


# CAEP, NCTM, and Secondary Mathematics Program Revisions

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## Agenda



- Background
  - Definitions, Acronyms, History
  - Overview of Secondary Mathematics Undergraduate Degree
- Description of Assessments for Accreditation
- Assessment Data Collection and Findings
- Program Changes: Driven by Assessments
- Assessment Changes: Driven by New Standards
- Challenges


## Preliminaries



- **NCTM** – National Council of Teachers of Mathematics
- **NCATE** – National Council for Accreditation of Teacher Education
- **TEAC** – Teacher Education Accreditation Council
- **CAEP** – Council for the Accreditation of Educator Preparation
- *CAEP is successor to NCATE and TEAC (2013)*
- *NCTM is the Specialized Professional Association (SPA) for NCATE/CAEP program recognition (content-specific standards)*

## Background: Degree Program

- B.S., major in “Mathematics with Secondary Certification” (a.k.a. “Secondary Math” degree)
- Housed in Mathematics Department
  - Advisement
  - Degree granted by department
  - Significant mathematics content
- Support from College of Education (COE)
  - Degree framework (+ some coursework)
  - Field placement logistics and support
  - Candidate admission to COE required



## Degree Comparison

### Secondary Math vs “Pure” Math Degree

Same number of required mathematics content courses; only differences outlined below



Course	“Pure” Math	Secondary Math Cert.
Discrete Mathematics	Elective	Required
Geometry	Elective	Required
History of Mathematics	Elective	Required
Real Analysis	Required	Elective

Other Requirements	“Pure” Math	Secondary Math Cert.
Minor	Required	(Essentially) Education Other Minor Optional
Culminating Assignment	Independent Study (1 credit hour)	Student Teaching

## Program Accreditation

- Previous accreditation cycle
  - Accrediting body: NCATE
  - SPA: NCTM (2003 Standards)
  - Nationally recognized
- Next accreditation cycle
  - Accrediting body: CAEP
  - SPA: NCTM (2012 Standards)

## Program Snapshot

### at Previous Accreditation Cycle

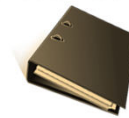
- Education Coursework (College of Education)
  - 3 lower level courses
  - 3 upper level courses
    - Assessment
    - Classroom Management
    - Curriculum
  - 12 hours associated with student teaching
- Mathematics Education Courses (Math Dep't.)
  - Methods and Materials for Secondary Mathematics
  - Mathematics Education Seminar (a.k.a. "Capstone Course")



## Assessments Identified

### for Previous Accreditation Cycle

- GACE State Licensure Test
- Teacher Work Sample: Internship evaluation component required by College of Education
- Mathematics Student Teaching Evaluation (rubric defined and used by Mathematics Department)
- Course Portfolios for five required courses
  - Geometry
  - History of Mathematics
  - Technology in Mathematics
  - Methods and Materials
  - Mathematics Education Seminar (Capstone)



## Math Education Seminar

### Capstone Course

- Goals
  - Review/synthesize mathematics content knowledge
  - Apply lens of pedagogical content knowledge
- Course Reorganization
  - Introduced portfolio as primary assessment
  - Explicitly aligned with NCTM 2003 content strands
    - Number and Operations
    - Algebra
    - Geometry
    - Measurement
    - Calculus
    - Statistics and Probability
    - Discrete Mathematics



2003 NCTM Program  
Standards for the Initial  
Preparation of  
Mathematics Teachers

## Capstone Portfolio



- One entry per content strand
- Each entry composed of multiple submissions (submission = problem with solution)
- Problems selected/assigned by instructor
- Different students given different problems
- Designated indicators aligned with each problem
- Example: Calculus Entry, Submission #1
  - 12.2 Apply concepts of function, geometry, and trigonometry in solving problems involving calculus
  - 1.4 Effectively monitor and reflect on mathematical problem solving

## Methods & Materials Portfolio

- Alignment to NCTM 2003 indicators
  - Standard 6: Knowledge of Technology
  - Standard 7: Dispositions
  - Standard 8: Knowledge of Mathematics Pedagogy
- Three components
  - Unit Plan
  - Observation of lesson conducted during pre-internship field placement
  - GCTM Georgia Mathematics Conference
    - Attendance and documentation
    - Summary and analysis of sessions attended



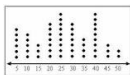
## Assessment Findings

- GACE: 100% pass rate for program completers
- Other assessments
  - Evaluated by mathematics faculty
  - More insight into specific areas of weakness
- Greatest areas for improvement
  - Statistics content knowledge
  - Axiomatic proof
  - Support system for assessments and program



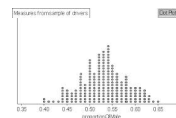
## Statistics Content Knowledge

- Which Assessment Data?
  - Capstone Portfolio
  - Student Teaching Evaluation for interns assigned to classes covering statistics content
- Analysis (and Dilemma)
  - Probability and Statistics course not well aligned with content knowledge needed to teach secondary math
    - Univariate plots and data summaries
    - Design of statistical investigations
    - Nature of variability
    - Reasoning of statistical inference
    - Statistical simulation
  - These concepts are covered in Elementary Statistics (non-calculus) – not required!



## Statistics – Solutions

- Unofficial: Advisement
  - Strongly encourage Elementary Statistics
  - Emphasize option of Statistics minor (relatively new)
- Official: Capstone Course
  - Increase focus on statistics
    - Direct instruction
    - Class time
  - No apparent negative impact
    - Same assignments in other content strands
    - Other content topics more readily perceived as review
  - Less than ideal solution for the long term



## Knowledge of Axiomatic Proof

- Which Assessment Data?
  - Capstone Portfolio
  - Geometry Portfolio
- Analysis
  - Proofs course covers many types of proof, but candidates show weakness leveraging axioms
- Solution
  - Adjustments in Geometry course
  - Adjustments in Capstone course
    - Portfolio assignment with novel system of axioms
    - Unfamiliar context to “force” student to rely on axioms

## Support Structure Needed

- What Data? Observations...
  - ...from implementing assessments
  - ...from **process** of interpreting results
- System needed for
  - Communication among faculty
  - Consistent implementation of assessments
  - Program revisions
- Solution
  - Secondary Mathematics Program Committee

## Secondary Mathematics Program Committee (SMPC)

- Membership
  - Mathematics faculty
  - Mathematics Education faculty
  - Field supervisors for internships
- Functions
  - Coordinate with College of Education
  - Review assessment data
  - Monitor all aspects of Secondary Math Program
    - Internship placements and supervision
    - Program curriculum



## Changes Initiated by SMPC

- Revise Coursework and Plan of Study: Designed Mathematics Education courses
  - Parallel upper level (general) Education courses (Replacing them for Secondary Math majors)
    - Classroom Management
    - Assessment
    - Curriculum
  - Situate course content explicitly in mathematics
  - Taught by Mathematics Education faculty
  - Remove burden from over-extended Methods/Materials course

$$y = mx + b$$

## 2012 NCTM Standards

- Six content domains under a single standard
  - Replace previous seven content standards
  - 2003 “indicators” within each content standard replaced with “elements” in each domain
  - Reorganization of content within domains
    - No separate domain for measurement
    - Trigonometry explicitly addressed within geometry
- Requires revised assessments for CAEP/NCTM
  - Adopted use of course grades as an assessment
  - Considered eliminating portfolios but did not
    - Grades + portfolios deemed more robust
  - Updated content of portfolios

## Challenges

- Articulation of 2012 standards
  - Items that were individual standards in 2003 rolled into a single standard in 2012
  - Example
    - Overall description of Algebra domain specifies: “the following topics...with...content understanding and mathematical practices supported by appropriate technology and varied representational tools, including concrete models”
    - A single element WITHIN Algebra domain reads: “Functional representations (tables, graphs, ...recursive definitions, and finite differences), characteristics (e.g., zeroes, intervals of increase or decrease, extrema, average rates of change, domain and range, and end behavior), and notations as a means to describe, reason, interpret, and analyze relationships and to build new functions”

## Challenges

- Comprehensive internship evaluation
  - Evaluation tools in COE replaced with edTPA
  - Previous NCATE assessment leveraged Teacher Work Sample
    - Unclear whether edTPA provides comparable data
    - Wish to avoid unnecessary duplication
    - Symptomatic of broader issue: relying on changeable assessments outside our control



## Challenges: Big Picture

- Keeping up with moving targets
  - Curriculum
  - CAEP assessments

