

Redefining Developmental Math for Non-Algebra Core Math Courses

Dr. Daryl Stephens (stephen@etsu.edu) and
Murray Butler (butlern@etsu.edu)
East Tennessee State University



Presented at Tennessee Mathematical Association for Two-Year Colleges
conference, Blountville, TN, April 18, 2008

Disclaimers

- We don't have all the answers.
- We don't even have all the questions!
- Your mileage may vary. (It may be that nothing in this presentation will apply to your institution's situation.)

ETSU's Situation (Here's where your mileage may vary.)

- About 90% of our students do NOT take an algebra-based course (such as college algebra, precalculus, calculus) for graduation. These students take MATH 1530, Probability and Statistics, as their core math class.
- Very little intermediate algebra is used in this course.
- Mostly majors in math and the sciences take something other than prob & stat for graduation, and they are required to take one semester of calculus. (Digital media majors take both P&S and trig.) These students benefit from intermediate algebra.
- NSTCC and WSCC are affected by ETSU's decisions.

Our Redesign Proposal -- What did we think we would do?

- Re-vamp DSPM 0800 to make it a better preparation for statistics
- Delete DSPM 0850 requirement for students not taking precalculus or other algebra-based courses

Same Topics, New Sequence

- What concepts do the statisticians think the incoming students need?

Emphasize:

- Order of operations, especially distributive property, even when using a calculator
- Comparing (order) fractions, decimals, percents, and signed numbers
- Interpret numerical answer—(what does it mean?)
- Estimation: does the answer make sense?
- Percent, proportions, decimals
- Solving and graphing linear equations
- The language of inequalities

Our Proposal – Technology

- Use My Math Lab, Hawkes Learning, or similar programs with both courses
- Alternate days between lecture classroom and computer lab as is done with statistics course
- Do spreadsheet activities in elementary algebra to prepare students for Minitab
- Use graphing calculator in elementary algebra to prepare for stat and in intermediate algebra to prepare students for precalculus
- Envisioned Advantages
- Cost savings: Cut back on sections of 0850 from ~12 each semester to ~3 or 4.
- Prepare students for courses they would actually take
- More individualized help with computer programs and developmental math tutors

Disadvantages

- Administration would be difficult
- What about students who placed in 0850? Move them on in to 1530 or put them in 0800?
- What about students who change to science major after finishing 0800→1530?

TBR DSP Redesign

- Subcommittees working in all areas including math
- Align with Tennessee high school exit standards
- This year's 7th graders (Class of 2013) will have to take math all 4 years of high school!
- New math curriculum standards based on NCTM, ADP, ACT, NAEP, . . .

Math Redesign Subcommittee

- Subcommittee includes university, community college, and high school faculty
- Currently surveying math and other faculty across TBR to see what math is actually needed in intro and gen-ed courses
- Some thought given to multiple exit points
- More questions than answers at this point

Committee's Charge

- Examine *what* should be taught, *when*, and *why*.
- Pilot programs help decide *who*, *how*, and *where*.

Subcommittee Members

- | | |
|--|---|
| • Chris Knight (Walters SCC)
Co-chair | • Helen Darcey (Cleveland SCC) |
| • John Kendall (SW TN) Co-
chair | • Mary Monroe-Ellis (PSTCC) |
| • Marva Lucas (MTSU) | • Sharon Lee (Wilson County
Schools) |
| | • Daryl Stephens (ETSU) |

MATH Survey

- The next few slides show a version of some questions that *may* be on the questionnaire to ask what math is needed in TBR core math classes with a prerequisite below the level of MATH 1xyz.
- MATH 1010, 1110, 1130, 1410, 1420, 1530, 1630, 1710, 1720, 1730
- Integrated Concepts
 - Connecting mathematics to other disciplines (real world applications)
 - Connecting mathematics symbolically, numerically, graphically and verbally (Reading and interpreting graphs and tables, communicating mathematics, modeling)
 - Integrating technology (as a tool for problem solving and discovery)
 - Developing study skills (problem solving strategies, managing math anxiety, time management, feasibility of solutions)
 - Analyze characteristics of functions (including domain, range, increasing, decreasing, and continuity)
- Math Skill List
 - Algebra and Number Sense
 - Perform operations on real numbers
 - Perform operations on complex numbers
 - Perform operations on polynomials (including factoring)
 - Analysis of linear functions and graphs (including inequalities)
 - Solve linear equations/inequalities
 - Analysis of quadratic functions and graphs (including inequalities)
 - Solve quadratic equations/inequalities
 - Analysis of rational functions and graphs (including inequalities)
 - Solve rational equations/inequalities
 - Analysis of radical functions and graphs (including inequalities)
 - Solve equations/inequalities with radical expressions
 - Analysis of exponential and logarithmic functions and graphs
 - Solve exponential and logarithmic equations
 - Unit conversions (mass, weight and volume in both standard and metric systems)
 - Solve systems of equations and inequalities
 - Introductory Probability and Statistics
 - Basic probability
 - Applying descriptive statistics (of center and variation)
 - Organize and display data (histograms, stems and leaf, pie charts, scatter plots)
 - Geometry
 - Geometric principles (parallel line and transversals, sum of angles in plane figures, distance formula, midpoint formula, volume, and surface area)

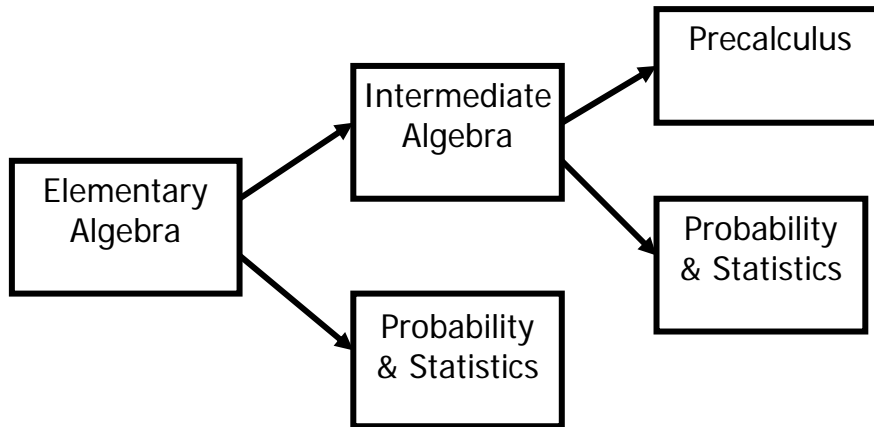
Questionnaire for Non-Math

- Please list the top prerequisite math skills needed in your program or course. Only include those courses that do not already have a math prerequisite/corequisite. In other words, what math skills do your students need to have before they enter your class to have a reasonable chance at success?

What to do now?

- Find money and/or share computer space
- Move forward with the changes we can make
 - Teach the important topics that prepare students for statistics in our DSPM 0800, then move students straight to Statistics
 - Students needing Precalculus take DSPM 0850

Proposed Sequences



DSPM 0800 Content (proposed) (Based on Martin-Gay combined 4th edition)

1. Review of Real Numbers

- 1.2 Symbols and Sets of Numbers
- 1.3 Fractions
- 1.4 Introduction to Variable Expressions and Equations
- 1.5 Adding Real Numbers
- 1.6 Subtracting Real Numbers
- 1.7 Multiplying and Dividing Real Numbers--Operations on Real Numbers
- 1.8 Properties of Real Numbers

2. Equations

- 2.1 Simplifying Expressions
- 2.2 The Addition and Multiplication Properties of Equality
- 2.3 Solving Linear Equations
- 2.4 An Introduction to Problem Solving
- 2.5 Formulas
- 2.6 Percent
- 2.8 Linear Inequalities

3. Graphing

- 3.1 Reading Graphs & the Rectangular Coordinate System
- 3.2 Graphing Linear Equations
- 3.3 Intercepts
- 3.4 Slope and Rate of Change

3.5 Slope-Intercept Form: $y = mx + b$

3.7 Functions

4. Systems of Linear Equations

4.1 Solving Systems of Linear Equations by Graphing

Integrated Review – Solving Systems of Equations

5. Exponents and Polynomials

5.1 Exponents

9. Inequalities and Absolute Value

9.1 Compound Inequalities

9.4 Linear Inequalities in Two Variables and Systems of Linear Inequalities

10. Radicals, Rational Exponents

10.1 Radicals and Radical Functions

Appendices

D. An Introduction to Using a Graphing Utility

G. Mean, Median, and Mode

Proposed New DSPM 0850

5. Exponents and Polynomials

5.1 Exponents

5.2 Polynomial Functions and Adding and Subtracting Polynomials

5.3 Multiplying Polynomials

5.4 Special Products

Integrated Review - Exponents and Operations on Polynomials

5.5 Negative Exponents and Scientific Notation

5.6 Dividing Polynomials

5.7 The Remainder Theorem

6. Factoring Polynomials

6.1 The Greatest Common Factor and Factoring by Grouping

6.2 Factoring Trinomials of the Form $x^2 + bx + c$

6.3 Factoring Trinomials of the Form $ax^2 + bx + c$ and Perfect Square Trinomials

6.4 Factoring Trinomials of the Form $ax^2 + bx + c$ by Grouping

6.5 Factoring Binomials

Integrated Review-Choosing a Factoring Strategy

6.6 Solving Quadratic Equations by Factoring

6.7 Quadratic Equations and Problem Solving

7. Rational Expressions

7.1 Rational Functions and Simplifying Rational Expressions

7.2 Multiplying and Dividing Rational Expressions

7.3 Adding and Subtracting Rational Expressions with Common Denominators and Least Common Denominator

7.4 Adding and Subtracting Rational Expressions with Unlike Denominators

7.5 Solving Equations Containing Rational Expressions

Integrated Review-Summary on Rational Expressions

- 7.6 Proportion and Problem Solving with Rational Equations
- 7.7 Simplifying Complex Fractions
- 10. Radicals, Rational Exponents, and Complex Numbers**
 - 10.2 Rational Exponents
 - 10.3 Simplifying Radical Expressions
 - 10.4 Adding and Subtracting and Multiplying Radical Expressions
 - 10.5 Rationalizing Denominators and Numerators of Radical Expressions
 - Integrated Review - Radicals and Rational Exponents
 - 10.6 Radical Equations and Problem Solving
 - 10.7 Complex Numbers
- 11. Quadratic Equations and Functions**
 - 11.1 Solving Quadratic Equations by Completing the Square
 - 11.2 Solving Quadratic Equations by the Quadratic Formula
 - 11.3 Solving Equations by Using Quadratic Methods
 - Integrated Review-Summary on Solving Quadratic Equations
 - 11.5 Quadratic Functions and Their Graphs
 - 11.6 Further Graphing of Quadratic Functions
- 4. Systems of Linear Equations**
 - 4.2 Solving Systems of Linear Equations by Substitution
 - 4.3 Solving Systems of Linear Equations by Addition
 - Integrated Review - Solving Systems of Equations
 - 4.5 Systems of Linear Equations and Problem Solving
- *12. Exponential and Logarithmic Functions (optional)**
 - 12.1 The Algebra of Functions: Composite Functions
 - 12.2 Inverse Functions
 - 12.3 Exponential Functions
 - 12.4 Logarithmic Functions
 - 12.7 Exponential and Logarithmic Equations and Applications

■ This presentation will be on Daryl's faculty web page:

<http://faculty.etsu.edu/stephen/handouts.htm>

Look for links from that page.

Contact Information:

Mailing address for both: Department of Mathematics, East Tennessee State University, Box 70663, Johnson City, TN 37614-1701

E-mail and phone:

Daryl Stephens 423-439-4676 stephen@etsu.edu

Murray Butler 423-439-4678 butlern@etsu.edu