A Basic Math Curriculum: Issues and Design

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A BASIC MATH CURRICULUM: ISSUES AND DESIGN

EUGENIE BALLERING

MASTER'S PROJECT

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UNIVERSITY OF MASSACHUSETTS, AMHERST
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<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREWORD</td>
<td>3</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>THEORETICAL FOUNDATION, SOCIAL CONTEXT AND ADULT LEARNING THEORY</td>
<td>5</td>
</tr>
<tr>
<td>- INTRODUCTION</td>
<td>5</td>
</tr>
<tr>
<td>- CLARIFICATION</td>
<td>5</td>
</tr>
<tr>
<td>- DEFINITION OF BASIC MATH</td>
<td>6</td>
</tr>
<tr>
<td>- THEORETICAL FOUNDATION OF BASIC MATH INSTRUCTION</td>
<td>6</td>
</tr>
<tr>
<td>- SOCIAL CONTEXT OF BASIC MATH</td>
<td>9</td>
</tr>
<tr>
<td>- MATH ANXIETY</td>
<td>9</td>
</tr>
<tr>
<td>- GENDER AND MATHEMATICS</td>
<td>11</td>
</tr>
<tr>
<td>- MULTICULTURAL CONSIDERATIONS</td>
<td>14</td>
</tr>
<tr>
<td>- CLASSROOM ENVIRONMENT</td>
<td>15</td>
</tr>
<tr>
<td>- ADULT LEARNING THEORY</td>
<td>16</td>
</tr>
<tr>
<td>THE BASIC MATH CURRICULUM</td>
<td>19</td>
</tr>
<tr>
<td>- INTRODUCTION</td>
<td>19</td>
</tr>
<tr>
<td>- PERSONAL ASSUMPTIONS AND ITS IMPLICATIONS FOR INSTRUCTION</td>
<td>20</td>
</tr>
<tr>
<td>- THE NCTM CURRICULUM AND EVALUATION STANDARDS</td>
<td>21</td>
</tr>
<tr>
<td>- NCTM's ASSUMPTIONS</td>
<td>22</td>
</tr>
<tr>
<td>- THE PURPOSE OF BASIC MATH</td>
<td>22</td>
</tr>
<tr>
<td>- CONTENT OF BASIC MATH</td>
<td>23</td>
</tr>
<tr>
<td>- INSTRUCTIONAL APPROACHES</td>
<td>23</td>
</tr>
<tr>
<td>- THE USE OF WHOLE LANGUAGE TECHNIQUES IN MATH INSTRUCTION</td>
<td>24</td>
</tr>
<tr>
<td>- ROLE OF THE INSTRUCTOR</td>
<td>25</td>
</tr>
<tr>
<td>- ASSESSMENT AND EVALUATION</td>
<td>26</td>
</tr>
<tr>
<td>- CLASSROOM MANAGEMENT</td>
<td>27</td>
</tr>
<tr>
<td>CONCLUSION AND RECOMMENDATIONS</td>
<td>29</td>
</tr>
<tr>
<td>ANNOTATED BIBLIOGRAPHY</td>
<td>30</td>
</tr>
</tbody>
</table>
This project evolved and is still evolving after many years of personal involvement in literacy practices in and outside the USA. In this paper I decided to focus on one particular aspect of adult literacy, mathematical literacy, because it deserves much more attention in Adult Basic Education (ABE) than it now gets. I have enjoyed combining my knowledge in nonformal education with research, courses, field interviews and with my work as an Adult Basic Education instructor at the Workplace Education Program at the University of Massachusetts. It was very exciting to read, hear and see so many different theories and practices in mathematical literacy and basic mathematics. I want to thank everybody, my students, friends, colleagues and advisors, who helped and encouraged me in doing this project and who were willing to share their thoughts with me.
INTRODUCTION

In most ABE programs reading and writing are the main areas of instruction. Teachers and tutors who work in Adult Basic Education are often only trained in how to instruct in reading and writing, focusing on different content areas like life skill-and workplace competencies. Besides not being trained in how to teach mathematics, teachers and tutors often don't value mathematics as much as they do reading and writing. They see mathematics as a separate content area which has nothing to do with reading and writing. Also many ABE teachers and tutors don't like to teach mathematics because they think that in order to teach math, you have to have a mathematical background. Some of them even have math anxiety, and if they teach mathematics they often teach the way they were taught at school and in college, with a focus on computation and rote memorization. However, learners in the ABE classrooms increasingly encounter math problems in their daily lives and often ask for support in the ABE classroom in solving these problems.

In order to overcome this teaching problem I propose a Basic Math Curriculum which can be taught by any ABE teacher or tutor. In this curriculum, math is taught in a holistic way, as a form of communication which can be instructed differently by using manipulatives and real life examples. Math is integrated with reading and writing, using reading and writing instructional techniques.

This project is meant to be a theoretical base for an ABE teacher and tutor training workshop in Basic Math. Such a training workshop is for teachers and tutors because they are key figures in changing how mathematics is taught and learned in the ABE classroom. The primary goal of such a workshop is to demystify Basic Math so that teachers and tutors themselves will feel comfortable doing math. This workshop has to convince educators that each of them can teach Basic Math. The workshop should have two parts which will be discussed in this project paper: in the first part I describe the issues which affect and inform a Basic Math curriculum such as the theoretical foundation, adult learning theory, math anxiety, gender, multicultural considerations, and classroom management; and in the second part I describe a general outline for a Basic Math curriculum, discussing the content, the instructional approaches, the role of the teacher, assessment and evaluation, and classroom management.
INTRODUCTION

Each aspect of the general ABE curriculum, and therefore also the basic math curriculum, is affected and informed by issues such as the theoretical foundation of instructional approaches in ABE, social context and adult learning theory. An ABE instructor must identify the issues and their impact on the curriculum, so that s/he can act upon them accordingly, depending on their own, the learner's, society's and institution's vision and belief system.

CLARIFICATION

The terms mentioned in this project are the theoretical foundation, the social context, adult learning theory, Basic Math Curriculum, and Adult Basic Education. The theoretical foundation of basic math can be divided into three paradigms: the positivist, the interpretive, and the critical. The social context factors that in particular affect a basic math curriculum are math anxiety, gender, multicultural considerations, the role of the math teacher and the classroom environment. The adult learning theory is the theory which describes the processes of adult learning in which adult men and women acquire new knowledge, understanding, skills, attitudes, interest, or values. Adult Basic Education learners are defined as those learners who have a reading level from K up to 8th grade. Most of them are high school drop-outs who "drop back in" as adults into job skills training programs and basic literacy classes. They are the "late developers"; people who may have forgotten -- or never learned -- the basic skills necessary to support success in further education or job retraining (Schmitt, 1990). Curriculum is defined as a guide describing the purpose, the instructional approaches, the content, assessment and evaluation of Basic Math, the role of the teacher and classroom management.
DEFINITION OF BASIC MATH

Some people call Basic Math, "Numeracy", others call it "Mathematical Literacy". Numeracy is to math as literacy is to language. Math is a means of communication and a powerful tool for description, communication, and representation. Math can also be called the "invisible culture" of our age because deeper insights are infrequently hidden from public view. We can divide Basic Math or Numeracy in different areas such as Practical Numeracy, Civic Numeracy, Professional Numeracy, Numeracy for Leisure, and Cultural Numeracy (Steen, 1990). In our public schools Practical and Professional Numeracy are taught the most, and in some colleges the focus is on Civic Numeracy in which, math helps you develop the confidence to analyze the numbers presented by others about issues of importance, the knowledge with which to make decisions about the kinds of numerical data you need to analyze those issues, the skills to research and use those statistics (Frankenstein, 1989, p.261).

The National Council of Teachers of Mathematics states that being mathematically literate includes having an appreciation of the value and beauty of mathematics as well as being able and inclined to appreciate and use quantitative information (NCTM, 1989). In this paper Basic Math is defined as the Math relevant to the ABE learner.

THEORETICAL FOUNDATION OF BASIC MATH INSTRUCTION

A Basic math curriculum is shaped by a teacher's belief system, the literacy institution's ideology and society's theoretical frameworks;

A theoretical framework can change the depth and types of questions one considers when thinking about one's practice. Theory can strengthen our energy in the struggle for humanization by focussing our attention on the interrelationships between our concrete daily teaching practice and the broader ideological and structural context (Frankenstein, 1983, p.324).

Fay's and Giroux's analysis of different theoretical frameworks and ideologies can be used to look at different instructional approaches in math. Fay and Giroux are using different names for the same paradigm. Giroux views ideology as a "dynamic concept that refers to the way in which meanings and ideas are produced, mediated, and embodied in forms of knowledge, cultural experiences, social practices, and cultural artifacts." And Fay describes the different theoretical frameworks in social sciences to show that every social science theory has an implied political theory. Fay and Giroux both consider three different theoretical frameworks and ideologies. Giroux calls them the instrumen-
tal, the interactive and the reproductive ideology while Fay calls them the positivist, interpretive and the critical theoretical model.

The first category, Giroux's category of instrumental knowledge, or Fay's positivist theoretical framework focus on principles of prediction, efficiency, and technical control. Knowledge is seen as objective and external to the knower. Facts are stripped of the subjectivity of class formations, race, and gender and celebrated for their neutrality. This ideological perspective underlies traditional math pedagogies and has its expression in remedial instructional methods which concentrate on lower-order cognition-mechanical proficiency, and rote memorization. This perspective omits any insight into the nature of math as a way of thinking and seeing the uses of math in understanding the world (Frankenstein, 1988). School grade equivalents are used for measurement of Basic Math. There is a direct relationship between Basic Math and social integration.

In many ABE programs Basic Math instruction is seldom offered to learners, and if offered, it is because of learners' long term goals to pass the Graduate Equivalency Diploma (GED) to get a better job. Such a need for Basic Math in the curriculum is competency based. Instructional approaches are often geared towards successfully achieving the learners' goals. The roles of the educators is to help learners reach their goals using instructional practices which partially fit in Fays's positivist theoretical framework and Giroux's instrumental ideology. Some instructors rely heavily on remedial instruction methods which concentrate on rote memorization, computation and drills but also use sometimes nonformal approaches considering class formation, gender and race which is used to help the learners to reach their goals.

The second category, Giroux's category of interaction ideology or Fay's interpretive theoretical framework, centers on the human dimensions of knowledge, viewing knowledge as a social construction. In this approach meaning, as opposed to mastery of content, is regarded as the central problem. This ideology underlies "humanistic" mathematics pedagogies which focus on alleviating math anxiety, individualizing instruction at the students' own pace, and problem solving with a stress on process over product (Frankenstein, 1988). In this approach one tries to understand and explain the social world primarily from the point of view of the actors directly involved in the social process.

Interaction ideology and the interpretive framework critique the positivist view of objectivity and view math as a culturally organized
system of skills with math's values learned in specific settings. It shifts the focus of attention from objectivity to subjectivity and critiques universal standards. Many new approaches and methods have developed in this field including changes in the theoretical perspective concerning the nature of math and the learning process. Though interaction ideology is concerned with cognitive dissonance and moral development it omits notions of political conflict and power differences among socioeconomic classes and racial, ethnic, and gender groups (Frankenstein, 1988). That is, "power and freedom collapse into an exaggerated notion of human will as well as a blindness towards those larger social forces that promote economic and cultural disintegration" (Giroux, 1982, p.338).

Many ABE programs would fit this category because learners, with their short- and long term Basic Math goals, demand competency based individualized learning, and the elimination of math anxiety. The instructional approaches of these programs are geared towards eliminating math anxiety, and the role of the educators is to be learner centered and to strive for optimal results. Such goals are well suited to this theoretical framework and ideology.

The third category, the critical ideology and critical framework, are committed to social change.

This ideological perspective, which owes much to Freire's pedagogy of the oppressed, extends the complex role schools play as institutions that mediate and sustain the logic of the state and the imperatives of capital, to include the important concept of human agency where, in a dialectical process, people both participate in their own oppression and struggle to resist (Frankenstein, 1988, p6).

As Giroux says, at the core of Freire's notion of critical literacy is "the insight that culture contains not only a moment of domination but also the possibility for the oppressed to produce, reinvent, and create the ideological and material tools they need to break through to myths and structures that prevent them from transforming an oppressive social reality" (Giroux, 1982, p354).

Math instruction in some ABE program could fit this category because a critical approach to Basic Math involves the ability to ask basic statistical questions to deepen one's appreciation of political, social and economic issues. The ability to present this data to change people's perception of those issues is also important in critical Basic Math approaches. In these ABE programs math is used to construct meaning instead of meaning constructing math. The purpose of Basic Math
is seen as to gain popular, democratic control over the economic, political and social structures of our society (Frankenstein, 1983). These instructional approaches are very similar to the nonformal educational approaches from interactive ideology but they go beyond those approaches in terms of their intent. The critical Math approach should help to develop new social relations in the struggle for humanization.

SOCIAL CONTEXT OF BASIC MATH

Many social context factors affect ABE. However, some in particular affect Basic Math instruction like math anxiety, gender, multicultural considerations, and the classroom environment. All these factors are interrelated and influence each other.

MATH ANXIETY

Math anxiety is a syndrome of enormous fear of failing in math and leading to the avoiding of math on all fronts (Tobias, 1978). In my own experience, as a ABE instructor in a Workplace Education Program, I have noticed that ABE students often don't have a special anxiety for math, but rather anxiety for learning in general. I think that a more important factor is that teachers themselves often have math anxiety, and this affects the way they teach Basic Math to ABE learners. It is important to pay attention to math anxiety and to look at its causes and ways of dealing with the problem because it will help teacher and tutor in becoming better Basic Math instructors.

Math anxiety is a negative label and learners who have this label in the formal school system are often put in remedial math classes or are send to special math anxiety workshops. Nevertheless in many of the remedial math courses and math anxiety workshops teachers and tutors try to create a learning environment where the learners feel safe, respected and in control. The power and success of these math courses lie in the process rather than the content where feelings and beliefs about anxiety are shared with each other among students and teachers. Having learners keep a journal in combination with other non-threatening teaching devices are teaching approaches that are used in many of these classes and workshops. Math is supposed to be conceptually based which means that instructors match it up with real life experiences and people's own experiences. However it might well be true that the deeper causes of math anxiety are not addressed in these math anxiety workshops;
Students are initially relieved that their feelings about mathematics is so common that educators "have a name for them." But in fact this label focuses the problem, and therefore the solutions, on individual failure rather than on the broader societal context which plays such a significant role in producing personal "math anxiety." (Apple, 1979, p67).

Also labels used in educational settings sometimes work against the development of critical consciousness by mystifying the situations and relations which they describe, so that causality and complexity are hidden (Freire, 1983).

Traditional math curricula have features which causes math avoidance, such as the use of rote calculation, memory dependance, unmotivated exercises and applications, authoritarianism in math education, and tests which assume math can be divided into tiny water-tight compartments (Hilton, 1980). Math anxiety is often caused by misconceptions about learning created and sustained by schooling and society. People believe in these misconceptions about learning and other math myths without examining the evidence and its potentiality to harm the person holding that belief because belief in math myths can result in false impressions about how math is done (Frank, 1990). Some math myths mentioned by Frankenstein (1983) and Frank (1990) are:

* You either have a mathematical mind or you haven't. Math ability is attributed to talent and to genetic factors.

* Math can only be learned during specific times in one's life.

* Smart people do math fast and in their heads.

* Learners think that they are stupid if they make mistakes or ask questions and these learners also think that they don't how to ask the right questions.

* There is only one correct answer and one correct way of solving each math problem.

* Cheating is bad and looking up the answer in the key is also bad.

* Men are better in math than women.

* Math requires a good memory.
These math myths are not easy to get rid of and are very pervasive because they are created and sustained by the majority of schooling and society. Frankenstein says that:

Understanding the deeper causes of math "anxiety" involves an examination of how the structures and hegemonic ideologies of our society result in different groups being more affected than others by this "anxiety." It also involves recognition that, to some extent, people participate in their own mathematical disempowerment (Frankenstein, 1983. p. 328).

She states that once learners and teachers know the deeper causes of math anxiety humanistic pedagogies will help the learner in getting confidence and feeling in control of his/her own learning.

GENDER AND MATHEMATICS

A person's sex has always been and still is influential to an individual's achievement in mathematics. Often female students don't achieve their full potential in mathematics in comparison with male students. In order to fully understand the difference between male and female students we cannot isolate it from other factors like a student's race and socio economic status. Like female students, many black students and students of low socio-economic status don't achieve up to their full potential in mathematics. These differences in math performance are not caused by the natural order of things. Research has failed to demonstrate any innate female inability to learn math and science. Biology cannot explain why such a large majority of women steer away from math and science related work (Skolnick, Langbert and Day, 1982, p.6). Differences are most likely caused by societal factors, school mathematics curricula, teacher attitudes, achievement related behavior and classroom processes.

Often the difference between boys and girls starts to become noticeable at the high school level. "This differential achievement is largest for application and problem-solving tasks" (Reyes and Stanic, 1988, p.31). Another consistent sex difference in math ability has been found in the area of spatial skills, which is the ability to manipulate an object or pattern in the imagination (Skolnick, Langbert and Day, 1982, p.6). The older girls get the bigger the difference in math performance in spatial ability, application, and problem solving in comparison with boys.
Societal attitudes can also be responsible for the lessened confidence of girls in their math ability. These attitudes send different messages to and about students of different sex, race, and Socio-economic Status (SES) regarding their aptitude and the appropriateness of their achieving at a high level in math. Examples of societal influences are the family, the community, religious institutions, the mass media and the implicit messages that result from the pattern of prevailing occupational and other societal roles held by members of particular groups. Although societal influences can and do change, those existing at any particular moment in history are powerful and persistent influences in human beings (Apple, 1979). Jon Beckwitch (1983) gave several results of parental, teacher, and societal attitudes in his article in the Journal of Education:

Girls were more likely than boys to attribute their success in math to hard work rather than ability. Conversely, girls would more often than boys, invoke lack of math ability to explain their failures in math. This was true at every level of achievement. They also concluded from earlier work that girls as compared to boys are less confident about their math ability and consistently underestimate their ability to solve mathematical problems (Beckwitch, 1983, p260).

There is a large body of literature on teacher expectations that indicates that teacher attitudes affect student achievement. Jon Beckwitch mentioned several examples of the encouragement of boys and the discouragement of girls in math:

In 33 second grade classes, Leinhardt, Seewald, and Engel (1979) found that teachers made more academic contacts and spent more "cognitive time" with girls in reading and with boys in math. Becker (1981) showed that in high school geometry classes, teachers favored boys over girls in a number of ways including "cognitive levels of questions," "praise and criticism," "encouragement," and "individual help" (Beckwitch, 1983, p 262).

John Ernest (1976) also found that 40% of prospective school teachers (eleven men and sixty four women) are likely to transmit something less than a positive attitude towards math to students. A teacher's attitude towards the school curricula may vary depending on her/his beliefs about the general ability of the students in the school. A teacher might think that certain courses, topics and activities are more appropriate for boys than girls.

In addition, the math curricula affect a student's attitude and achievement related behavior. Confidence in learning math, which is a student's attitude and achievement related behavior, affects math
achievement. Sex difference in confidence is usually associated with sex difference in math achievement. Perceived usefulness of math has been identified as one of the most important variables in understanding sex-related differences in math. This usefulness might again be influenced by parental, teacher and societal attitudes. Achievement related behavior is often different for boys and girls.

I think the female students I have worked with in my ABE class don't have a particular negative or positive attitude towards math. Female students, like male students in the ABE classroom, often have anxiety about learning in general. I have noticed however, that a male ABE teacher I have worked with always does math with his male learners; this might say something about the teaching/learning preference of male teachers and learners. The teacher and tutor have to be very sensitive towards the female learners mathematical needs because they can have a major impact on their students' attitude towards math. Many ABE learners who have had some formal school experience in math expect a Basic Math curriculum which is more or less the same as the one they had in schools and rebelled against. On the other hand they are also open to new ideas and attitudes because they have had so many negative experiences at school. The Basic Math curriculum should therefore give women a change to appreciate math, to experience math in such a way that they can understand and enjoy it, feel that it can be fun and that it isn't only for men. The teachers and tutors should show an enthusiasm for math, and should have an attitude which reflect the values of equality of men and women in a Basic Math curriculum.

The instructional approaches can be geared towards a problem solving approach by focussing on building confidence and reducing fear of taking risks, valuing manipulative materials, arranging social arrangements in such a way that group work and independent work are validated, by raising gender role awareness regarding typical male and female professions in which math is required (Skolnick, Langbert and Day, 1982).
MULTICULTURAL CONSIDERATIONS

Many people believe that mathematics is universal and culture-free. Some people say that this is not true and if we look at the history of mathematics we can see that social-economic and political factors have shaped the whole field of mathematics. Math started as separate scholarly activity for the elite and a practical activity for manual workers. Later, during the Middle Ages in Europe, a convergence of the two took place and this increased in pace during the industrial era, not only for reasons of necessity in dealing with increasingly complex machinery and instruction manuals, but also for social reasons. Math was not only seen as a topic area for the children of the aristocracy, which had to be prepared to keep its social and economical predominance in a new order, but also as a topic for the lay people because they needed to know math as well in order to work effectively for the aristocracy. It also became recognized as a human right to have access to education. This change resulted in the math we have now for everybody in our schools in Western society (D’Ambrosio, 1985).

However during the last two decades another division has become obvious, the division between Western mathematics and the mathematics done by people from other cultures, socio-economic groups, gender, race and from different age brackets. This field of mathematics is called ethnomathematics. Ethnomathematics lies on the borderline between the discipline of the history of mathematics and cultural anthropology. Educators in favor of combining the two advocate a broader interpretation of mathematics.

Now we include as mathematics, apart from the Platonic ciphering and arithmetic, mensuration and relations of planetary orbits, the capabilities of classifying, ordering, inferring and modelling. This is a very broad range of human activities which, throughout history, have been expropriated by the scholarly establishment, formalized and codified and incorporated into what we call academic mathematics. But which remain alive in culturally identified groups and constitute routines in their practices. (D’Ambrosio, For the Learning of Mathematics 5, 1, 1985, p 44-48)

The researchers who study ethnomathematics look first at the pedagogical procedures which favor computation and rote memorization, commonly practiced around the world.

Secondly ethnomatematicians look at the methodological and conceptual differences in various cultures' mathematics, such as cultural use of the period and comma in mathematical notation or classification structures of other languages. For example, in the African language
Setswana, things are classified by what they do, rather than what they are, as in Euro-European languages (Berry, 1985). Because of rote memorization and testing in many traditional math classes in and outside the US, many of such difficulties with math will fail to appear. People will say that these difficulties occurred because of the physical often bad classroom conditions, or not knowing the language of instruction. However these difficulties in learning math are difficulties of an unsuitable curriculum which is inappropriate for people’s cognitive structure (Berry, 1985).

Thirdly researchers look at the hidden and distorted contribution to math by people from other cultures, labor groups, different age brackets, social economic status (SES), gender and race, professional classes and so on. Many people from these groups have made valuable contributions which have been recognized as such because of their background.

Basic Math instruction can incorporate some of these findings by:

* Multiculturalize the Basic Math curriculum by appealing to a diversity of cultural backgrounds and learning styles, rather than dismissing the students as incapable of learning math (Zavlavsky, 1989).

* Incorporate methodological and conceptual differences in the curriculum as much as possible. Schmitt (1985) has written a handout for math instructors on the different ways learners do or write mathematical computation. Also letting learners become aware of their own and other people’s ethno math. Learners in the USA can have a different mode of cognition and different method for performing operations. The instructors should incorporate or acknowledge this as much as possible.

* Acknowledge hidden and distorted part of history by exposing student to unknown parts of math history such as the contribution to the mathematics field by mathematicians form other cultures, socio economic groups, gender and class.

CLASSROOM ENVIRONMENT

Many ABE classes constitute beginning, intermediate and advanced GED learners, ranging from 6 to 10 learners; classes often meet only twice a week, two hours each time. ABE teachers are often assisted by volunteer tutors who have had 3 to 15 hours of training in how to teach reading and writing, and are willing to tutor 2 or 4 hours a week. Tutors often don’t receive training in how to teach Basic Math and are faced with the great challenge of how to teach a learner in the most appropriate way. Also many tutors are only able to tutor once a week while the learners often come twice a week and have to work with two different tutors. The
result of this is that teaching Basic Math becomes quite a challenge, not only because of learner group size, but also because of the different levels of learners, the availability of volunteer tutors, and the quality of training of volunteer tutors.

Many learners don't have previous school experiences and it is a big step for them to come into a classroom again. It is very important that the learner feels physically and emotionally safe in the learning environment and that the learner's way of knowing is appreciated and valued. The classroom environment forms a hidden curriculum with messages about what counts in learning and doing math: neatness? speed? accuracy? Attentive listening? being able to justify a solution? working independently? If we want students to learn to make conjectures, experiment with alternative approaches to solving problems, and construct and respond to others' mathematical arguments, then creating an environment that fosters these kinds of activities is essential (NCTM, Professional Standards, 1989).

ADULT LEARNING THEORY

Another issue affecting basic math instruction is adult learning theory. Adults are defined by the social roles typically assigned to those considers adults: the roles of worker, spouse, parent, responsible citizen, soldier, and the like. Adults are also defined as persons who perceive themselves to be essentially responsible for her or his own life.

In adult learning theory there are four assumptions about adult learners:

As individuals mature: 1) their self-concept moves from one of being a dependent personality toward being a self-directed human being; 2) they accumulate a growing reservoir of experience that becomes an increasingly rich resource for learning; 3) their readiness to learn becomes oriented increasingly to the developmental tasks of their social roles; and 4) their time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly, their orientation toward learning shifts form one of subject-centeredness to one of performance-centeredness (Knowles, 1981, p44-45).

Adult learners have lives outside the classroom and must therefore have authentic lives within the classroom; only then can students be avid and eager language users, learners, resource persons, thinkers, planners, teachers, self-disciplinarians and friends (Gilles, Bixby, Crowley, e.a., 1988).
Adults have lots of experience, are very goal oriented and don't have much time. The role of experience plays an important role in adult learning because adults are what they have done. Experiential techniques can be used in the adult education classroom and it will enable adults, who are rich resources for learning, to tap into their own experience by having group discussions, using case methods, critical incident processes, simulation exercises etc. The emphasis should be on practical application, not only drawing on the experiences of the adult learner but also helping them apply to their day-to-day lives.

Adults, too, have their own phases of growth, resulting developmental tasks, readiness to learn, and teachable moments. Adults are the products largely of the evolution of social roles. This implies for practice that the timing of learning and the grouping of learners should be done carefully. The immediacy of application and performance centeredness demands that the timing of adult learning be in step with their developmental tasks. For some kinds of learning, creating homogeneous groups according to developmental task can be very effective. For example, if adult learners want to know more about gardening while others are more interested in learning about carpentry, learning in separate groups would be recommended.

Many problems arise when teachers start treating adult learners if they were dependent personalities, for this induces an inner conflict within the adults between this preconditioned intellectual model of the role of learner and the adults' deep psychological need to be self-directing. There is the need to build into our program designs some preparatory experiences which don't completely focus on learners' input, but gradually ease learners in getting into a new way of thinking about the role of the learner, and to develop some new skills in self-directed learning.

Some key conditions need to be addressed in order to have adult learning experiences take place:

(1) The physical and psychological learning climate has to be conducive to adult learning. Adults have to feel comfortable, respected and free to say what they want. The teacher has to really listen what the students say and be sensitive to the learners' verbal and facial expressions. Adult educators must be primarily attuned to the existential concerns of the individuals and institutions they serve and be able to develop learning experiences that will be articulated with these concerns.
(2) The learner's self-diagnosis of needs is of crucial importance in adult learning which can be done through instructor's support through organizing the curriculum around thematic units which are relevant to the adult learner. The design of the learning experiences in these units must always start with the ideas and concerns that the adults have while in a learning environment. A continuous dialogue between instructor and learner will help the learner's self diagnosis of needs.

3) The planning process is one in which the learner should be involved, with the teacher serving as a procedural guide and content resource. Responsibility for performing this function is a mutual one between the learner and the teacher. As Freire says, the object of knowledge is not the private property of the teacher. Rather, it is "a medium evoking the critical reflection of both teacher and students" (Freire, 1971, p.). Instead of the teacher thinking about the object privately and talking about it publicly so that the students may store it, both teacher and students must engage in the process of thinking, and talk about what they are thinking in a public dialogue. As they think and talk together, their will roles merge. "Through dialogue, the teacher-of-the students and the students-of-the-teacher cease to exist and a new term emerges: teacher-student with student-teachers" (Freire 1971, p 67). The teacher has to trust which doesn't mean just tolerating a variety of view points, but acting as an impartial refugee, assuring equal air time to all. It means to try to connect, to enter into each student's perspective (Belenky, 1986, p.227).

4) Conducting learning experiences are also mutual responsibility of learners and teacher. A teacher cannot really teach in the sense of making a person learn, but can only help another person learn.

Educators can help learners develop their own authentic voices if they emphasize connection over separation, understanding and acceptance over assessment, and collaboration over debate; if they accord respect to and allow time for the knowledge that emerges from firsthand experience, if instead of imposing their own expectations and arbitrary requirements, they encourage students to evolve their own pattern of work used on the problems they are pursuing. These are the lessons we've learned in listening to the learners' voices (Belenky, 1986, p.229).
5) Evaluation of learning should be a process of self-evaluation, in which the teacher devotes energy to helping the adults get evidence for themselves about the progress they are making toward their educational goals. In this process, the strengths and weaknesses of the educational program itself must also be assessed in terms of how it has facilitated or inhibited the learning of the students. So, evaluation is a mutual undertaking, as must be all other phases of the adult learning experience. Evaluation can also be seen as re-diagnosing learning needs, or as an on-going process. Learners often see this as more constructive because it launches them into a new cycle of learning, reinforcing the notion that learning is a continuing process. Fortunately, once adults make the discovery that they can take responsibility for their own learning, as they do for other facets of their lives, they often experience a sense of release and exhilaration (Knowles, 1980, p.46).

THE BASIC MATH CURRICULUM

INTRODUCTION

In this part of the paper I will give a general outline for a Basic Math Curriculum. This Curriculum is meant to be general because only after the instructor meets the learners can a more definite curriculum evolve. Teachers and tutors together with learners must create, change and be in charge of the curriculum. The final more definite version of the Basic Math Curriculum depends on all the factors mentioned in the first part of my paper. My assumption regarding a typical Basic Math class is that each Basic Math teacher has the typical type of literacy class; 6 to 10 learners, all at different levels, volunteer tutors to work with the learners, and each learner with different goals. The goals can range from reading and writing better to the acquisition of some life- and workplace skills. Before describing the Basic Math curriculum I will describe my personal assumptions regarding Basic Math. Many of my assumptions are based on my opinion on the issues mentioned in the first part of this project paper. I'll then describe the Basic Math Curriculum using NCTM curriculum and evaluation standards. In the discussion of curriculum I will cover the content of Basic Math, the instructional approaches, the role of the teacher, assessment and evaluation, and classroom management.
PERSONAL ASSUMPTIONS AND ITS IMPLICATIONS FOR INSTRUCTION

Teachers' personal assumptions regarding Basic Math have implications for instructional practices and the Basic Math Curriculum. My personal assumptions are:

* Theory affects practice and can change the depth and types of questions one considers when thinking about one's instructional practices in math. Theory can strengthen our energy in the struggle for humanization by focusing our attention on the interrelationships between our concrete daily teaching practice and the broader ideological framework (Marilyn Frankenstein, 1983). When designing or implementing Basic Math Curricula one needs to explore theoretical frameworks and ideologies and check whether it is in harmony with one's own belief statement or vision.

* The goal of education is to develop new social relations in the struggle for humanization (Freire, 1971). As long as the world is full of injustice and unequal relationships, change is necessary. Sharing this with learners and others will make a honest dialogue possible.

* Some groups are more affected by math anxiety than others because of the structure and hegemonic ideology of society. Basic Math instructors need to explore with the learners the underlying causes of math anxiety so that learners will understand their own math anxiety and be able to deal with it effectively.

* The physical and emotional aspect of the classroom environment forms a hidden curriculum with messages about what counts in learning and doing mathematics. Basic Math educators need to share their hidden curriculum with their learners.

* Adult learners have an enormous reservoir of negative and positive school and life experiences. Schools have sometimes negated their histories, cultures, and day-to-day experiences affecting the way they perceive ABE tutors and teachers. Basic Math instructors have to be sensitive to learners' experiences and learning goals. Extra sensitivity is required for learners who have always been labelled a certain way. An effort needs to be made to find Basic Math materials which reflect learners' histories, cultures, and day-to-day experiences.

* Women are often made to believe that they as a group are not good at math. The Basic Math instructor need to address this issue by discussing this in length, incorporating examples of female mathematicians and giving extra encouragement for female learners.
Instructors are key figures in how math is taught and learned in school. Instructors can be strong influences without being "superiors" who totally control the learning environment. Basic Math instructors have to be a role model for their learners.

Basic math deserves as equal attention in the ABE curriculum as reading and writing. An integrated approach with reading and writing is necessary, using reading and writing instructional techniques for teaching Basic Math.

THE NCTM CURRICULUM AND EVALUATION STANDARDS

The curriculum and evaluation standards for school mathematics of the NCTM, which came out in 1989, advocate a more holistic, conceptually based teaching approach to math. These curriculum and evaluation standards are also applicable for a Basic Math Curriculum in the ABE classroom. These standards were a reform response to a computation-dominated curriculum in the schools. The new standards promote a more conceptually oriented approach instead of rote learning, using active involvement as problem solver, real life applications, utilization of technology, and the development of number sense.

The rationale for the NCTM standards was that our technological world is changing at an ever-increasing rate, and our responsibilities as citizens in international affairs continue to increase. As the demands of society change, so do the essential competencies needed by individuals to live productively in that society. All students, including those of all races and both sexes, will need competence in essential areas of mathematics. This must cover those competencies that are necessary for the doors to employment and further education to remain open. Essential mathematics represents the mathematical competence students will need for responsible adulthood (NCTM, 1989).
NCTM's ASSUMPTIONS

NCTM's standards are based on four assumptions:

1. The goal of teaching math is to help all students develop mathematical power which means that the learners will have the ability to explore, conjecture, and reason logically, as well as the ability to use a variety of mathematical methods effectively to solve non-routine problems and the self-confidence and disposition to do so (NCTM, 1989, p5).

2. What students learn is fundamentally connected with how they learn it. Students' opportunities to learn mathematics are a function of the setting and the kinds of tasks and discourse in which they participate (NCTM, 1989, p.10).

3. All students can learn to think mathematically (NCTM, 1989, p.10).

4. Teaching is a complex practice and, hence, not reducible to recipes or prescriptions (NCTM, 1989, p11).

THE PURPOSE OF BASIC MATH

The NCTM standards articulate five general goals for all students: (1) that they learn to value math; (2) that they become confident in their ability to do math (3) that they become mathematical problem solvers (4) that they learn to communicate mathematically, and (5) that they learn to reason mathematically. Although each Basic Math curriculum depends on the issues mentioned in Part One of this paper and the goals of the learner, the NCTM standards can be kept in mind. NCTM is taking a proactive stance regarding the improvement of the mathematics preparation for the nation's future work force and has pledged itself to four societal goals in its Standards: mathematically literate workers, lifelong learning, equity of opportunity, and an informed electorate. ABE is helping to equip today's work force for its present challenges, is educating the parents of the children, is providing lifelong learning, is giving opportunity to learn, and is providing an understanding of today's issues as informed citizens (Schmitt, 1990).

The NCTM came up with twelve critical areas on mathematical competence for all students. The critical areas don't imply an instructional sequence or a priority among topics. In fact, the twelve essential mathematics areas are interrelated; competence in each area requires competence in other areas. The twelve components of essential math are (1) Problem solving, (2) Communicating mathematical ideas, (3) Mathematical Reasoning, (4) Applying mathematics to everyday situations, (5) Alertness to the reasonableness of results, (6) Estimation, (7)

CONTENT OF BASIC MATH

The ABE learner needs a Basic Math Curriculum which evolves around mathematical themes which can be either problem posing or competency based. The learner and the tutor have to decide which theme to focus on depending on the learner's short and long term goals. Resources for problem-posing materials can be newspaper articles containing numbers and mathematical concepts, life skill related materials like tax-forms, bills, food labels, medicine labels, health information, charts, or many types of data. Another content area can be school math materials, especially when the adults want to work with their children. Because of the new NCTM standards many conceptually oriented math activities for children have already come and more will, which can also be used for adult learners. The math activities should also consider multicultural and gender issues.

INSTRUCTIONAL APPROACHES

In order to teach Basic Math evolving from the themes I favor teaching them critically through reading and writing using whole language techniques. Other instructional strategies are the use of manipulative materials, cooperative work, problem-solving, content integration, and calculators and computers. Once decided upon the themes, Basic Math facts, skills, concepts, and principles can be taught using the different instructional approaches. The instructional approach can become critical by exploring the political, cultural and socio-economic dimensions of math. For example one can look at the meaning of certain numbers, asking the learners to discuss who created them and to figure out their intent. It can also include actively involving students individually and in groups, in exploring, conjecturing, analyzing, and applying mathematics in both a mathematical and a real-world context.
THE USE OF WHOLE LANGUAGE TECHNIQUES IN MATH INSTRUCTION

The instructor can use language to teach the mathematical facts, skills, concepts, and principles. In order to teach math I distinguish two types of language: spoken and written language. For the spoken language we talk and listen and for the written language we write and read.

While the learners investigate the different Basic Math themes, most often the spoken language is used. Especially when learners are working in small groups they talk with and listen to each other explaining and understanding the math they have to do. The written language can also be used. Reading can play a significant role through the use of written resources; learners can read instructions, explanation, definitions, applications, summaries, reports, rules, facts and questions. The reading is primarily for gathering specific information about Basic Math to answer questions that arise as they conduct their investigations. The learners need specialized reading strategies such as skimming, scanning, using indexes and tables of contents, and interpreting tables and diagrams.

Writing can occur frequently in the Basic Math Curriculum. Writing can be encouraged by writing to the teacher or each other, by developing charts with explanations, as well as publishing a newsletter or writing announcements or discoveries on a bulletin board. Types of writing that can be used are summaries, translations, definition, reports, personal writing, labels, instructions, notes, lists, evaluations, descriptions, predictions, arguments, explanations. The purpose of writing is to reflect, to clarify, to record and demonstrate their learning processes and outcomes. The outcome of learners' writing can be to identification of present and future learning needs, the sharing and celebrations of successes, and the development, use and understanding of mathematical language and symbols. It also gives the learners an insight in their own thinking, their use of resources, skills and strategies. The instructor can encourage recording by showing that s/he values it and by (1) praising good recording and give feedback, (2) questioning, and by (3) requesting more information (Richards, 1990).
ROLE OF THE INSTRUCTOR

For a Basic Math instructor teaching mathematics draws on knowledge from several domains: knowledge of mathematics, of diverse learners, of how students learn mathematics, of the context of classroom, school and society. Such knowledge is general. Instructors, however, must also consider the particular, for teaching is context-specific. For instance Knowledge about adult learners in general, for instance, can only be part of the decision an instructor must make about using a mathematical concept in a given context. Instructors must weave together knowledge from these different domains to decide how to respond to a learner's question, how to represent a particular mathematical idea, and how to pursue the new topic. Instructors will find themselves having to balance multiple goals and considerations; these decisions depend on a variety of factors that cannot be determined in the abstract nor governed by rules of thumb (NCTM, 1989, p.11).

NCTM has defined the role of the instructor in the Basic Math Classroom as to:

* Create a classroom environment to support teaching and the learning of mathematics.

* Set goals and select or create mathematical tasks to help students achieve these goals.

* Stimulate and manage classroom discourse so that learners and the instructor are clearer about what is being learned.

* Analyze learner learning, the mathematical tasks, and the environment in order to make ongoing instructional decisions. (NCTM, 1989).

Instructors don't teach learners to think; the learners think already. Instead, teachers must listen to the learners to discover themes which they then organize and present as problems to challenge learners' previous perceptions. However, instructors are not neutral objects who don't have opinions which won't influence their instruction, they will and should be able to suggest themes to the learners they judge as important.
Instructors can be strong influences without being "superiors" who totally control the learning environment. Freire also has this opinion, he says that:

The opposite of manipulation is not an illusory neutrality, neither is it an illusory spontaneity. The opposite of being directive is not being non-directive that is likewise an illusion. The opposite both of manipulation and spontaneity is critical and democratic participation by the learners in the act of knowing of which they are the subjects (Freire, 1981, p.28).

ASSESSMENT AND EVALUATION

Assessment and evaluation are some of the most important aspects of a Basic Math Curriculum because it enables both the instructor and the learners to to find out what the learners know, what they want to know and how they learn. There are different types of assessment and evaluation of Basic Math possible: a traditional evaluation of the learners' grasp of the material - by the instructor, the same type of evaluation but then done by the instructor and learner together, an evaluation of the program by the learner, and also self-evaluation. A traditional evaluation is not very effective for ABE learners because it makes the adult learners dependent on the instructor's judgement. For the ABE learner a collaborative instructor-learner evaluation is most likely be a successful one, because both instructor and learner can use their judgement and knowledge regarding the learners grasp of the materials. I think that many ABE learners would feel very uncomfortable doing the evaluation completely by themselves, especially in the beginning of their new Basic Math learning experience. However it is still important to leave much of the evaluation responsibility with the ABE learner and self evaluation should be encouraged as much as possible.

Assessment and evaluation has to be an ongoing process so that necessary changes can be incorporated during each tutoring session. NCTM developed fourteen school evaluation standards which can also be used for teaching Basic Math in the ABE setting. These fourteen school evaluation standards mentioned by NCTM (1989) are:

* Assessing what students know and what they think about mathematics.

* Having assessment be an integral part of teaching and learning

* Focussing on a broad range of mathematical tasks and taking a holistic view of mathematics
* Developing problem situations that require the applications of a number of mathematical ideas

* Using multiple assessment techniques, including written, oral, and demonstration formats.

* Using calculators, computers, and manipulatives in assessment

* Evaluating the program by systematically collecting information on outcomes, curriculum, and instruction.

* Using standardized achievement tests as only one of many indicators of program outcomes.

NCTM proposes to put less emphasis on:

* Assessing what students do not know

* Having assessment be simply counting correct answers on tests for the sole purpose of assigning grades

* Focusing on a large number of skills organized by a content-behavior matrix

* Using exercises or word problems requiring only one or two skills.

* Using only written tests

* Excluding calculators, computers, and manipulative from the assessment process

* Evaluating the program only on the basis of test scores

* Using standardized achievement tests as the only indicator of program outcomes.

Many Math educators have the opinion that evaluation data must come from various sources (e.g., observation, interviews, journal writings, portfolios, and extended projects); and evaluations must be conducted by evaluation teams consisting of various parties involved (Portia Elliot, 1990).

CLASSROOM MANAGEMENT

The Basic Math environment has to physically and emotionally support the ABE learners. ABE classrooms need to be equipped with a wide variety of physical materials and supplies. Classrooms should have ample quantities of such materials as counters; interlocking cubes; connecting links; base-ten, attribute, and pattern blocks; tiles; geometric models; rules; spinners; colored rods; geoboards; balances; fraction; pieces; and graph, grid, and dot paper. Simple household
object, such as buttons; dried beans, shells, egg cartons, and milk cartons, also can be used.

Emotionally the environment also need to be supportive, for learners have to feel safe and respected the way they are. A community of learners, tutors, and teachers need to established. The members of the community has to support each other and help each other in their learning.
CONCLUSION AND RECOMMENDATIONS

I started this paper describing the issues affecting a Basic Math Curriculum for ABE learners, and I also attempted to give a general outline for such a curriculum. I intend this to be directly usable as a theoretical base for teacher training in Basic Math. The new NCTM curriculum and evaluation standards for school math form an important basis for my Basic Math. If my curriculum used by ABE teachers and tutors it should help the ABE learner get the Basic Math s/he deserves. The Basic Math Curriculum will differ each time an instructor teaches depending on the social context the Basic Math learning occurs. The adult learner comes to the classroom with a great deal of life experience that can and must be built upon. The adult learner is goal-oriented, and time is an issue. I have therefore presented techniques to develop special ABE materials which are relevant to the adult learners. I believe that Basic Math for ABE learners deserves attention from universities and NCTM. It would be very useful if NCTM and Universities could focus some of their research towards Basic Math in ABE. Also, Basic Math courses and publications should become available to ABE teachers and tutors. ABE learners, tutors, teachers, administrators and policy makers must work together to collaborate with the other people in the mathematics field. Some Basic Math instructors are already in favor of a more holistic, conceptually based Basic Math instruction, which is more relevant to the ABE learner. So let's work together in order to come up with a one holistic field of Basic Math for everybody.


Frankenstein, Marilyn (1990). "Memorandum written to The Futures Committee, Umass Boston".


