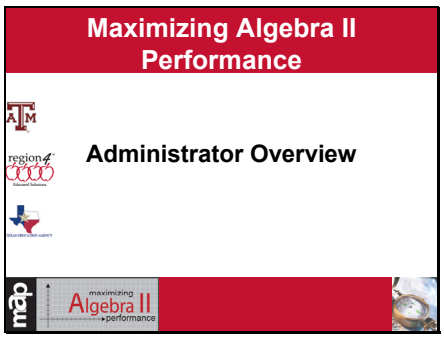
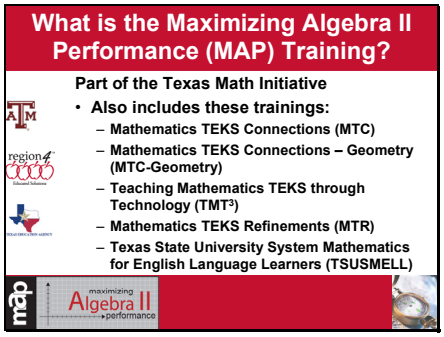
# Maximizing Algebra II Performance

## Administrator Overview

Slide 1

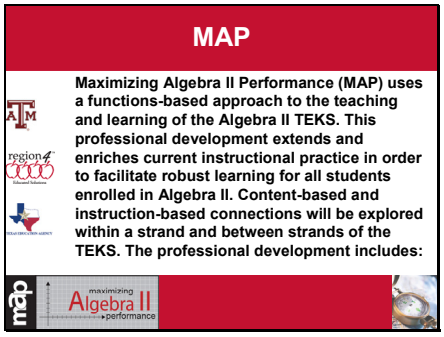



Slide 2

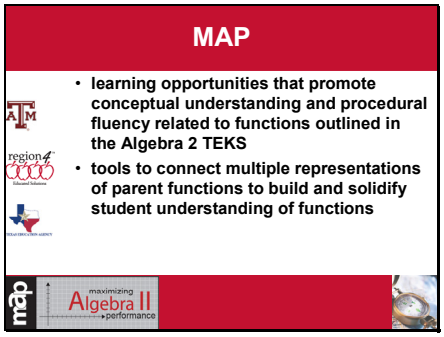



*Short description of the Texas Math Initiative. Each of the trainings has a specific purpose yet is related to the others. MTR focuses on the refinements in the TEKS. TMT3 focuses on the judicious use of technology to enhance mathematical understanding. TSUSMELL focuses on resources to support English Language Learners. MTC focuses on making conceptual to abstract connections within and across the TEKS. MTC-Geometry is a continuation of the MTC project and focuses on the conceptual connections within Geometry and to other courses. MAP is a continuation of the MTC project and focuses on the conceptual connections within Algebra II and to other courses.*

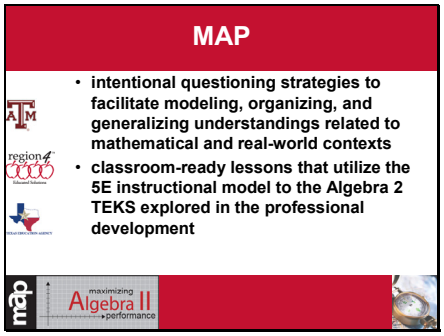
Slide 3



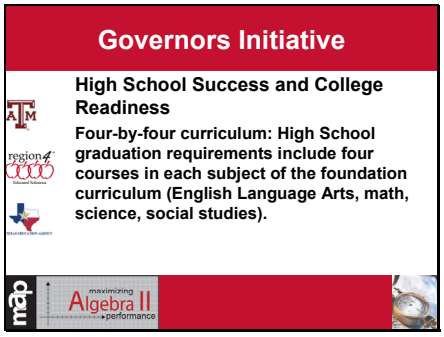

Slide 4




Slide 5

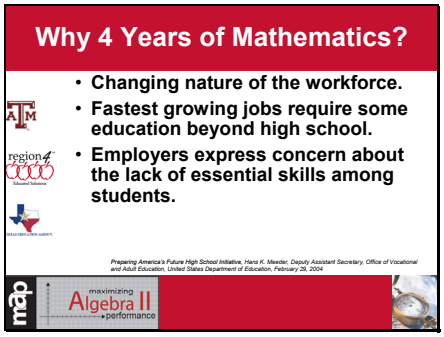


Slide 6



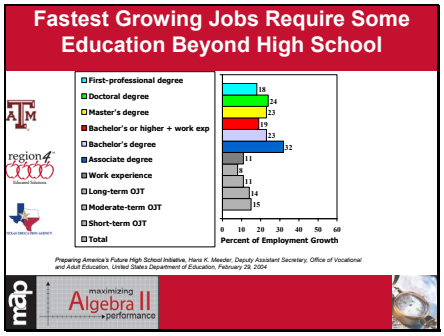

*Business and government entities agree that college readiness in high school must be improved.*

Slide 7



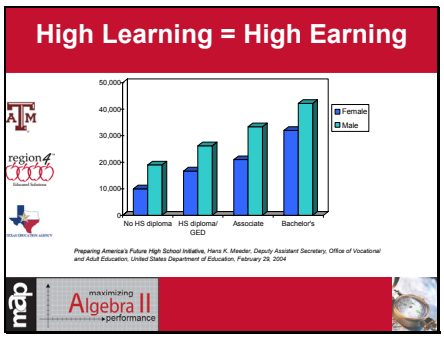

*Point out outsourcing and the impact of technology.*

Slide 8



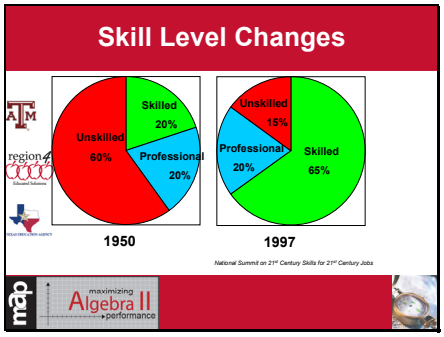

*Note top categories require an associate degree and above.*

Slide 9



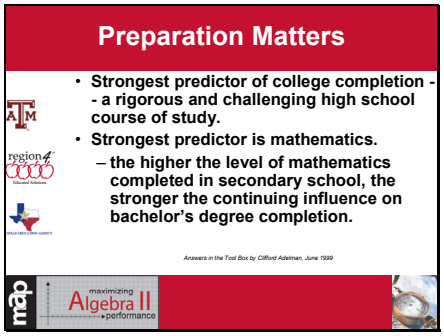

*Note the vast disparage between a high school diploma and a bachelors degree.*

Slide 10

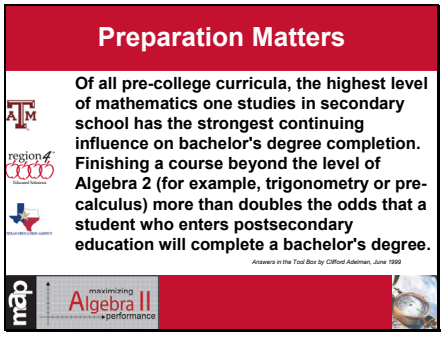



*Note the data, ask participants to conjecture as to the percentages now.*

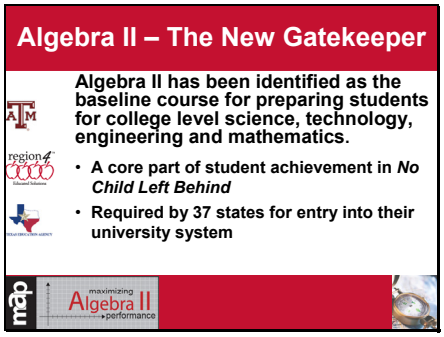
Slide 11



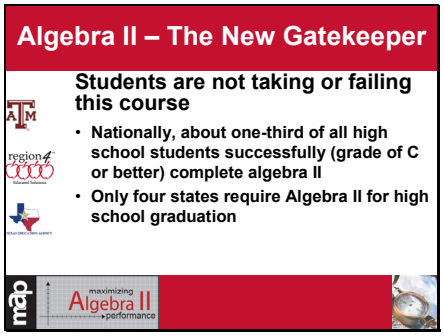
Slide 12




Slide 13

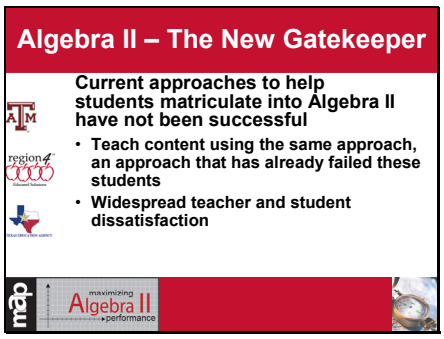



Slide 14



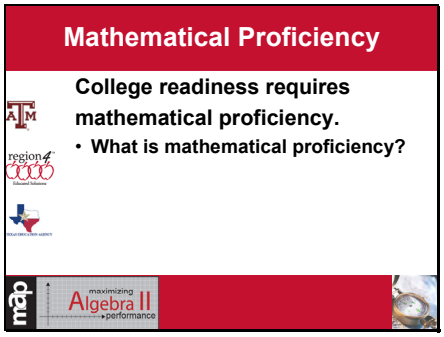

*Historically, Algebra II has had a high failure rate. This high rate has generally been viewed as acceptable. Why?*

Slide 15



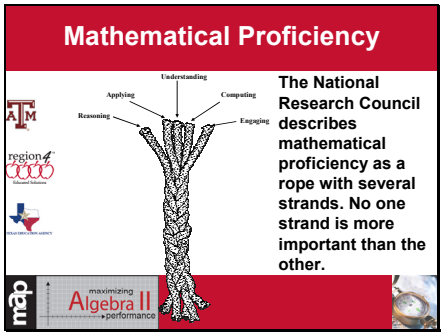

*What is the typical approach to teaching Algebra II?*

Slide 16

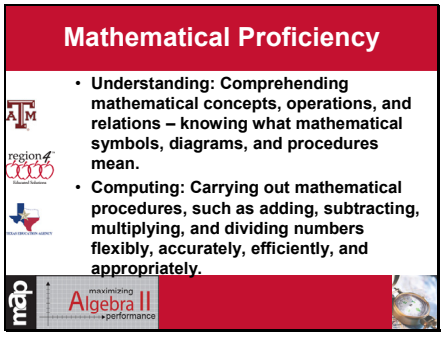



*Brainstorm with participants.*

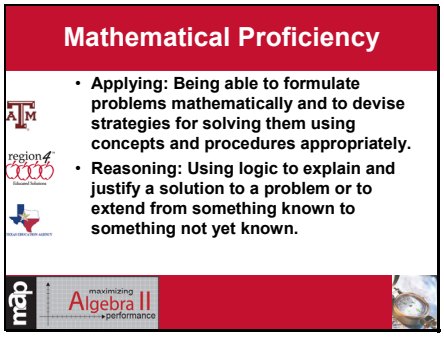
Slide 17



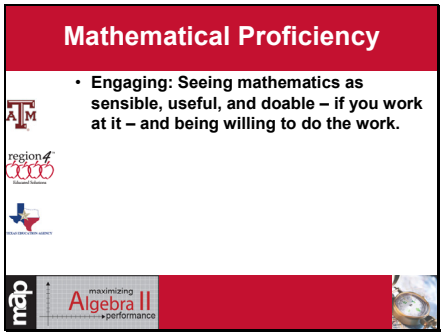
Slide 18



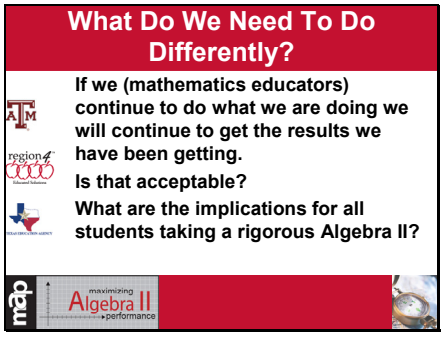

Slide 19




Slide 20

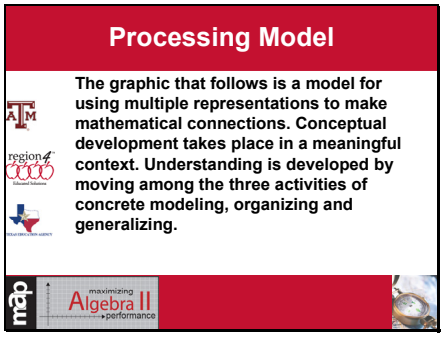


Slide 21

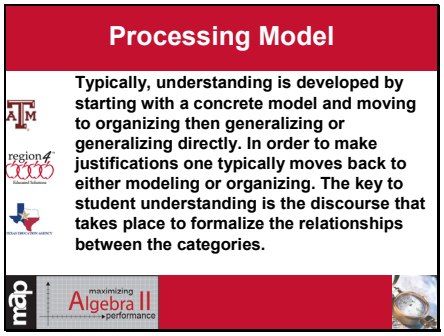



*How does instruction need to change so that all students can become mathematically proficient in Algebra II?*

Slide 22




Slide 23



Slide 24

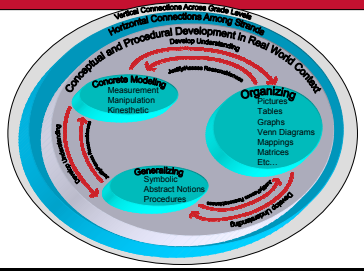
## Processing Framework Model

Once a concept is developed it can be applied in different contexts across strands within a grade level or courses. Finally it is connected vertically across grade levels or courses.

maximizing Algebra II performance

Slide 25

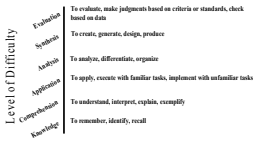
## Processing Framework Model




Slide 26

## Rigor vs. Complexity of Content

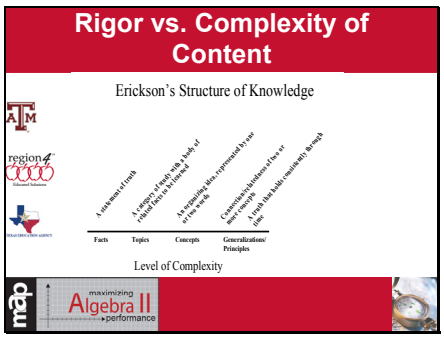
Bloom's Taxonomy



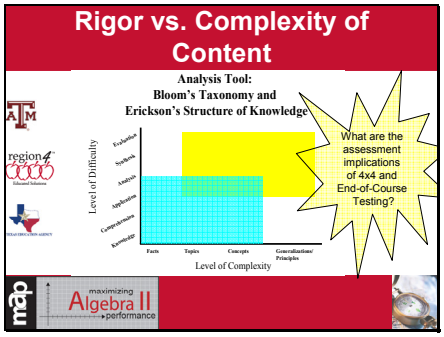

maximizing Algebra II performance

*Rigor is key but balance is critical.*

Slide 27

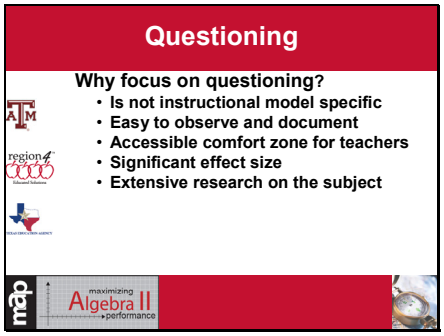



Slide 28



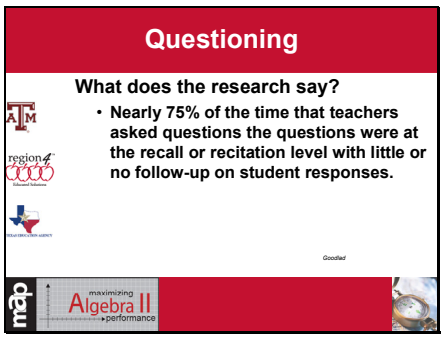

*Assessments have become much more conceptual in design. Whether the assessment is TAKS, SAT, or AP exams, questions are becoming more sophisticated. This requires a higher level of problem-solving on the part of students.*

Slide 29



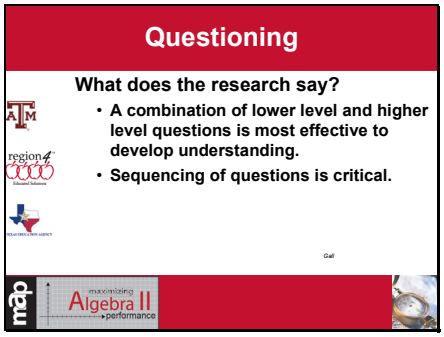

*The discourse that occurs in the classroom is critical to student achievement. Classroom discourse is facilitated through teacher questions.*

Slide 30



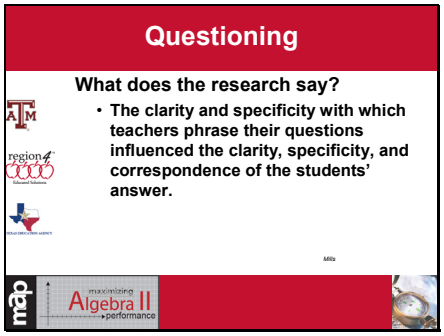

*A significant amount of questions that teachers ask have nothing to do with content. i.e. Why are you late?*

Slide 31



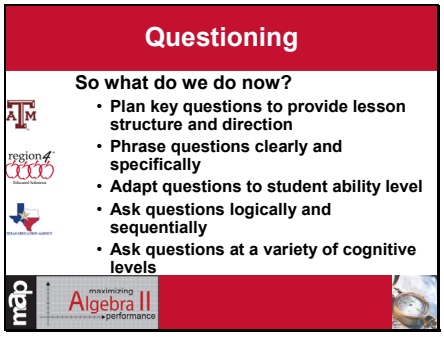

*Balance is critical. Sequence does not necessarily mean low rigor to high rigor. A very rigorous question might be asked to stimulate investigation then the rigor of questions might move down and build.*

Slide 32



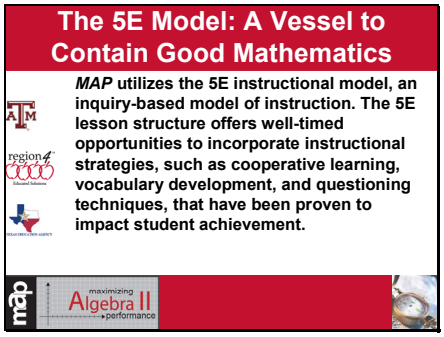

*Ask quality questions and get quality responses.*

Slide 33



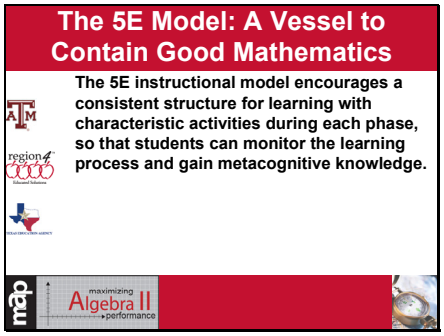

*The key is planning. In addition to planning questions teachers should plan for student responses.*

Slide 34

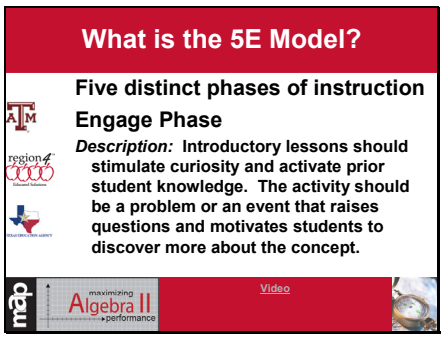



*A large body of research exists about different types of instructional cycles and their effectiveness. The particular model that we are following today is called the Five E Instructional Model.*

Slide 35

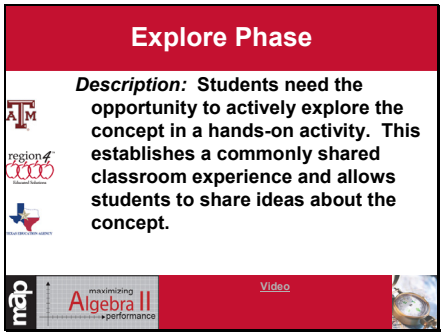


Slide 36



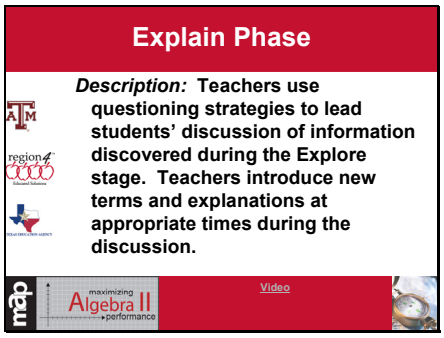

*In this model, Stage 1 is appropriately referred to as "Engage".*
*Emphasize:*
*During the Engage phase, are teachers looking for students to have the "right answer"?* NO
*Are teachers explaining new concepts to students or giving lectures?* NO
*Are teachers providing new vocabulary terms and definitions?* NO

Slide 37



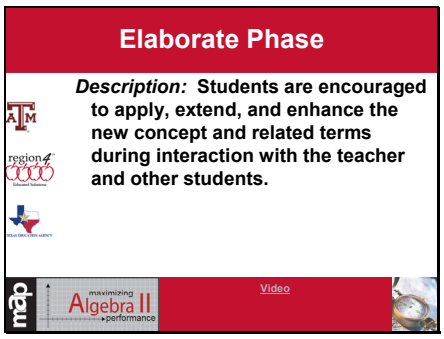

*Emphasize:*
*During the Explore phase, are teachers looking for students to have the "right answer"?* NO
*During the Explore phase, who appears to be doing the most work?* The students
*Are teachers explaining new concepts to students or giving lectures?* NO
*Are teachers providing new vocabulary terms and definitions?* NO

Slide 38



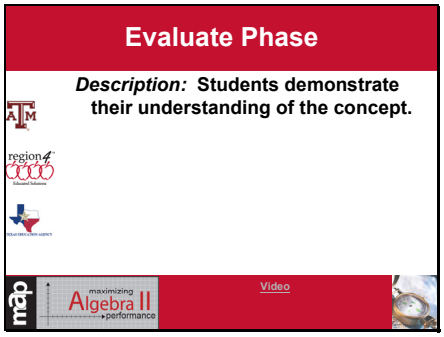

*Emphasize:*
*Are teachers explaining new concepts to students or giving lectures?* Only after hearing from students first
*Are teachers providing new vocabulary terms and definitions?* YES

Slide 39



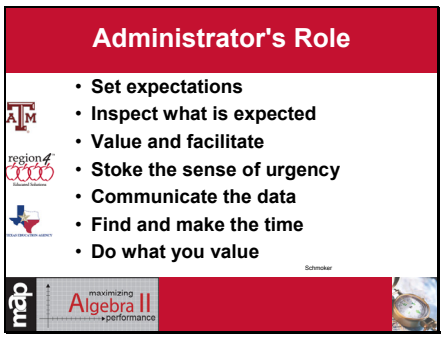

*Emphasize:*
*During the Elaborate phase, are teachers introducing students to new concepts and processes?* NO
*Are teachers explaining new concepts to students or giving lectures?* NO
*Are teachers providing new vocabulary terms and definitions?* NO

Slide 40



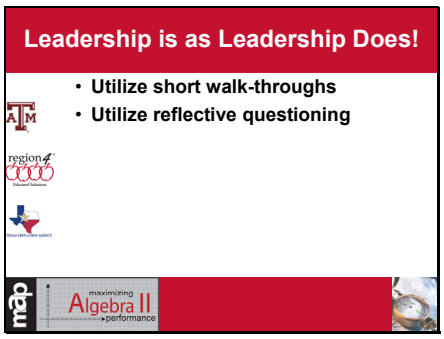

*Evaluation takes place throughout the phases of the 5E lessons in the form of questions and assessments. The evaluate phase itself is a performance assessment requiring significant thinking and problem-solving on the part of students.*

Slide 41




*If implementation is desired administrators must communicate with teachers. Data is a powerful tool to drive change.*

Slide 42




*The short walk-through is an excellent tool to demonstrate the importance of implementation. While they do require time the potential impact on instruction can be extremely valuable. Administrators can use coaching techniques to manage staff more effectively.*

*Reflective questions do not require an answer. Their purpose is to stimulate thought on the part of the teacher.*

# Maximizing Algebra II Performance

## Administrator Overview

# What is the Maximizing Algebra II Performance (MAP) Training?

**Part of the Texas Math Initiative**

- **Also includes these trainings:**
  - **Mathematics TEKS Connections (MTC)**
  - **Mathematics TEKS Connections – Geometry (MTC-Geometry)**
  - **Teaching Mathematics TEKS through Technology ($TMT^3$)**
  - **Mathematics TEKS Refinements (MTR)**
  - **Texas State University System Mathematics for English Language Learners (TSUSMELL)**

# MAP

**Maximizing Algebra II Performance (MAP) uses a functions-based approach to the teaching and learning of the Algebra II TEKS. This professional development extends and enriches current instructional practice in order to facilitate robust learning for all students enrolled in Algebra II. Content-based and instruction-based connections will be explored within a strand and between strands of the TEKS. The professional development includes:**

## MAP

- learning opportunities that promote conceptual understanding and procedural fluency related to functions outlined in the Algebra 2 TEKS
- tools to connect multiple representations of parent functions to build and solidify student understanding of functions

## MAP

- intentional questioning strategies to facilitate modeling, organizing, and generalizing understandings related to mathematical and real-world contexts
- classroom-ready lessons that utilize the 5E instructional model to the Algebra 2 TEKS explored in the professional development

## Governors Initiative

**High School Success and College Readiness**

**Four-by-four curriculum: High School graduation requirements include four courses in each subject of the foundation curriculum (English Language Arts, math, science, social studies).**

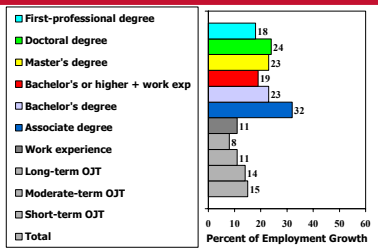
## Why 4 Years of Mathematics?

- Changing nature of the workforce.
- Fastest growing jobs require some education beyond high school.
- Employers express concern about the lack of essential skills among students.

*Preparing America's Future High School Initiative, Hans K. Meeder, Deputy Assistant Secretary, Office of Vocational and Adult Education, United States Department of Education, February 29, 2004*

map maximizing Algebra II performance

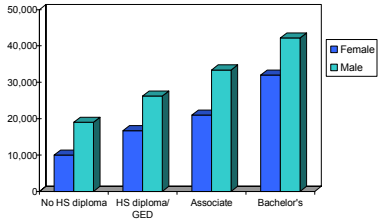
## Fastest Growing Jobs Require Some Education Beyond High School




*Preparing America's Future High School Initiative, Hans K. Meeder, Deputy Assistant Secretary, Office of Vocational and Adult Education, United States Department of Education, February 29, 2004*

map maximizing Algebra II performance

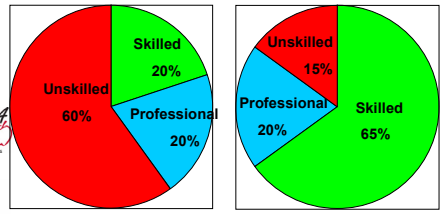
## High Learning = High Earning




*Preparing America's Future High School Initiative, Hans K. Meeder, Deputy Assistant Secretary, Office of Vocational and Adult Education, United States Department of Education, February 29, 2004*

map maximizing Algebra II performance

## Skill Level Changes




1950 1997

*National Summit on 21st Century Skills for 21st Century Jobs*

maximizing Algebra II performance

## Preparation Matters

- **Strongest predictor of college completion -- a rigorous and challenging high school course of study.**
- **Strongest predictor is mathematics.**
  - **the higher the level of mathematics completed in secondary school, the stronger the continuing influence on bachelor's degree completion.**

*Answers in the Tool Box by Clifford Adelman, June 1999*

maximizing Algebra II performance

## Preparation Matters

**Of all pre-college curricula, the highest level of mathematics one studies in secondary school has the strongest continuing influence on bachelor's degree completion. Finishing a course beyond the level of Algebra 2 (for example, trigonometry or pre-calculus) more than doubles the odds that a student who enters postsecondary education will complete a bachelor's degree.**

*Answers in the Tool Box by Clifford Adelman, June 1999*

maximizing Algebra II performance

## Algebra II – The New Gatekeeper

**Algebra II has been identified as the baseline course for preparing students for college level science, technology, engineering and mathematics.**

- **A core part of student achievement in *No Child Left Behind***
- **Required by 37 states for entry into their university system**


## Algebra II – The New Gatekeeper

**Students are not taking or failing this course**

- **Nationally, about one-third of all high school students successfully (grade of C or better) complete algebra II**
- **Only four states require Algebra II for high school graduation**


## Algebra II – The New Gatekeeper

**Current approaches to help students matriculate into Algebra II have not been successful**

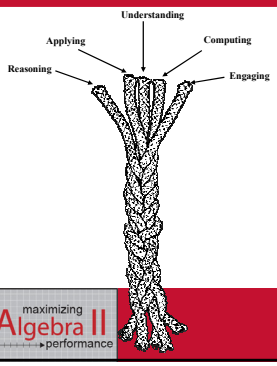
- **Teach content using the same approach, an approach that has already failed these students**
- **Widespread teacher and student dissatisfaction**

## Mathematical Proficiency

**College readiness requires mathematical proficiency.**

- **What is mathematical proficiency?**

## Mathematical Proficiency




**The National Research Council describes mathematical proficiency as a rope with several strands. No one strand is more important than the other.**

## Mathematical Proficiency

- **Understanding: Comprehending mathematical concepts, operations, and relations – knowing what mathematical symbols, diagrams, and procedures mean.**
- **Computing: Carrying out mathematical procedures, such as adding, subtracting, multiplying, and dividing numbers flexibly, accurately, efficiently, and appropriately.**

## Mathematical Proficiency

- **Applying: Being able to formulate problems mathematically and to devise strategies for solving them using concepts and procedures appropriately.**
- **Reasoning: Using logic to explain and justify a solution to a problem or to extend from something known to something not yet known.**

## Mathematical Proficiency

- **Engaging: Seeing mathematics as sensible, useful, and doable – if you work at it – and being willing to do the work.**

## What Do We Need To Do Differently?

**If we (mathematics educators) continue to do what we are doing we will continue to get the results we have been getting.**

**Is that acceptable?**

**What are the implications for all students taking a rigorous Algebra II?**

## Processing Model

The graphic that follows is a model for using multiple representations to make mathematical connections. Conceptual development takes place in a meaningful context. Understanding is developed by moving among the three activities of concrete modeling, organizing and generalizing.

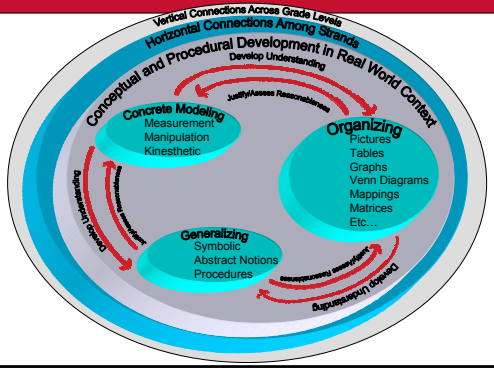

## Processing Model

Typically, understanding is developed by starting with a concrete model and moving to organizing then generalizing or generalizing directly. In order to make justifications one typically moves back to either modeling or organizing. The key to student understanding is the discourse that takes place to formalize the relationships between the categories.


## Processing Framework Model

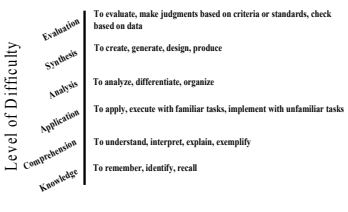
Once a concept is developed it can be applied in different contexts across strands within a grade level or courses. Finally it is connected vertically across grade levels or courses.

# Processing Framework Model




# Rigor vs. Complexity of Content

Bloom's Taxonomy

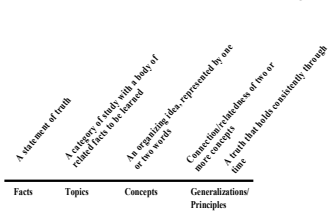



Anderson, L. W., & Krathwohl, D. R. (2001). (Eds.). *Taxonomy for learning, teaching, and assessing:*



# Rigor vs. Complexity of Content

Erickson's Structure of Knowledge

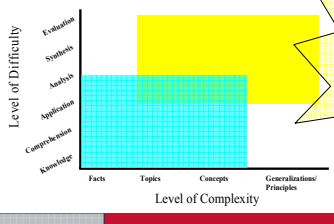



Level of Complexity



## Rigor vs. Complexity of Content

**Analysis Tool:**
**Bloom's Taxonomy and**
**Erickson's Structure of Knowledge**




What are the assessment implications of 4x4 and End-of-Course Testing?

map maximizing Algebra II performance

## Questioning

**Why focus on questioning?**

- **Is not instructional model specific**
- **Easy to observe and document**
- **Accessible comfort zone for teachers**
- **Significant effect size**
- **Extensive research on the subject**

map maximizing Algebra II performance

## Questioning

**What does the research say?**

- **Nearly 75% of the time that teachers asked questions the questions were at the recall or recitation level with little or no follow-up on student responses.**

*Goodlad*

map maximizing Algebra II performance

## Questioning

**What does the research say?**

- **A combination of lower level and higher level questions is most effective to develop understanding.**
- **Sequencing of questions is critical.**

*Gall*


## Questioning

**What does the research say?**

- **The clarity and specificity with which teachers phrase their questions influenced the clarity, specificity, and correspondence of the students' answer.**

*Mills*


## Questioning

**So what do we do now?**

- **Plan key questions to provide lesson structure and direction**
- **Phrase questions clearly and specifically**
- **Adapt questions to student ability level**
- **Ask questions logically and sequentially**
- **Ask questions at a variety of cognitive levels**

## The 5E Model: A Vessel to Contain Good Mathematics

***MAP*** **utilizes the 5E instructional model, an inquiry-based model of instruction. The 5E lesson structure offers well-timed opportunities to incorporate instructional strategies, such as cooperative learning, vocabulary development, and questioning techniques, that have been proven to impact student achievement.**

## The 5E Model: A Vessel to Contain Good Mathematics

**The 5E instructional model encourages a consistent structure for learning with characteristic activities during each phase, so that students can monitor the learning process and gain metacognitive knowledge.**

## What is the 5E Model?

**Five distinct phases of instruction**

**Engage Phase**

***Description:*** **Introductory lessons should stimulate curiosity and activate prior student knowledge. The activity should be a problem or an event that raises questions and motivates students to discover more about the concept.**

Video

## Explore Phase

***Description:*** **Students need the opportunity to actively explore the concept in a hands-on activity. This establishes a commonly shared classroom experience and allows students to share ideas about the concept.**

map maximizing Algebra II performance

Video

## Explain Phase

***Description:*** **Teachers use questioning strategies to lead students' discussion of information discovered during the Explore stage. Teachers introduce new terms and explanations at appropriate times during the discussion.**

map maximizing Algebra II performance

Video

## Elaborate Phase

***Description:*** **Students are encouraged to apply, extend, and enhance the new concept and related terms during interaction with the teacher and other students.**

map maximizing Algebra II performance

Video

## Evaluate Phase

***Description:*** **Students demonstrate their understanding of the concept.**

Video

## Administrator's Role

- **Set expectations**
- **Inspect what is expected**
- **Value and facilitate**
- **Stoke the sense of urgency**
- **Communicate the data**
- **Find and make the time**
- **Do what you value**

Schmoker

## Leadership is as Leadership Does!

- **Utilize short walk-throughs**
- **Utilize reflective questioning**