Math Lit & Pathways

5 Years Later

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- ✓ Pathways overview
- ✓ National update
- ✓ Data
- ✓ Lessons learned

Pathway

Developmental math: *a course other than traditional algebra that is designed to prepare students for non-STEM college mathematics*

Examples include *Math Lit, Statway, Path to Stats, Quantway, and the New Mathways Project*

Pathways: Ahead of their time

- In 2009, we didn't know developmental math landscape was going to be turned upside down in coming years.
- Pathways are a sound way to accelerate developmental education while actually doing something different.
- Pathways complement co-requisites.
  - Pathways for lower students
  - Co-requisites for bubble students
- Pathways are less expensive unlike emporiums redesigns.
- See CCCSE report

Pathways: They work

- Students are getting through developmental math faster
- Students are better prepared for college-level courses
  - Persistence
  - Learn how to learn
- Increased student motivation, hope, and confidence

Pathways Nationally

5 years ago

- Pockets of use
- Intermediate algebra was the gateway course in most states
- Uniform implementation

Now

- Courses being developed or in use in almost all states
  - Updates for CA, CO, FL, MT, NM
- Policy changes
  - AMATYC's intermediate algebra position statement
  - States change dev math policy (e.g., IL, CA, CO, FL)
- Course pedagogy is varied
  - Use of group work varies
  - All major publishers have texts

Outcomes: Pass rates

- Rock Valley College Math Lit: **59%** (351/596)
- Results are comparable to other pathways projects
  - Quantway 1: **56%**
  - New Mathways Project Foundations: **65%**

NOTES:

- Data for Math Lit is from F11-SP16
- Math Lit in IL is 6 credit hours compared to 4 credit hours nationally

One and Done

		Initial Course	
		Beginning Algebra	Math Lit
Outcome Course	Intermediate Algebra	**62%** (877/1412)	**68%** (45/66)
	Statistics	**59%** (153/260)	**50%** (39/78)
	Gen ed math	**83%** (252/302)	**83%** (121/146)

NOTES:

- Data for Beg. Alg. is from F09-SP16; Data from F11-SP16
- No statistically significant differences in outcome courses between initial courses
- Majority of students complete Math Lit & next course in one year
- College level course results are comparable or better than other pathways projects
  - 67% for Quantway>Stats or Gen ed
  - 49% for Statway CC students
  - 30% for NMP>Stats

Lessons Learned from Teaching Pathways for 5 Years

Experience is simply the name we give our mistakes.

-Oscar Wilde

Content

Problems

- Missing some traditional developmental topics
- Not enough emphasis on statistics
- Too much student success content

Solutions

- More algebra topics
  - Factoring, quadratic formula, function notation and more
- Additional statistics topics
  - Qualitative & quantitative variables
  - Relative frequencies and tables
  - Statistics contexts used in problems

Lesson learned:

Algebra matters but it's not everything

- Techniques for solving problems should be taught with content
  - *When* to use algebra, not just *how*
- A full-course prerequisite of algebra is not necessarily needed
- If you can't get to everything, the course can still be successful
- 5 or 6 credit hours are not necessary

Lesson learned:

Having a context matters

Contexts can…

- Motivate students which increases engagement
- Improve understanding and retention
- Prepare students for other courses
- Improve reading skills
- Desensitize students to word problems

To make it work…

- Use novel and creative problems
- Use problems, not just exercises
- Provide background info for new contexts
- Spiral content, not contexts

Focus Problems

Problems

- Only one focus problem per cycle
- 4 focus problem lessons per cycle took too much class time
- Students struggle to write the solution

Solutions

- New focus problem options
- Only introduction and debriefing done in class
- Collaborative can be work done online outside of class
- Guidance can be provided in the form of rubrics and templates

Lesson learned:

Developmental students can solve rich problems

- Give students support but let them solve the problem over time
- Include a test question on the focus problem to encourage accountability
- Require students to complete focus problem individually if absent too often

Instruction & Delivery

Problems

- Uniform implementation too rigid
  - Focus on group work
  - Reliance on student problem solving for most content
  - Face-to-face format

Solutions

- Use content suitable for group, lecture, or both
  - Section introductions and closures have little to no scaffolding to encourage collaboration
- Provide worked-out examples
- Can be taught face-to-face, hybrid, or online

Lesson learned:

Pedagogy matters, not just content

- Address *how* to teach as much as *what* to teach
- Students need more than just activities
- Teachers need flexibility and students want options

Group Work

Problems

- Students resisted working in groups for certain problems
- Some students would not contribute to the group

Solutions

- Increase difficulty of problems if needed and reduce scaffolding
- Use groups when students need support for problem solving
  - Group quizzes
  - Focus problems

Before

Exploration problems had a lot of scaffolding.

You are planning an event that will require renting tables and chairs.

1. Given one square table, how many chairs are needed if one chair will be used per side?

2. If two tables are set adjacent to one another as shown, how many chairs can be seated around them?

3. If three tables are set adjacent to one another as shown, how many chairs can be seated around them?

4. How many chairs will be needed for 6 tables arranged in this way? For 20 tables? Draw a picture only if necessary.

5. Write in words how you can determine the number of chairs needed based on the number of tables in this type of arrangement. Think about the physical situation as you form your generalization. Your group should agree to one result that will be shared with the class.

After

Exploration problems have less scaffolding.

Sometimes multi-part problems are used but steps don't scaffold to the answer.

1. Consider the following sequence of figures. How many squares will there be in the *n*th figure? Explain how you wrote your expression based on the physical pattern in the figures.

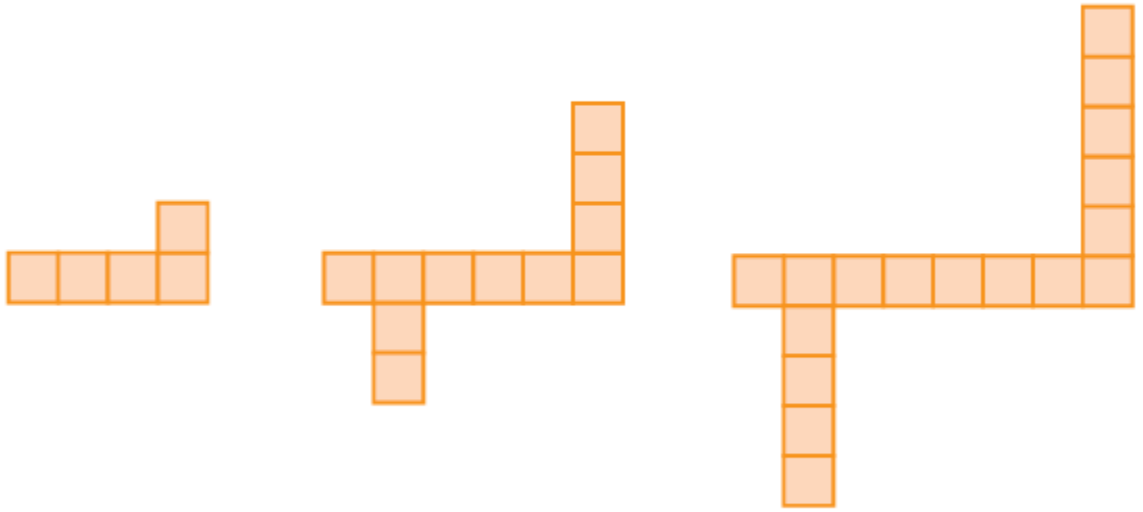

Figure 1 Figure 3 Figure 5

Lesson learned:

Effective group work is possible

- Hold students accountable
  - Include a participation and/or attendance grade
- Technology can encourage group interaction
- Know the research on using group work effectively
  - Form heterogeneous groups of 3 to 4 students
  - Establish clear expectations
  - Structure group work to encourage interaction

Technology

Problems

- Instructors wanted to use technology more
- Online homework for skills only

Solutions

- Increased use of Excel, graphing calculators, and Learning Catalytics
- Online homework can include more conceptual questions

Lesson learned:

Use technology appropriately

- Use Excel when it makes sense, not just to use it
- Encourage mental math techniques to build numeracy
- Can include online homework conceptual problems that are manually graded

A professor is wondering if his final exam really provides any additional information about what his students have learned during the semester. To help him decide, he looks at his students' grades from the previous semester, both before the final exam and on the final exam.

Overall Grade before Final Exam	Final Exam Grade	Predicted Final Exam Score	Residual
72	73	68.8	4.2
68	54	64.8	−10.8
81	76	78.0	−2
88	86	85.1	0.9
78	75	74.9	0.1
80	81	76.9	4.1
92	90	89.1	0.9
70	52	66.8	−14.8
66	82	62.7	19.3
75	70	71.9	−1.9

After graphing the paired data (overall grade, final exam grade), he finds the following trendline equation to model the relationship in the data:

$$\text{Final exam grade} = 1.0138(\text{overall grade}) - 4.1629$$

Lesson learned:

Vary assessments

- Traditional quizzes and tests are helpful and useful
- Unusual grading schemes are unnecessary
- Back up your philosophy with your grading
- Must grade homework to get students to do it

Lesson learned:

Plan ahead for implementation

- Advising, advertising, course number, number of credit hours, and number of sections matter
- Choose teachers who buy in to teach the course
  - Teachers can sabotage it if they don't buy in
- Plan for data collection
- May need to give in on some traditional topics to get pilots going
- Lots of training isn't needed
  - Faculty need to understand philosophy and new approach and be provided support as they work
- Must commit to the approach in the course – not just here and there

Final thoughts on pathways

- Impacted other courses
- Re-energized teaching
- See growth in all students no matter their final grade
- Developmental students can do more than one might think

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NEW: Math Lit instructor forum