Bridging the Gap

Using Contexts and Manipulatives to Prepare for College Math
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• In Ohio ABLE, there is no standardized math curriculum. This is problematic because
  – Many instructors in the state have weak backgrounds in mathematics
  – Most instructors have had little or no training in math education and are unsure of what or how to teach
  – Instructors typically have little time available to develop high-quality lessons
  – K-12 textbooks fail to account for unique strengths and needs of adult learners (pedagogy vs. andragogy)

• Ohio ABLE Curriculum and Instruction Committee tasked with developing a model curriculum
Contextualization

- Teaches life skills and facilitates abstract learning (Kalchman & Koedinger, 2005)
- Numeracy cannot be achieved without contextualization (Evans & Thorstad, 1995)
- Resources needed to build a contextualized curriculum are beyond those of most ABLE programs (Cordova & Lepper, 1996)
- Instructors need to feel empowered to adapt the curriculum (Shaikh, Tamim, & Bernard, 2007)
- Contexts must be familiar to learners (Walkington & Sherman, 2012)
Background:

Explicit Instruction (EI)

• Implicit instruction less effective with low-achieving students (Cronbach & Snow, 1977)
• Implicit instruction can have negative socio-emotional effects with working class populations (Ball, 2003; Lubienski, 2000)
• EI shown to help students with learning disabilities (Witzel, Mercer, & Miller, 2003)
• EI appropriate for the majority of adult basic learners (Mellard & Scanlon, 2006)
Research Questions

• What are the main barriers and facilitators to implementing a high-level contextualized mathematics curriculum for adult learners?
• In what ways do instructors adapt the curriculum?
• What do instructors report as outcomes of using the curriculum?
• What role does context play in the implemented curriculum?
Data Collection

• The curriculum:
  – 9 lesson plans (~20 hr instruction time)
  – 4 contexts (home, health, games, money)
  – TABE levels 5 and 6
  – Manipulatives

• The pilot:
  – 6 programs, each with an instructor pair
  – All-day workshop, 3 conference calls
  – Online forum posts (Edmodo)
  – Conferencing and observations
  – Creation of a contextualized lesson plan
Data Analysis

- Qualitative Software (Atlas.ti)
- Codes:
  - Barriers & Facilitators (Quigley, 1998)
    - Institutional
    - Situational
    - Dispositional
  - Outcomes
    - Student level (dispositional, application)
    - Instructor level (dispositional, application)
  - Adaptation of Curriculum (Proactive, Reactive)
  - Use and Perception of Context
  - Content Level
- Case Analysis
- Cross-Case Themes
What are the main barriers and facilitators to implementing a high-level contextualized mathematics curriculum for adult learners?
Barriers

Classes were not set up for the highest levels of content, so students had some difficulty.

• “…I only had 2 students that met those requirement levels. They struggled a little at first with learning metric measurements.”

• “…I probably won't teach the actual lesson. My students (except for one) have never solved quadratic formulas nor factored.”

• “My pilot is being tried in our GED with childcare 13-week class, so I have a mix of levels, which requires a lot of prior knowledge work, but it is a good group willing to try it out!”
Facilitators

Relevant content and contexts create a positive learning environment.

• “With the recent opening of casinos in Ohio the students wanted to calculate the probability of getting "21" in Black Jack....”

• “…the students appreciated that the higher level, multi-step type of questions could be on the GED test and on employment or post-secondary entrance tests.”

• “We did this lesson since multiple students were taking the GED over the break and wanted to review measurements.”
In what ways do instructors adapt the curriculum?
Instructors focused on making high-level content accessible to lower-level students.

- “Finally one thing that was done in class was using more examples than what the lesson dictated or provided. The steps involved one to two problems for each step however most students benefited from having numerous examples.”
- “Also after trying with a different group I rearranged the problems to performing the soccer field, followed by the track, then followed by the basketball court in order to start easy and get harder.”
- “…using decimals dilutes the problem if you are teaching the beginning concept like I am we needed to change the numbers to whole numbers.”
What do instructors report as outcomes of using the curriculum?
Student Outcomes

Made conceptual gains through use of tools and strategies. Enjoyed using manipulatives to facilitate learning.

• “During explicit instruction, my students are spending more time applying Pólya, even during the "I do" part of instruction. For example, when I did the first ladder problem, thinking aloud to demonstrate, one student pointed it that the answer didn't make sense, since you cannot purchase a 19.3 foot ladder, and it would make sense to buy a 20 foot ladder!”

• “In fact, one student was at the board working one of the problems and multiplied 5.8 times 1.115 and got 66. The other students told her that did n't make sense and should be closer to 6. The student looked at her work and found her mistake. She said that step never had crossed her mind before.”

• “They really enjoyed using the mira and patty papers.”
Applied strategies to multiple situations and were able to fully explain concepts and skills using strategies. Positive outlook based on student feelings and outcomes.

- “They could regurgitate the definition and even calculate on paper but they couldn’t show me with tiles because I know that they really didn't understand the concept of what finding the average really meant. Using the tiles was an excellent way to allow students to see and understand what they are actually doing when they calculate those problems in textbooks. I don't think they will forget now.”
- “I have learned alot and am eager to apply the lessons and adapt them to the levels of my students.”
- “I always feel like i do too much ‘i do’ so it has been good to think about. This questions reminds me to go back and do less ‘i do.’”
What role does context play in the implemented curriculum?
Contexts were helpful when they were relevant and purposeful.

- “The interesting thing was, again, the discussions about the amounts in permutations and combinations. A couple of my students talked about how many different choices they have had when creating Dungeons and Dragons characters and battles based on the multiple-sided dice used!”
- “It was such a fun lesson. The students could relate it to real life situations and truly get some hands-on experience. They had the most fun with the coupons. We actually cut coupons and came up with mock situations-following your lesson-revolving around name brand with coupon not on sale, name brand sale, and store brand products.”
- “We worked on the Vitamin worksheets together. They found it very difficult. I kept getting the questions, "Will this even be on the GED?", "Why do we have to do this when it won't look like this on the GED?" So far this was their least favorite lesson.”
- “We also discussed the ladder problem. We talked about what a safe incline for a ladder would be. We looked up ladder safety and found that the lean should be in a ratio of 4 vertical to 1 horizontal.”
How can teachers learn from these findings?
What can administrators do based upon findings?
What types of professional development would be beneficial?
Our Next Steps

• Continue to develop the curriculum to cover all content levels
• Focus more heavily on contexts that reach everyone
• Encourage the use of manipulatives to build foundational concepts
• Give workshops around manipulatives and problem solving
References


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