Pathways without Barriers: Course embedded alternative to remediation

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Overview

• The need for a new approach to math remediation for adult learners
• Campus collaborations and the course redesign processes and model
• Map and recognize the quantitative literacy outcomes in content-level assignments
• Impact on guided pathways, especially for part-time students, and applications of this approach for reading and writing remediation in other programs of study.
The Need

• In “Developmental Education: Challenges and strategies for reform” (2017), the US Department of Education reports that 59% of beginning students at public 2-year colleges enroll in developmental math courses within 6 years of entering college.

• First time pass rates in developmental mathematics typically range from 30-60%, and among those with developmental requirements, fewer than 50% complete the developmental courses in which they were placed within 6 years.

• First-time/full-time students who take developmental courses in the first year after high school are 74% more likely to drop out of college than non-developmental students.
Remediation Reform

• Strategies with supporting evidence for improving remediation include (but are not limited to) these:
  
  • **Contextualized instruction (aligning content with the student’s major program of study)**
  
  • **Practices to teach metacognition, productive persistence, and college success skills**
  
  • **Comprehensive, integrated support programs**
    • Early assessment programs in high schools and academic support to prepare students for college level course work
    • Enhanced and early alert advising
    • Performance-based monetary incentives
    • Practices to accelerate, compress, or mainstream developmental education
    • Practices to modify information used to make placement decisions
Developmental Mathematics: Procedural skills vs. Conceptual learning

• Quarles and Davis (2017), in “Is Learning in Developmental Math Associated with Community College Outcomes?”, challenge the assumption that remedial math should focus on procedural skills to increase students’ preparation for college mathematics.

• Their study shows that a focus on conceptual learning better prepares students for success in credit math and for making progress toward the degree than a focus on procedural skills.
Procedural skills fade faster than do conceptual skills.
The Model for the Maths Literacy Project

• Contextualize instruction (align content with the student’s major program of study and career goals)

• Retention-centered pedagogy
  • Teach and model metacognition, productive persistence, career awareness, and applied college success skills
  • Comprehensive, integrated support programs
  • Individualized alignment with goals – especially in team and discussion assignments
Grounding*

- Applied recreational Math
- Feeling of Knowing/Metamemory
- Expectance Value Interventions (applied Growth Mindset)
- Fit/Fear/Focus retention model for New Majority learners

*Your handout has explanations of these concepts.
Recreational Math

• Games that require quantitative reasoning increase understanding of math concepts, develop learners’ mathematical skills, increase learners’ knowledge of mathematical facts, contribute to mastery of the language of mathematics, and develop learners’ abilities in cognition and reasoning.

• Application: Substitutes goal-oriented learning activities in the area of students’ academic/career interests for “game” and in so doing, seeks to achieve similar conceptual learning outcomes. “Math is Fun” vs. “Business is fun/relevant when you employ math reasoning”
Feeling of Knowing (FOK)

• If the distance between someone’s FOK and the needed learning is short and relatively easy to traverse, then it takes little motivation to make that short hop;

• However, if there is a large perceived gap between what one knows one knows and what one knows one needs, then the target has to have a very high value to motivate the learner to make the trek.

• FOK involves
  • identifying the need for knowledge,
  • reflection to determine the level of prior knowledge and understanding available,
  • describing the gap between current knowing and needed learning,
  • evaluating the value of the needed learning, and
  • calculating the return on investment of time, energy, and good will to gain that value.
Expectancy Value Intervention (EVI)

• Students make explicit personal connections with the materials and identify evidence that the materials have long-term value.

• Boosts student performance and interest, particularly for students who have low initial expectancy that the subject can be learned and mastered.

• Related to Growth Mindset, an intentional approach to incorporating EVI increases learners’ persistence and levels of success – in the subject and in subsequent learning events.
Fit/Fear/Focus*

• Fit-Fear-Focus retention model and template for sustainable learning environments that improve learning and persistence outcomes with course redesign.

• The primary dimension of course redesign in Weber’s model is changing the type and quality of human effort by building students’ core capacities and accountability behaviors and shifting the instructional presence to a “learning with” rather than a “teaching to” pedagogy.

• Addresses learners’ college imagination and persistence across the student life cycle and provides a mechanism to audit the college environment for its student readiness.

• Are there students like me here?  
  • **Retention message:** Yes, and we know students like you do well here.

• I’m afraid I’ll fail -- will my challenges undermine my success?  
  • **Retention message:** Because we serve students like you, we have the support resources to grow and celebrate your strengths and address your challenges.

• Will the learning experience provide a good return on my investment of time, energy, and good will – and, of course, money?  
  • **Retention message:** We ensure high-value credentials and a commitment to eliminating unnecessary barriers to your progress.
• Students who **fit** with other “students like me”, can develop **belonging** and habits of working well with diverse others.

• Students who overcome the **fear** of admitting and addressing their challenges, whether those are personal, cognitive, social, or financial, gain a sense of openness and **security** that can support effective help-seeking behaviors and generosity in helping others.

• Students who **focus** their time, energy, and good will have **hope** that these investments will result in their achieving their **lifestyle goals** (self-sufficiency, taking care of others, and autonomy).
<table>
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<tr>
<th>Expectance Values Interventions</th>
<th>Fit-Fear-Focus Retention Principles</th>
<th>Belonging-Security-Hope: Fit-Fear-Focus outcomes</th>
<th>Maths Literacy Project Design Elements</th>
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<tr>
<td>Students believe they can succeed.</td>
<td>Fit: Gather concrete evidence that there are students “like me” engaged in the behavior.</td>
<td>Belonging: Students apply evidence of the success of students “like me” to engage in help-seeking and engagement behaviors.</td>
<td>Common student characteristics: New Majority learners who are interested in the field of study and who struggle with quantitative reasoning.</td>
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<tr>
<td>Students perceive they have the time and resources to engage in the desired behavior.</td>
<td>Fear: Students’ existence, relatedness and growth (ERG) needs are met, or the students have confidence in their ability to gain access to resources to meet these needs.</td>
<td>Security: Because students’ ERG needs are addressed, students make and pursue long-term goals and align their resources and priorities to attain them.</td>
<td>The content area faculty are not math experts fluent in the language of maths, but they model how to use the support resources to refine quantitative abilities to resolve authentic problems in the field.</td>
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<tr>
<td>Students perceive an important reason to engage in the desired behavior.</td>
<td>Focus: Calculate the return on investments and the factors that influence the probability of success.</td>
<td>Hope: Use evidence of the value of the behavior to plan and execute success strategies.</td>
<td>Explicit connections between maths literacy and understanding that quantitative reasoning is valued in various workplaces.</td>
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Math Modelling
Conceptual approach to quantitative reasoning

1. Make sense of the problem
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique others' reasoning
4. Model with Mathematics
5. Strategically use the right tools
6. Check the precision of the work
7. Look for and make use of structure to see patterns or connections
8. Look for and express regularity in repeated reasoning
Mathematic Concepts embedded in principles of management assignments

- **Basic Mathematical Operations.** Addition, subtraction, multiplication, and division.
- **Algebraic thinking** includes recognizing and analyzing patterns, studying and representing relationships, making generalizations, and analyzing how things change.
- **Numbers and operations in base 10 and in fractions**
- **Patterns in bivariate data (statistics and probability)**
- **Writing algebraic expressions in equivalent forms to solve problems (quadratic expressions and exponents)**
- **Using functions to model relationships between quantities**
Persistence and Completion KPIs

• Improve students’ rates of successful completion of general education mathematics by connecting quantitative reasoning to their lives and goals

• Expand students’ range of active learning, accountability, persistence, and help-seeking strategies

• Increase students’ understanding of the connection between quantitative reasoning and the program of study

• Deepen students’ insights into their skills and preferences to shape their college and career goals
Typical management decisions with mathematics
(management competencies)
• **How much** should the organization produce?
• What **profit level** is required to keep the organization stable?
• What do people need to be secure, motivated and productive, and **what should those needs cost**?
• **How much can be invested** in research and new product development without taking away from existing core processes?
• What kinds of **financial risks are survivable** using current resources?
The Business Reasoning Portfolio

• Components
  • Learn with: “Puzzles” presented in discussions to introduce math concepts that will apply to major assignments.
  • Learn from: Math Model discussions that accompany major assignments; present and discuss different approaches to use math to conceptualize the problem and the evidence needed for a decision

• Demonstrate learning: Final Business Reasoning portfolio
  • Evaluate solutions and decisions completed
  • Identify optional mathematical models to gain information needed for a decision
  • Reflect on change in habits and attitudes toward mathematics
  • Solve new problems independently to demonstrate mastery
Rewards: Our message to students

- **Alternative to remediation**: If you currently are required to take a developmental mathematics course, completing this portfolio at a high degree of quality can waive this requirement, and you can go directly to your credit level math course. (You’ll also get the letter described below.)

- **Career development**: If you already have completed your developmental math sequence, or if you were not required to take these courses, you will receive a letter from the Dean of the Business and Computer division recognizing your achievement. You can attach this letter to job applications, and you’ll get support for your resume writing to include your quantitative reasoning skills.

- **Student engagement**: Finally, all of you can feel a sense of accomplishment because you’ll be helping other HCC students as the College explores alternatives to these developmental math courses.
Motivation – Intentional repetitions of ideas

• 4-year degrees in business require some form of math beyond algebra, typically calculus
• Articulate skill in critical thinking and analysis in authentic real-life management situations
• Close “awareness gap” – Explaining skills that advance career goals
• Applying skills to your personal financial decisions
Sample “Learn With” Puzzle

• You have been offered a temporary full-time job ($22 an hour for 40 hours a week, for 6 weeks). However, to take it, you will have to drop your courses, and it’s past the deadline for a refund. Dropping courses will impact your financial aid eligibility, and you would likely have to drop to part-time for at least 2 semesters and pay your own tuition until your eligibility is restored. Should you take the job?

• Assumptions
  • You will pay 25% taxes on the income
  • You will pay $828 a semester for two semesters to regain eligibility
  • The $2,070 tuition for the current semester will count against your lifetime eligibility for financial aid ($36,750)
Hmm ... what would that look like?

- **Profit**
  - Your total earnings: $6 \times ($22 \times 40) = 5280$
  - Taxes (25%) = $1,320
  - Net earnings = $3,960

- **Loss**
  - This term’s tuition + 2 terms of part time: $2,070 + (2 \times 828) = 3,726$

- **Difference**:
  - $3,960 - 3,726 = 234$

- **Other costs**
  - Accrued interest on the lost tuition
  - Transportation/child care costs when working full time
  - Longer time to graduation when you’ll earn more money over the long run
Decision

• By doing the math, you see that you would gain $234 in this deal, but other costs might wipe out this profit.

• But you could also use these numbers to try to come up with other solutions:
  • Negotiate the hours so you don’t have to drop all 5 classes
  • Using the money to pay off high interest debts, lowering the impact of the financial loss
  • Working with the employer to work fewer hours, perhaps job sharing with someone else

• And, you could use your knowledge to inform your decisions
  • Statistically, part-time students are less likely to ever graduate with a credential than full-time students
  • Going part-time would make it take longer to finish your degree and therefore reduce the number of years you will be earning a higher salary when you achieve your career goal
  • Taking this job will give you the kind of experience you will need to get a higher paying part-time when you return to school
Sample Assignment: VRIO* Analysis

• Based on the scenario provided in the handout, make these reasoned business decisions:
  1. Should you beat SurfnTurf’s salary offer or wish Tom well and start looking for a new employee?
  2. Should Tom accept SurfnTurf’s offer?
  3. How long would it be until the new employee adds value to the company?
  4. If you decide to hire someone new and hire another employee to close the production gap, how much could you afford to pay that person (assume salary only, no benefits because it will be a temporary position)? Would this be the best solution?

*Valuable, Rare, Inimitable, Organizational readiness – process for high cost/risk decisions.
You try it ...

Puzzles ("Problems")

formulation

Model

calculation

Solution

Troubles

application
Puzzles or Problems

What are the grand challenges that experts in the discipline wrestle with?
Model and Formulation

- What kinds of information do experts consume, create, and deploy?
- How do experts in this academic/career area make informed decisions?
What do experts do with the solutions?
How do central concepts in this area build on each other to support more complex decisions and actions?
Impact on guided pathways

- Clarify the path
- Help students choose and enter a path
- Help students stay on the path
- Ensure that students are learning
Clarify the Path

• The math’s literacy approach can be applied to other programs of study and even to general education courses. Consider criminal justice, psychology, or cyber security.

• Other core capacities – like critical reading, effective writing, or technology – can also be modularized and adapted to entry level courses, thus facilitating block schedules and/or a momentum year for full and part-time learners.
Help students choose and enter the path

• Learning from, learning with, and mastery demonstration of core success skills (critical reading, effective writing, quantitative literacy, critical thinking) focuses learners on the capacities needed for college success and valued in career destinations.

• Modularizing and distributing content in these areas across the first year experience helps students to increase their Feeling of Knowing about their capacities and where they need to grow to in reaching their goals.
Help students stay on the path

• Providing alternatives to remediation – especially for New Majority Learners – helps students with progress to degree.

• Developing alternatives shows students that the college has investigated and reimagined barriers students might encounter on their pathways to persistence
Ensure that students are learning

• Electronic portfolios – the 13th High Impact Practice
• Readiness for success in credit math
• Readiness to apply core skills to the program of study
More on Pillar 4 – Assurance of Learning

• New contract with internal and external stakeholders: College readiness vs. student readiness.

• Clarify pre-college imagination and revive public trust and understanding of higher education

• Re-imagine learning environments – “dual enrollment” of working students and porous borders with work force development and transfer destinations
Project critical path

Plan
• Design
• Develop
• Communicate

Do
• Recruit
• Train
• Pilot

Check
• Learning
• Behaviors
• Persistence

Act
• Scale
• Adapt
• Learn
Interested?

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