

# Analysis of Preservice Teacher's Knowledge of Mathematics Competencies

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Who will teach the math of this millennium?



# Impetus for Study

- Content knowledge is a prerequisite to teach ANY student
- If teachers are not competent in their content area knowledge, they cannot teach in ANY language.
- Supporting studies

# Rationale for Implementation

- ~ 5% of Texas State University pre-service graduates acquire mathematics and/or science certification
- In 2004 77 % of Texas State certified math and science teachers were EC - 4 certified.
- Only 50% of Texas graduates certified in math actually enter math education profession
- In San Marcos CISD only 35 of 240 math teachers are certified in mathematics.
  - 11 of these have a BS in mathematics

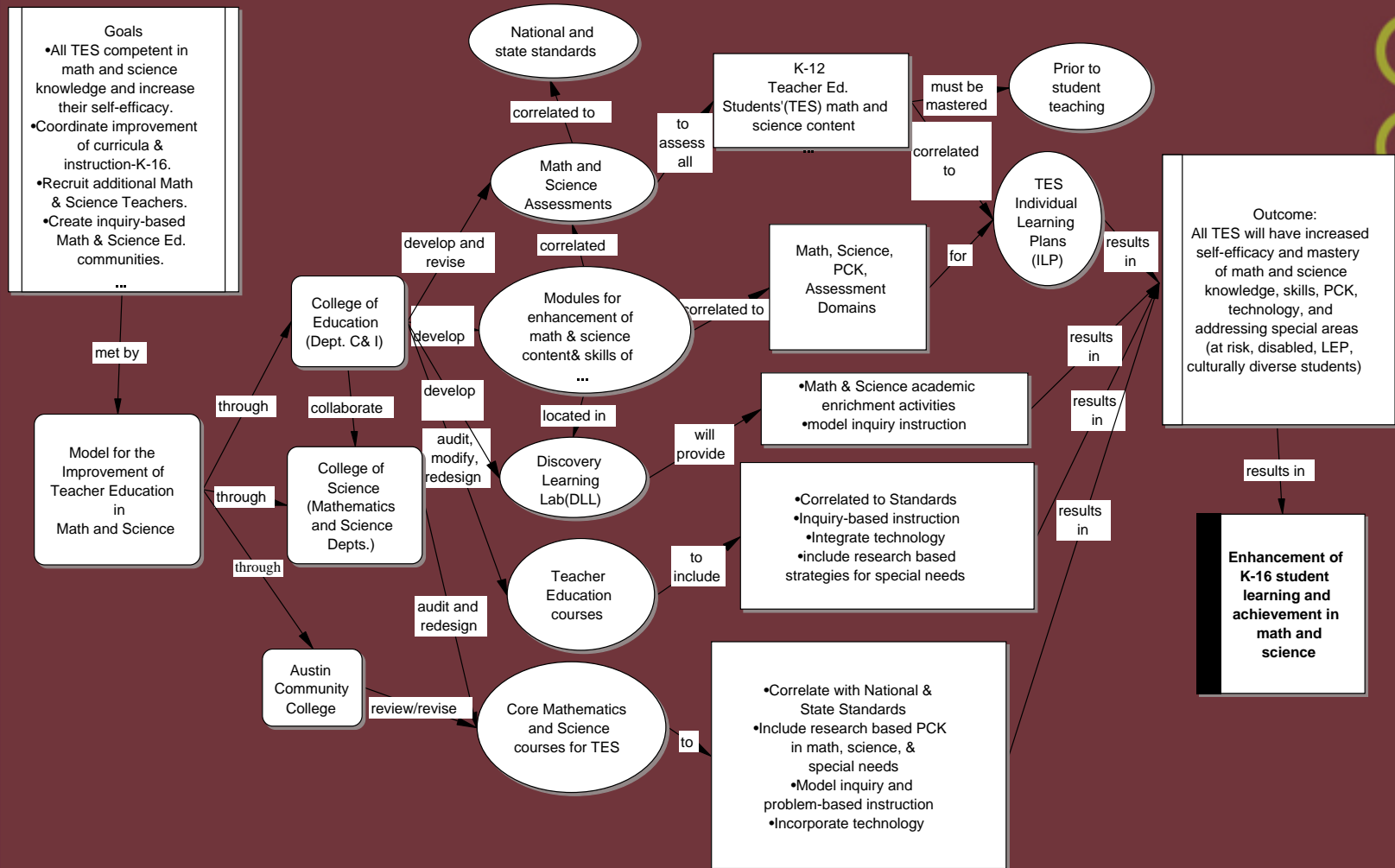


## Rationale cont...

- Preservice teachers at Texas State University often avoid math and science courses until late in their academic careers.
  - Due to math/science anxiety
  - Due to uninteresting math/science experiences in K-12 schools
  - Due to poor self efficacy on math and science

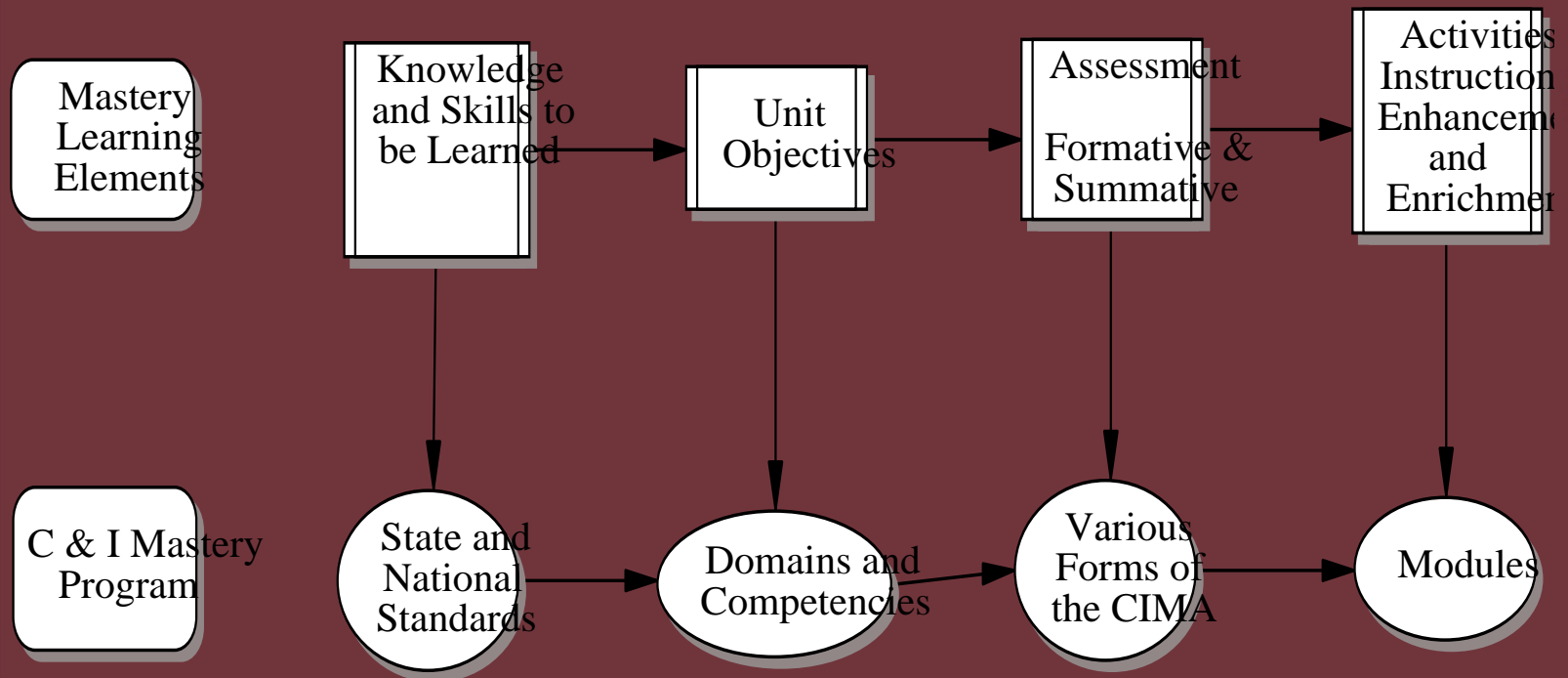


# Model for the Improvement of Teacher Education in Math and Science

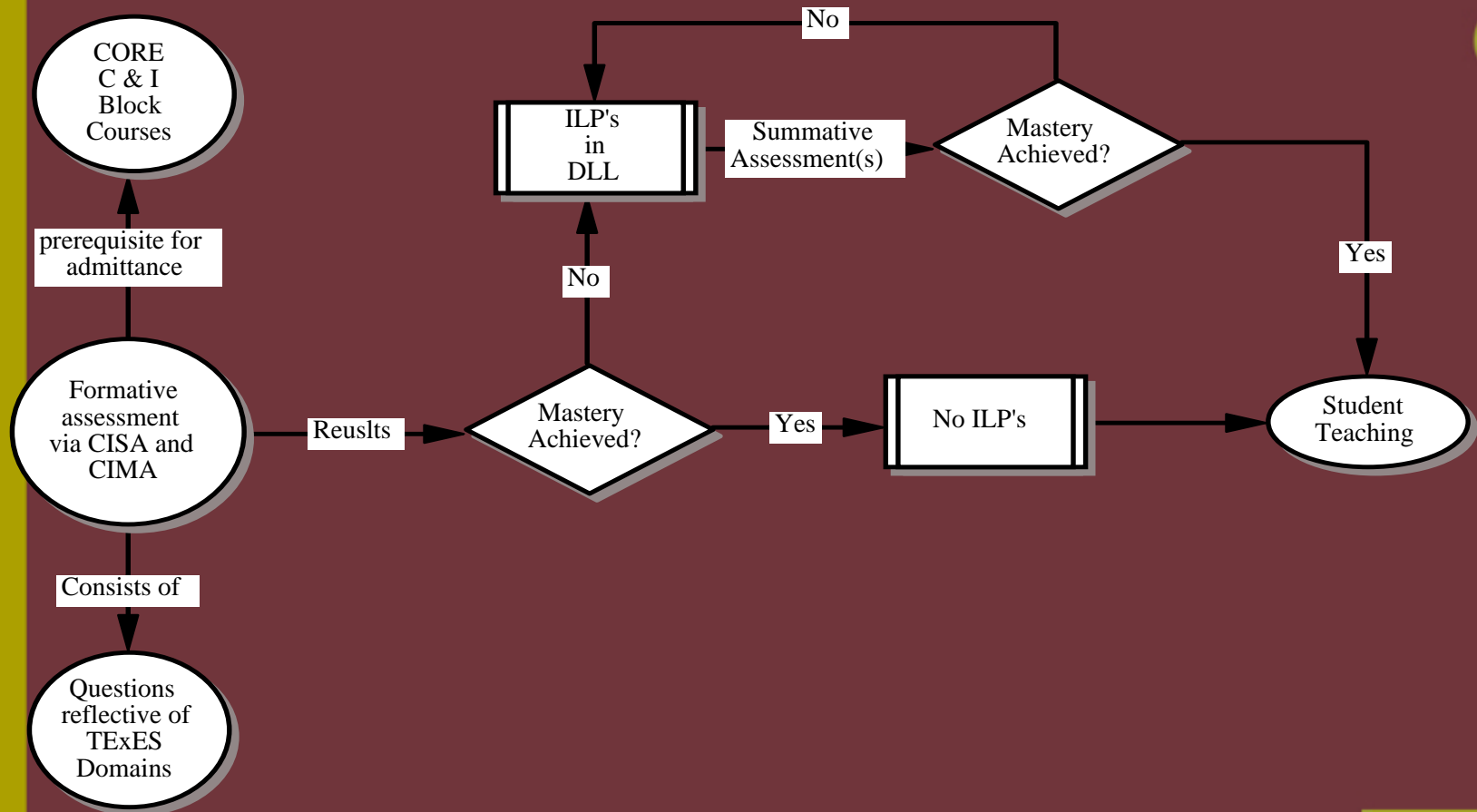


# Planning and Implementing for Mastery

## General process and C&I's Math and Science Mastery Program



# DLL Assessment flow chart



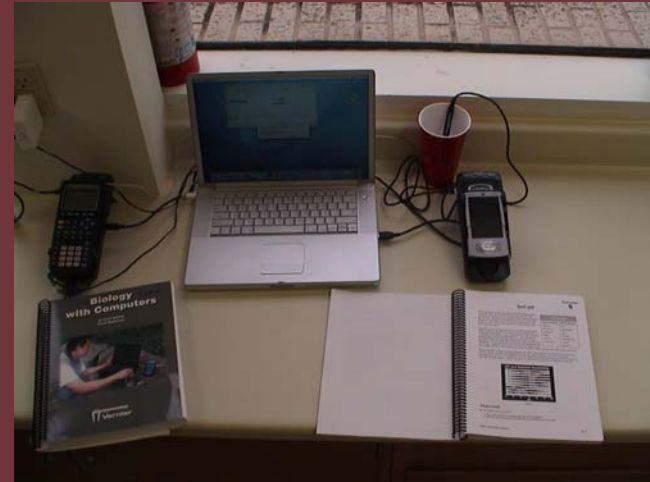
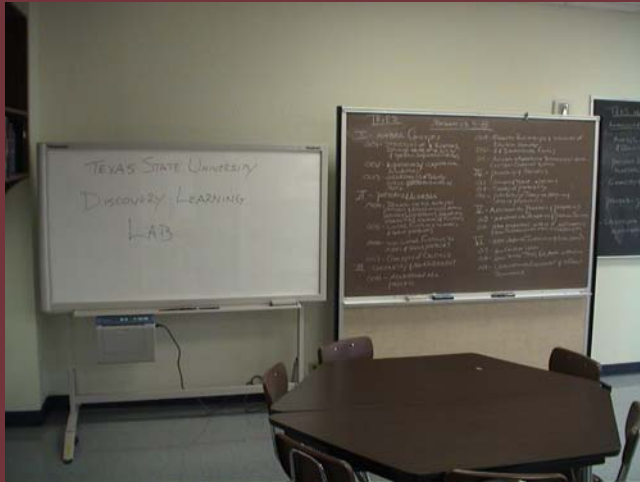


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# Layout of DLL



# Technology in the DLL



# Manipulatives and Resources



# Entry level Math Prerequisites at Texas State University

- All entering students must have at the minimum:
  - Algebra I
  - Algebra II
  - Geometry
- Any course that requires the above courses as a prerequisite.

# • Curriculum and Instruction Math Assessment (CIMA)

- CIMA was piloted in spring 2004 and spring 2005
  - Reliability indices for each domain was greater than 0.85
  - Construct validity
  - Expert validation

# CIMA Domains

- Reflective of National and State Standards
  - Domain I - Number Concepts
  - Domain II - Patterns and Algebra
  - Domain III - Geometry and Measurement
  - Domain IV - Probability and Statistics
  - Domain V - Math Processes and Perspectives
  - Domain VI - Math Learning , Instruction and Assessment



# Summary of Scores by Domains

Domain	Mean	STD
I	77.7	15.3
II	57.4	16.7
III	57.7	17.9
IV	59.6	15.8
V	30.2	16.4
VI	48.8	15.6
Total Score	55.2	11.0

# Criteria for Mastery in Math

- Six domains
  - Students must achieve a score of 75% in each domain
- Twenty-three competencies
  - Students must achieve a score of 50% in each competency



# Demographic Assessment

- Type of certification
- Content area courses taken
- Where courses were taken
- HS math/science courses taken
  
- Data might aid in coordinating math and science curricula and instruction at three levels:
  - Institutions of higher learning from which Texas State students transfer
  - Texas State University math and science departments
  - Texas State University C & I Department

# Certification Seekers Demographics

EC -4	85% Generalist	4.7% Bilingual
4 - 8	2.8% Math	0.5 % Math/Science
8 -12	0.5% Math	0.5% Science
EC -12	0.9% Phys Ed	1.4% Special Ed

# Preliminary Findings from CIMA

- Logistic Regression analysis
  - Domain outcomes dichotomized into pass/fail
  - Model correctly classifies 94.6% of the cases
- Each Domain analyzed to determine odds ratio for likelihood of achieving mastery
- Data will aid in aligning math courses with domains in CISA
  - Results in course alignment with national and state standards

# • Courses with significant contribution to mastery in Domains of interest

- Domain I - Number Concepts
  - College Algebra, Informal Geometry
- Domain II - Patterns and Algebra
  - College Algebra, Principles of Math I
- Domain III - Geometry and Measurement
  - College Algebra, Informal Geometry, Business Math
- Domain IV - Probability and Statistics
  - Elementary statistics, Business Math, Modern Geometry
- Domain V - Math Processes and Perspectives
  - College Algebra, POM I, Informal and Modern Geometry, Pre Calculus, Calculus, Elementary Statistics, History of Math
- Domain VI - Math Learning, Instruction and Assessment
  - Business Math, Calculus, Modern Geometry, History of Math

Students can access their scores



<http://www.dll.txstate.edu>

# Individual Learning Plans

- Each pre-service teacher will have a specific ILP designed based on their test results---domains and competencies mastered
- Consist of enhancement activities completed and summative test data noted

# Math Modules

- Address each Domain and all Competencies
- Math and science competencies may be integrated within one module
- Technology
  - Probes and data loggers
  - Computer and internet resources
- Utilize both academic and non-academic language
- Modules designed to represent math concepts in multiple formats

# C&I's Math and Science Mastery Program

- Offers pre-service Science and Math teachers opportunities to:
  - Increase content area knowledge
  - Increase pedagogic skills
  - Increase self-efficacy
- Provides information to help coordinate math and science curricula at three levels
- Provides resource for recruitment of new math and science teachers
- Provides opportunities to increase math and science teacher retention
- Provide a model pre-service teacher training facility



# In Summation

- The coordinated activities presented here will result in higher achieving K-16 students, thus enabling each student to share in the richness and excitement of comprehending the natural and technological world.
- Such students will in turn be better prepared and more motivated to pursue and enter careers in math, science, and technology, and teaching in these disciplines.