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AUTHOR Comings, John; Mullinix, Bonnie
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ABSTRACT

A study sought to identify and examine key factors that influence adult basic education (ABE) mathematics instruction in Massachusetts and to develop a detailed picture of the adult basic math learning environment. Phase I involved a survey by questionnaire directed at the entire Massachusetts population of instructors and program directors involved in ABE math instruction. Responses were received from 141 teachers and 78 administrators. Phases II and III used a combination of in-depth interviews with 15 instructors and 13 learners and 2 sets of classroom observations to assess current teaching practices, skills, and attitudes toward mathematics among teachers of mathematics based in a variety of ABE programs. Although over 61 percent of instructors used questioning several times a session, only 20 percent found this to be one of their most important methods; 28 percent felt that repeated practice and worksheets were most effective; and 22 percent identified group problem solving and cooperative learning as the most effective. Most programs used the Test of Adult Basic Education to record levels and occasionally place learners in class, but few instructors relied on it to diagnose needs or assess learner progress. Roughly three-fourths of instructors had only basic high school math, 11 percent had teacher certification, and 11 percent held a masters in education. Many math classes were taught based on curriculum developed by instructors (41 percent), groups or instructors (21 percent), or programs (18 percent). (The research framework is appended.) (YLB)

World Education

Exporing What Counts: Research into Adult Basic Education Mathematics (RABEM)

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Contacts:

John Comings
Project Director
World Education

tel: 617/482-9485
fax: 617/482-0617

Bonnie Mullinix
Research Coordinator
World Education

tel: 413/545-4177
fax: 413/545-1263
E-mail: Mullinix@EDUC.UMASS.EDU

Research into Adult Basic Education Mathematics (RABEM)
Summary Overview

Purpose of the Study: To identify and examine key factors that influence ABE mathematics instruction in Massachusetts and to develop a detailed "picture" of the adult basic math learning environment.

Base Questions:

1. What are the current instructional strategies and approaches utilized in ABE math classes in Massachusetts?

2. What assessment mechanisms are currently employed and to what degree do instructors and learners believe they accurately reflect learning?

3. What are the backgrounds and attitudes towards mathematics of ABE instructors who teach math?

4. What are learner perceptions and opinions on mathematics teaching and learning in ABE classes?

5. What are the existing curricular and support materials for ABE math and to what degree do they influence instruction and/or reflect current recommendations for mathematics instruction?

6. What is current practice and content of ABE mathematics and how does this relate to existing recommendations for mathematics instruction?

Research Design Summary:

Data Collection Technique	Sources of Information
1. Questionnaires	ABE Program Administrators
2. Questionnaires	ABE Math Instructors
3. Interviews (individual)	ABE Math Instructors
4. Observation	ABE Instructors and Learners interacting in math learning environments (classrooms/centers)
5. Interviews (group or individual)	Learners
6. Review of materials/ documents etc.	Assessment/Intake forms, curriculum materials,

Introduction

The previous page provides an overview and summary of the Research into Adult Basic Education Mathematics, an OERI funded Field Initiated Study. The following pages provide a brief description of the design and structure of the study, preliminary findings, recommendations and plans for dissemination.

General Methodological Approach

In structuring this ethnographic inquiry into ABE Mathematics, a combination of survey and case study methodologies were used and spanned the following three phases of data collection activities:

Phase I: The initial phase of the study involved a survey by questionnaire directed at the entire Massachusetts population of instructors involved in ABE math instruction. This data provided general background information on the ABE math environment. It was reviewed for thematic patterns and used to identify criterion for selection of a case study sample.

Phase II & III: A combination of in-depth interviews with instructors (Phase II) and learners (Phase III) and two sets of classroom observations (Phase II & III) were then used to assess current teaching practices, skills and attitudes towards mathematics among teachers of mathematics based in a variety of ABE programs throughout the Commonwealth of Massachusetts.

Final research questions were identified during a research design process that subjected the basic guiding questions to further elaboration, analysis and refinement. Through a series of meetings and correspondence, research questions were reviewed by a Research Design and Dissemination Network (RD&D Network) comprised of technical advisors, the aforementioned team of ABE Math Teachers from Massachusetts, and key members of the American Association of Adult and Continuing Education.

In addition, the design of the study utilized the *Curriculum and Evaluation Standards for School Mathematics* and *the Professional Standards for Teaching Mathematics* recently developed by the National Council of Teachers of Mathematics (NCTM) as a primary reference point. It also made use of the initial findings of the NCTM Task Force on Mathematics Literacy for Adults and maintains integrated contact with the Task Force and the Massachusetts ABE Math Team's Project to develop ABE Standards. Through dialogue and deliberation, research questions were modified to reflect both the NCTM standards and the realities of ABE teaching in Massachusetts (the home site of the research) and the nation.

Sampling Procedure

The research activity was carried out in the Commonwealth of Massachusetts. Massachusetts encompasses a diverse network of more than 250 ABE providers including school departments, community-based organizations, community colleges, correctional institutions,

workplace education programs, libraries, homeless shelters, and others who provide basic education to more than 40,000 adults annually. The quantitative survey was directed at all program and their math instructors in the state. The qualitative case sample included a total of fifteen ABE programs selected to provide a stratified sample reflecting variables such as: regional distribution, program venue, program type, size, and math focus balanced against various instructor-specific characteristics. Instruments and responses are shown below:

Instruments	No. of Responses	No. of Items/Instrument
Program (Administrator) Questionnaire	78	28
Instructor Questionnaire	141	42
Instructor Interview Guide	15	38
Classroom Observation Guide	15 x 2	28
Learner Interview	13 x 2-5	28

In each program, one math teacher was interviewed about their math training, experience and teaching practices. The resulting data is being analyzed to present a profile of teachers that will describe their backgrounds and present instructional practice. In most programs, adult learners were identified to participate in individual and/or focus group interviews. These interviews utilized an open-ended and action oriented interview format to uncover the needs and desires of learners regarding math instruction. Questions focused on how they are using math, skills they need to improve or acquire, ways in which they find learning easy and difficult, changes they would make in their present program, and their feelings of self-confidence in math. Interviews are being analyzed to produce a profile of learner insights into the teaching and learning of math.

Structured Grounding and Organization of the Research

As proposed, the original design of the research was reviewed and adjusted to develop a more comprehensive and grounded picture of the ABE mathematics environment. The RD&D Network considered the proposed design and spent its first meeting restructuring the research methodology so that it retained the integrity of the original design but approached the study in a more coherent manner. Building a foundation of data on which to select a meaningful case sample and discarding the potentially threatening and meaningless comparative test of math skills between ABE teachers and secondary teachers, the Network members expanded the scope of the project beyond the original proposal, grounding it in the reality of the ABE instructional environment.

One of the first steps the research design was to develop a key question guide that would focus and direct the research activities. The local RD&D Network began by generating direct questions for instructors, learners and program administrators and identified appropriate instruments for collecting responses (questionnaire, interview guide, observation guide). Each question generated was rephrased in a general form and sequenced to construct a framework of generalized research questions that could guide the development of the

research instruments. Through a process of recursive review and revision, instruments and the research organizing framework were refined. The final framework (detailed in the last pages of this paper) serves as summary and focus for the analysis and provides a quick reference for accessing related data from multiple sources through different instruments.

Analysis of Data

To encourage unlead, generative responses supportive of the baseline nature of the study, questions were often open-ended. Responses to questionnaires were formed the basis of a coding key that was expanded with each subsequent instrument for questions linked through the generalized research framework. Coded responses were entered into a relational database (RBase 3.1) and initial descriptive and statistical analysis were carried out on questionnaire data. Interview data was coded and entered and further supplemented through partial transcription of interview tapes (highlighting detail and preserving the ethnographic quality or respondent 'voice').

Preliminary and Anecdotal Findings and Implied Needs

The adaptation of the research design, while improving its integrity, required additional activities to be incorporated into the original design. As we are currently involved in completing the data entry of the phase II and III instruments, only the broad statistical tallies are available at this stage. Although the majority of the analysis still remains to be done, the following clips of statistical and anecdotal information provides a few interesting insights into ABE mathematics on the threshold of change.

Methods of Instruction - Although over 61% of instructors used questioning several times a session, only 20% found this to be one of their most important methods. 28% felt that repeated practice and worksheets were most effective and 22% identified group problem solving and cooperative learning as the most effective. These findings left team members suggesting that we explore whether responses indicate the existence of 'old-school' and 'new school' instructors. Learners and instructors both know and remember the methods and techniques of instruction that are most effective: those that are active, group-based and make use of manipulatives (preferably edible) to illustrate the practical application of a concept. *There is a need to model and share specific instructional methods that encourage group activities and the use of manipulatives. Instructors need to have the opportunity to explore how these can be used given the constraints of their ABE instructional settings.*

Assessment - Most programs used the Test of Adult Basic Education (TABE) to record levels and occasionally place learners in classes. Few instructors relied on this standardized intake as a means to diagnose needs or assess learner progress. Goals checklists, interviews, instructor generated instruments and self-analysis represent some of the program-specific assessment techniques represented in the field. *There is a need to develop a mechanism for diagnosing needs and assessing learner progress that is meaningful, flexible, useful and in step with the new standards.*

Backgrounds of ABE math instructors - Roughly 3/4 (76%) of instructors had only basic high school math, 11% have Teacher Certification (1% in Math) and 11% hold a masters in Education. Roughly 1/3 (36%) of instructors had no experience teaching math. Of the 63% who did have experience about half had taught children. More than half of the instructors who know about NCTM have some opinion about math reform and even those who are not members of any math organizations or groups have opinions about what they see as the current trends in math reform. Interviews with instructors showed that they were generally very keen to be connected with other math instructors and mechanisms for discovering and discussing new approaches to math instruction. The sense of isolation of some instructors contrasts sharply with the sense of fulfillment experienced by those instructors who are connected to a support network and have regular opportunities to share their experiences and approaches to instructional challenges. This differential experience is reflected in the mathematical learning environments they facilitate. *There is a need to extend the information and opportunities for networking around math instruction to as many instructors as possible.*

Curricular and support materials used in ABE math instruction - Seems that many math classes are taught based on curriculum developed by instructors (41%), groups or instructors (21%) or programs (18%). 25% are chosen by programs and only 4% are selected (from standard published curriculum) by instructors alone. Observations and interviews indicate that the majority of curricula consist of a collection of items drawn from a range of published materials kept in libraries and pieced together by instructors based on the needs of learners and guided by content coverage considerations. *To adequately address mathematics reform, there is a need to review existing materials and develop alternate curricula and supplemental materials that show how the ABE Math Standards can be brought to life in adult learning environments.*

Some additional points of interest collected from interviews include the following anecdotal observations on instructors and learners. Descriptive themes that are emerging for the ABE Math instructor are that: ABE instructors are learner-centered; Most instructors had traditional math learning experiences, and didn't like it; Most are open to new methods, but need/want training; Most require need a much deeper understanding of math to be truly effective; they generally emphasize practical/life skills math. ABE Math Learners have distinct fears of, feelings for and understanding of the need for math in their lives. Unlike children, there is seldom a question of whether they should spend time on math. The examples of its usefulness flow easily and frustration occurs only when the mathematics become abstract, unattached to reality, unnecessarily complex, or focussed on repetitive drill (although many will choose the latter as a refuge from continuing). While many dislike and distrust word problems, given the proper approach and support (stepped, practical, use of manipulatives, cooperative strategies), they are able to overcome this psychological obstacle.

Dissemination and Future Research Directions

Future directions for research and activities that proceed directly from this study include:

- o Adapting the study to look at Volunteers and one-on-one instruction (a focused segment of the instructional population missing from responses)
- o Replicating the study at national level - in selected states (linking with dissemination of ABE Math Standards and state math teams)
- o Using information from study to design meaningful staff development activities with respect to math instruction;
- o Repeating the study in two-three years time to determine impact of dissemination of ABE Math Standards and staff development activities (with this study serving as baseline data and allowing for longitudinal data).

In addition to these obvious offshoots, additional research questions have emerged during the study as important areas to pursue if we are to pursue change from an informed perspective. Two examples of such questions include an over arching question of *How adults learn mathematics* and an applied question concerning *the authentic (real world) mathematical tasks needed by adults and how these compare with classroom tasks.*

Continued support of research into Mathematics Education for the adult learner will provide a window into a world that has been viewed only briefly, but holds the promise of quick and meaningful transformation. The community of adult educators is small, but dedicated. It is understaffed, undersupported, undertrained and well aware of its own limitations. Given the information, opportunity, and support ABE math instructors gravitate towards change. Over the course of this 18 month study, the impact of the activities of the Massachusetts ABE Math Team was starting to ripple through the community. We have laid minimal foundations for tracking the implementation and dissemination of mathematical reform in Massachusetts. We should be prepared to follow through and observe the impact this reform will have on adult learners, a segment of the population so immediately involved with economic vitality of the nation.

RABEM GENERALIZED RESEARCH FRAMEWORK

Code /Ref #	FOCUS, CATEGORIES, Questions, and (- subtopics)	Source(s) of Information	Data Collection Strategy	Corresponding Questions on Instruments
I	**FOCUS ON MATH INSTRUCTION**			
I1	INSTRUCTIONAL APPROACH			
I1a	Which instructional methods, strategies or approaches are used to teach math in ABE classes? Questioning, Discussion, Memorization, Drilling, Lecture, Group Problem Solving, Prediction, Estimation, Writing (about math, for practice), Exploration and conjecture, use of instructional aids: technology (calculators, computers)/ manipulatives	Instructor Learner	Questionnaire Observation + Interview (individual) Interview	IQ: 14 II: 8, 13 CO: 7 LI: 15, 16
I1b	Which methods of instruction are perceived to be most effective in supporting math learning?	Instructor Learner	Questionnaire Interview (individual)	IQ: 15 II: 9, 10 LI: 10, 12, 13
I1c	Does (and/or should) learner culture and background impact on selection of instructional strategies (i.e. Which instructional strategies are successful with which groups of learners (e.g. Haitians, Cambodians, etc.)?	Program Instructor Learner	Questionnaire Interview (individual) Observation	PQ: 6 IQ: 7 II: 19 a,b CO: 16 LI: 9a-c, 10
I2	What are the existing recommendations for mathematics instruction? (Content - Instructional strategy)	Documents (NCTM Standards, etc.)	Literature Review	LR
I4	ASSESSMENT			
I4a	What assessment strategies are used in ABE math classes? (type, frequency, etc.)	Program Instructor Learner	Questionnaire Interview Observation	PQ: 16 IQ: 13 II: (follow-up) 20a, 21 CO: 11 LI: 23a
I4b	What assessment instruments are used? (source: instructor designed, standardized tests, textbook, self-assessment, peer-assessment...)	Instructor Sample Instruments (tests, quizzes, checklists, etc) Learner	Questionnaire Interview Observation Document Review	PQ: 15, 16 IQ: 18 II: (follow-up) 20a, 21 CO: 12 LI: 24a-c

Code /Ref #	FOCUS, CATEGORIES, Questions, and (- subtopics)	Source(s) of Information	Data Collection Strategy	Corresponding Questions on Instruments
I4c	How are assessment results used?	Instructor Learner	Questionnaire Interview Observation	IQ: 19 II: (follow-up) 20b/c, 21 CO: 12, 23a
I4d	How well does the instructional program match the student(s) needs?	Instructor Learner	Interviews Observation Analysis	II: 21 a,b CO: 13
T	**FOCUS ON INSTRUCTOR**			
T1	MATHEMATICS BACKGROUND			
T1a	What mathematics education and training have ABE instructors received? (post-high school math training, college courses (credit and non-credit), degrees, etc.)	Instructor	Questionnaire	IQ: 21, 22 II: 6, (11)
T1b	What teaching experience have ABE math instructors had? (for each position: math level taught, ages of students, setting of classes (high school, etc.), amount of time spent (in months/years)	Instructor	Questionnaire	IQ: 20
T1c	What knowledge to instructors have of current trends in mathematics reform? (membership, organizations, NCTM standards)	Instructor	Questionnaire and/or Individual Interview	IQ: 23, 24 II: (follow-up) 32
T2	INSTRUCTOR VIEWS AND ATTITUDES			
T2a (L2a)	How do instructors define mathematics?	Instructor	Questionnaire Interview	(IQ: 5) II: 12
T2b	What are instructors personal opinions, interests or attitudes with respect to mathematics?	Instructor Learner	Interview Observation Individual/ Group Interview	II: 7, (11) CO: 14 LI: 11, 6
T2c	How confident are ABE math instructors in their math abilities/ (ability to teach math/to do math)	Instructor	Interview (Observation)	II: 7 a,b,c, 13, 31 CO: 15

Code /Ref #	FOCUS, CATEGORIES, Questions, and (- subtopics)	Source(s) of Information	Data Collection Strategy	Corresponding Questions on Instruments
P	**FOCUS ON PROGRAM**			
P1	What levels of mathematics and which instructional formats are utilized in ABE math instruction (ESL, ABE, ASE, FL, WE...)	Program Instructor	Observation Questionnaire Interview	PQ: 4, 5 IQ: 6, 8 II: 5, 8 CO: 8
P2	How much instructional time is devoted to mathematics in ABE programs?	Program Instructor Learner	Questionnaire Interviews Observation	PQ: 3, 12 IQ: 8 II: (follow-up) 22 a,b CO: 4 LI: 22a-c
P3	PARTICIPATION IN MATH INSTRUCTION			
P3a	How many instructors teach math?	Program	Questionnaire	PQ: 7
P3b	How many learners take math?	Program Instructor	Questionnaire	PQ: 12 IQ: 8
P4	How are math instructors selected? (criteria, procedures)	Program (Learner)	Questionnaire or Interview	PQ: 8 II: 6a LI: 19
P5	How are learners selected to participate in math classes? (intake assessments, selection criteria, programmatic limitations)	Program Instructor Assessment Instruments	Questionnaire Document review and analysis	PQ: 15 IQ: 13
P6	INSTRUCTOR TRAINING AND SUPPORT			
P6a	How are math instructors trained?	Program Instructor	Questionnaire or Interview	PQ: 9 IQ: 25 II: (follow-up) 26
P6b	How much training do math instructors receive?	Program Instructor	Questionnaire or Interview	PQ: 10 IQ: 26 (II: 26)
P6c	What other support do math instructors receive from their programs?	Program Instructor	Questionnaire or Interview	PQ: 11 IQ: 27 II: (follow-up) 27
P6d	What types of support are most helpful/useful?	Instructor	Questionnaire Interview	IQ: 28 II: (follow-up) 27

Code /Ref #	**FOCUS,** CATEGORIES, Questions, and (- subtopics)	**Source(s) of Information**	**Data Collection Strategy**	**Corresponding Questions on Instruments**
P7	STRENGTHENING MATH PROGRAMS			
P7a	How could Math Programs be strengthened?	Program Instructor Learner	Questionnaire	PQ: 17 II: 15 LI: 18
P7b	How could support to Math Instructors be strengthened?	Instructor	Questionnaire	IQ. 29 II: 25, 27
L	**FOCUS ON LEARNER**			
L1	PAST EXPERIENCE WITH MATHEMATICS			
L1a	What were learners' past experiences with learning math?	Learner	Group and/or Individual Interview	LI: 6a
L1b (C1a)	What reasons do ABE learners give for wanting to learn math/participating in ABE math classes? What math topics or skills do learners want to learn? Why? (also see C1a)	Learner	Group and/or Individual Interview	II: 24 LI: 7a,b
L2	INTEREST IN MATHEMATICS			
L2a (T2a)	How do learners define math	Learner	Group and/or Individual Interview	LI: 14
L2b	How do learners feel about math?	Learner	Group and/or Individual Interview	II: 23 LI: 6b, 8a-c
L3	MATHEMATICS INSTRUCTION AND LEARNING			
L3a	When do learners feel successful at math (i.e. What is their criteria for success)?	Learner (Instructor)	Interview Group Interview	(II: 23) LI: 23
L3b (P7a)	What aspects of the learning environment do learners most appreciate? What would they change?	Learner	Interview (individual) or Group Interview	LI: 18, 19

Code /Ref #	FOCUS, CATEGORIES, Questions, and (- subtopics)	Source(s) of Information	Data Collection Strategy	Corresponding Questions on Instruments
C	**FOCUS ON CURRICULUM, CONTENT AND SUPPORT MATERIALS**			
C1	CURRICULUM CONTENT			
C1a (L2a)	What math topics and skills are important for ABE adults to learn and why?	Instructors Learners Materials Documents (NCTM Standards)	Interview (individual)s Group Interviews Literature Review	IQ: 5 II: (follow-up) 28 LI: 20a
C1b	What math topics and skills are being taught and why?	Instructors Learners Materials Class Syllabus/ Lesson Plans	Observation Interview (individual) Document Review	IQ: 10 II: 16, 29 CO: 10 LI: 20b
C1c	Which mathematical topics, concepts and/or skills are easiest/most difficult to teach and learn? Why?	Instructor Learner	Questionnaire Interview	IQ: 11, 12 II: (follow-up) 18 LI: 21a,b
C1d	How do math content and skills covered in ABE classes relate to NCTM standards?	Documents (NCTM Standards)	Literature Review & Analysis	LR II: 16 LI: 20b
C2	MATERIALS			
C2a	What curricular and support materials are being used in ABE math classes? (types: print, concrete, technological)	Instructor Materials Learner	Questionnaire Observation Interview	PQ: 13, 14 IQ: 9, 16 (II: 9) CO: 9 LI: 17a-b
C2b	How are various materials used to support math learning? (instructional aids, in-class activities, homework, calculators, manipulatives, reference,...)	Instructor Learner Classroom	Observation Questionnaire Interview (individual)	(PQ: 14) (IQ: 16) (II: 9) CO: 9
C3	What materials are perceived to be most helpful in learning math?	Instructor Learner	Questionnaire Interview (individual)	IQ: 18 (II: 9) LI: 17c

Code /Ref #	**FOCUS,** CATEGORIES, Questions, and (- subtopics)	**Source(s) of Information**	**Data Collection Strategy**	**Corresponding Questions on Instruments**
B	**FOCUS ON BACKGROUND INFORMATION**			
B1	Who are we gathering information from? [Contact/Sorting Information (Name, Position, Program, Address, Phone, Class, etc.)]	Program Instructor (Learner)	Questionnaire Interview Observation	PQ: 1, 2 IQ: 1, 2, 3 II: 1, 2, 3, 4 CO: 1, 2, 3 LI: 1, 2
B2	How long have they been associated with the program?	Instructor Learner	Questionnaire Interview	IQ: 4 LI: 3, (4, 5)