Accelerate and Improve Developmental Mathematics: The New Life Model

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This session ...

- Identifies specific problems with the “old”
- Describes a new model to solve the problem
- Explores math paths within the model
- Shows how to accelerate using these courses
- Describes courses which emphasize good mathematics from the first day
What Dev Math has Been: The OLD

3 common courses (sometimes 4)
Pre-algebra
Beginning Algebra
Intermediate Algebra
and perhaps Basic Math

Presumption of appropriateness
Origins? It was “found in a box” back in 1968
Existing system was not designed – it was copied from a different context

A given student might be accidentally well-served by portions of the old system (or not)

A 3-course sequence guarantees general failure of the design

Even a 2-course sequence presents huge challenges
The Risk of a Longer Sequence: 2 Dev Courses
Assume 70% pass rate, 80% retention

Beginning Algebra
- 100 students
- 70 pass

Intermediate Algebra
- 56 enroll
- 39 pass

College Math
- 31 enroll
- 22 pass
# The Risks: Three Dev Math Courses (70% pass, 80% retention)

<table>
<thead>
<tr>
<th>Course</th>
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<th>Pass Rate</th>
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The System has Fatal Flaws

- Too many courses: Exponential Attrition
- Content is not designed to serve a purpose

The shock is not that the system does not work

The shock is that the system has survived this long
The Path Forward

- Good solutions are not likely to resemble our old system (can not use pieces)
- Deliberate design needed
- Identification of basic goals for dev math
- Creativity based on good mathematics
- Professional development and networking
Where the New Life Project came from

- AMATYC Developmental Math Committee
- Teams used professional sources (MAA, AMS, AMATYC, etc)
- Learning outcomes identified ... 2008 & 2009
- 3-Day workshop organized outcomes into two courses (Seattle; 2009)
- Outcomes for “Math Lit” were vetted (Carnegie Foundation, Dana Center)
- Our work is closely related to Pathways and Mathways.
Goals Addressed by New Life Model

- Prepare students for college mathematics (traditional and modern)
- Prepare students for science and technology
- Prepare students for college and life success

Content and pedagogy designed to serve all three goals
Where is the New Life Project today?

- Most implementations of New Life courses are initiated by math faculty.
- Commercial textbooks are generally used.

Current implementations (as of Oct 2014):
- Over 75 colleges,
- 26 states,
- Over 550 sections this semester,
- >10,000 students

Results: Preliminary 50 to 55% complete

Math Lit ➔ College Math in 2 semesters
New Vision of Mathematics Pathways: Fewer non-credit math courses for most students
from the New Life Project

- Algebraic Literacy (AL)
  Bridge to Some College Mathematics

- College Algebra and Pre-Calculus
- Reform College Algebra (gen ed)
- STEM: Calculus-based courses
- STEM: Non-Calculus-based courses
- Math for Elementary Education Teachers
- Liberal Arts and Finite Mathematics
- Quantitative Reasoning
- College-level Intro Statistics
- Business Math & Occupational Math
- Basic Science and Technology Courses

Students can place directly into Algebraic Literacy

Numerical Sense (few start here)
Mathematical Literacy for College Students (MLCS)

New Life Project, AMATYC Developmental Mathematics Committee
(Does not reflect official AMATYC positions or actions)
One side has the New Life Model

The other side has references and links

Links include details on the courses

We will look at the Model in detail

We will also sketch the content of the courses
A Two-Course Model

One and done: MLCS (Math Lit) prepares students for some college math, science & technology (basic)

One and done: AL (Algebraic Lit) prepares students for ‘STEM’ college math, biology & high-tech

Smaller population needs both courses

No pre-algebra or basic math course (consider a workshop or boot camp for this need ... or ‘just in time remediation’)
MLCS – Stat Path

MLCS ➔ Statistics Path
from the New Life Project

Mathematical Literacy for College Students (MLCS)

College-level Intro Statistics
Note: Mathematical Literacy is not a college-level quantitative reasoning course.
MLCS – STEM related paths

MLCS – Algebraic Lit → STEM Related Paths

- Algebraic Literacy (AL)
  - Bridge to Some College Mathematics

- Mathematical Literacy for College Students (MLCS)
  - Students can place directly into Algebraic Literacy

- College Algebra and Pre-Calculus
- Reform College Algebra (gen ed)
- STEM: Calculus-based courses
- STEM: Non-Calculus-based courses
Math Lit (MLCS) focuses on learning outcomes commonly needed (all three goals)

Algebraic Lit (AL) focuses on preparation for “STEM-Like” courses and programs

Each course is more accessible than old courses: fewer semesters in remediation

More students will be done with one developmental math course
The Idea of Math Lit (MLCS)

- Good mathematics from the beginning
- Focus on central ideas and reasoning
- Symbolism and technology included
- Fewer prerequisite skills (primarily basic numeracy)
- Designed to prepare all students; helps STEM students
Content Goals of Math Lit

- Numeracy
- Proportional Reasoning
- Algebraic Reasoning
- Functions
- Symbolic statements, communication, some procedures in symbolic form
Math Lit: Example Topics

- Quantities and measurements
- Intro to dimensional analysis
- Paired data
- Rate of change
- Equations in two variables
- Linear relationships
- Exponential relationships
Math Lit: Appropriate Instruction

- Discussion, verbal work
- Active
- Blended with direct instruction
- Applications (not puzzles)
- Deliberate connections
- Emphasis on reasoning ... and communication
Math Lit – is Getting Ready For ...

- STEM paths (heading towards calculus)
- Quantitative Reasoning/Liberal Arts Math
- Introductory Statistics
- Basic Science
- Technology courses
New Vision of Mathematics Pathways: Fewer non-credit math courses for most students
from the New Life Project

Students can place directly into Algebraic Literacy (AL) Bridge to Some College Mathematics

Mathematical Literacy for College Students (MLCS)

Algebraic Literacy (AL)

College Algebra and Pre-Calculus

STEM: Calculus-based courses

Reform College Algebra (gen ed)

STEM: Non-Calculus-based courses

Math for Elementary Education Teachers

Liberal Arts and Finite Mathematics

Quantitative Reasoning

College-level Intro to Statistics

Business Math & Occupational Math

Basic Science and Technology Courses

New Life Project, AMATYC Developmental Mathematics Committee
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Updated October 2012
Algebraic Lit — STEM & Calculus Paths

- Students can place directly into Algebraic Literacy
- Algebraic Literacy (AL) Bridge to Some College Mathematics
- College Algebra and Pre-Calculus
- STEM: Calculus-based courses
Algebraic Lit – STEM Related (including biology and technology)

- Students can place directly into Algebraic Literacy
- Algebraic Literacy (AL) Bridge to Some College Mathematics
- Reform College Algebra (gen ed)
- STEM: Non-Calculus-based courses
The Idea of Algebraic Literacy (AL)

- Good mathematics from the beginning
- Focus on central ideas and reasoning
- Procedures and applications in balance
- Designed to prepare students and even inspire students
- “STEM boosting” outcomes identified (needed for pre-calculus)
Content Goals of Algebraic Literacy

- Numbers and Polynomials
- Functions
- Geometry and Trigonometry
- Modeling and Statistics
- Symbolic and numeric methods; focus on reasoning and connections
Algebraic Literacy – is Getting Ready For ...

- STEM paths (pre-calculus)
- College Algebra (reform or old-fashioned)
- Other college math (Finite Math, elementary teacher’s math)
- Biology (i.e., taken by health careers students)
- Technology programs (emerging technologies)
Algebraic Lit: Example Topics

- Properties and equivalent polynomials
- Numeric methods to solve exponential equations
- Symbolic and numeric methods for systems
- Connecting rate of change and the function
- Right triangles and 3 basic trig functions
- Models as approximations
- Correlation
Optional Handouts

- Goals and Outcomes for Math Lit
- Goals and Outcomes for Algebraic Lit
- Comparison of Three Models
  (AMATYC New Life; Carnegie Pathways; Dana Center Mathways)
Implementing “New Life” Courses

- MLCS replaces pre-algebra AND beginning algebra for some students ... or for all students
- MLCS is typically 4 credits
- MLCS has two available textbooks

- Algebraic Literacy replaces intermediate algebra (& beginning algebra) for some or all students
- Algebraic Literacy is typically 4 to 6 credits
Faculty-centered: propose the course, get approval, design course, pilot the course

Professional development: send email through the “dm-live” wiki (or contact the publisher)

Grants are not normally needed for implementing New Life courses

Implementations have been done from small scale to state-wide
The New Life Model:
  * Purposes of Dev Math *
  * Math Paths *
  * Broad Acceleration *

Optional Handouts available
Other questions?

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