined by the math faculty. Prerequisites in the BAE track include many of the same math courses in the BS track, but also include requirements in secondary education courses, such as classroom management and assessment. In order to be eligible for teacher certification, students in both tracks will be required to complete state mandated courses regarding teaching English Learners, Reading, and clinical experiences.

3) Outcomes: The ultimate outcome of both programs is the preparation of qualified high school math teachers. The outcomes of the BS track include students who have in-depth knowledge of multiple math disciplines and will be able to teach them at the high school level (I.e., algebra, geometry, trigonometry, calculus, etc.). They will also be able to pursue a graduate degree in math if so desired. The outcomes of the BAE include students who will be able to teach high school math courses, as well as involvement in curriculum development and other areas of the high school curriculum.

I hope this helps.

Sincerely,
Liz Hinde
Elizabeth R. Hinde, Ph.D., Director
Division of Teacher Preparation
Mary Lou Fulton Teachers College
Arizona State University
PO Box 37100
Phoenix, AZ 85069-7100
Phone: 602-543-6315

PROGRAM COMPARISONS

	BS in Mathematics with Secondary Education Concentration	BAE in Secondary Education Mathematics Specialization
Individuals Served	This program's primary audience is students interested in mathematical concepts and qualitative methods with the added option of obtaining a secondary education teaching certificate.	The BAE in secondary education program prepares students wishing to teach 7-12 students in the academic area of mathematics in a variety of school settings.
Pre-requisites	Prerequisites for both programs are identical.	Prerequisites for both programs are identical.
Program Outcomes	Students completing this degree may enter multiple fields including applied math (scientific computing), business (actuary for banks or insurance agencies), engineering, biotechnology, computers, government, medicine, but also have the option of obtaining teacher certification in secondary education. This degree provides students with additional options they would not have with the B.A.E.	Students completing this degree program have a primary goal of teaching 7-12 grade students in the area of mathematics in a variety of school settings. Students learn theory, and teaching methodology to be a successful middle or high school teachers.