ABC's (Activity Based Curriculum) and cognitive abilities.

William H. James

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ABC's (Activity Based Curriculum) and Cognitive Abilities

A Thesis Presented
By
William H. James

Submitted to the Graduate School of the University of Massachusetts in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
February 15, 1977
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ABC's (Activity Based Curriculum)
and
Cognitive Abilities

A Thesis Draft Presented
By
William H. James

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Finally, I would like to thank the Upward Bound project, and my wife, Ramona, whose support I treasured throughout this research effort.
ABSTRACT

The purpose of this research was to determine the effects of an Activity Based Curriculum (ABC) on the cognitive abilities in minority students, as measured by their performance on tests. These tests were administered within the curriculum designs for Algebra I and Geometry, in an Upward Bound Program at the University of Massachusetts.

The students involved in the research were recruited from disadvantaged socio-economic situations. The students were also recruited on the basis of their potential for improving academic performance. Most of the students had received low grades during the regular school year.

The summer program design included an academic component, in which students were required to participate. All courses met Monday through Friday for the six week period.

This research focused on the Activity Based Curriculum designs for Algebra I and Geometry. The study involved the seventeen students in these two courses, and assessing their academic achievement in reference to a comparison group that did not participate in the program.

The results of an analysis of covariance yielded significant differences between the ABC and the Control group. These differences were gains in school performance during the following school year, for the ABC group.
The differences were measurable by improved grade point averages (GPA's), and can be viewed as gains in cognitive abilities through the use of an Activity Based Curriculum.
Background of the Problem

The performance of Black American and other minority group children in school has come under detailed analysis recently by social scientists. Terms such as "culturally deprived" and "enrichment program" have surfaced quite often. In addition, numerous studies comparing lower class minority group children to various classes of white children and other ethnic groups are quite evident in the literature.

Lesser, Fifer, and Clark (1965) examined verbal ability, reasoning, number facility and space conceptualization in Chinese, Jewish, Negro and Puerto Rican children from both middle class and lower class groups. Their purpose was to examine patterns among these various mental abilities in children from different ethnic and social class groups. They concluded that different ethnic groups do differ significantly in these mental abilities and in the pattern of scores on these abilities.

Some of the research with different ethnic groups measures group performance on cognitive tasks. Other research with different ethnic groups examines the experiences of the individuals in the particular study, to determine to what extent these experiences would contribute to cognitive development. Indeed, some of these experiences are contained within different cultures.

Black children have their own culture, which is often either ignored or evaluated by white, middle class standards.
In the Black culture, verbal communication often takes the form of Black English (Seymour, 1971). Often, Black children are labeled "verbally deficient", on the basis of their performance on an experimental task. These same children, when observed in their natural environment, display a rich variety of verbal communication. Their use of Black English, the effects of their culture, and a white, middle class test/testor compound the problem of accurately measuring verbal ability among Black children.

The remainder of this paper contains the following sections. A review of the literature will focus upon three topic areas. The topic areas are cognition, social behavior and Upward Bound research. The review of the literature will deal with material that has both direct and indirect relationships to this research. The hypotheses section will present the various hypotheses that were investigated. The ABC design section will detail the methods and procedures that were used in the summer program. Finally, there are sections that outline the basic research question, along with method, results and discussion sections.

REVIEW OF THE LITERATURE

COGNITION

The first section of this literature review will focus upon cognitive structure, processes and synthesis. Indeed, there are numerous definitions of cognitive structure. One
definition is presented by LeFrancois (1972). He describes cognitive structure as "the organized totality of an individual's knowledge." In addition, there are numerous definitions of cognitive processes in the literature. Guilford (1967) classified cognitive processes as the "immediate discovery, awareness, rediscovery, or recognition of information in various forms; comprehension and understanding."

Cognitive synthesis was investigated by Farnham-Diggory (1970). There were three experiments that investigated the synthesis of ideas and concepts among Negro and white children. Specifically, the experiments involved verbal, maplike, and mathematical tasks, that required the synthesis of symbols (black lines) with other conceptual information. An example of a verbal task was instructions to "shake hands with teacher." The results were that Negro and white males were superior to both Negro and white females. An example of the maplike task was to make a bridge going across a river with a road on each side, using black strings. The results of this task was that white males and females were superior to Negro males and females. However, within the Negro children, the females performed better than the males. This particular result was ascribed more to housekeeping responsibilities among lower-class Negro females. This performance by females on the maplike task led to the hypothesis that females might perform better in geometry than males. (See Hypothesis V.)
Finally, an example of the mathematical task was to match blocks (e.g., 2 x 2 inches) and cards with dots (e.g., 2) on them. Significantly more white males and females performed this task better than Negro males and females. There were no significant differences between males and females. The results indicate that among Negro children, the successive synthesis (performance on verbal tasks) is greater than the performance on simultaneous synthesis (maplike and mathematical tasks). This research design involved successive synthesis through the use of sequential teaching and specific curriculum methods. (See ABC design, procedures.)

The focus of this research will be upon improving academic performance through the use of an activity based curriculum design. And finally, the fundamental hypothesis is that an improved performance in mathematics would reflect the use of cognitive structure, processes and synthesis.

Abstract and Concrete

Research pertaining to abstract and concrete abilities relates directly to understanding cognitive abilities and test performance, in reference to the ABC design. A good deal of research pertains to the measurement of both concrete and abstract skills, but leaves the definitions of these terms or concepts up to the reader.
For the purposes of this research, the term "concrete" applies to something that is tangible, such as a classroom model of a polygon. The term "abstract" applies to a non-tangible entity such as verbal information given out in class. By virtue of the subject matter, both Algebra I and Geometry are abstract. Finally, because concrete models and visual cues were used in the ABC design, a brief review of literature that contains concrete and abstract dimensions seems appropriate. These dimensions are directly related to developing problem-solving skills.

Houtz and Feldhusen (1975) used a test they designed to measure problem-solving skills in children. The test consisted of multiple-choice items, in one of four different forms, and the child was asked to respond to the problem. A sample problem was a picture of a boy holding a torn dog's rope, with the other end of the rope tied to the doghouse. Four forms were used for each problem, representing a continuum from the concrete to the abstract. The four forms were a) two and three-dimensional models representing the problem situation, b) slides, c) cartoons, and d) verbal information.

The child was asked what the problem was, and the response was viewed as a measurement of three things: the child's ability to sense whether a problem exists, the child's ability to define a problem, and the child's ability to come up with a solution.
The results of two separate studies with both disadvantaged and non-disadvantaged children indicated that the subjects performed better on the models, slides and cartoons as compared to the verbal information. Essentially, the subjects performed better when either concrete models or visual cues were utilized, both of which were integral components of the ABC design used in this research.

**Rules and Relationships**

Another concern for this experimenter was the importance of the child knowing the rules of the game and the relationships between concepts, or problems to be solved. These rules and relationships exists in all tests of cognitive abilities. The nature of the materials, and the ways in which the materials may be structured determine what kinds of rules are used. Also, it is important that these rules make sense to the individuals that are being tested. These are very difficult tasks in any test of cognitive abilities, as will be examined briefly using IQ test items.

The following examples were selected from the Stanford-Binet Intelligence Scale, Form L-M, 1960. The scale was developed by Terman and Merrill. Before examining the first test item, it is important to realize that the child has in his or her cognitive structure a classification scheme for materials that make up a book. These materials include pictures, cardboard, and pages. The first test
item selected from the IQ test is, "What is a book made out of?". The only acceptable answers for this question are paper, cloth, leather, cardboard, sheepskin, plastic, and pieces of paper. Two of the items that the child has in the cognitive structure are not included on the list of correct responses.

Two additional examples from the same IQ test are the following:

2) Tester: (OPPOSITE ANALOGIES) "The sun shines during the day; the moon at _____."
Child: acceptable responses are: night, the moon shines at night, during the night. non-acceptable responses are: lights up at night, I think the moon is white in the night.

3) Tester: (DIFFERENCES) "What is the difference between a bird and a dog?"
Child: acceptable responses are: a bird flies and a dog runs, the dog can run and the bird can't, a bird can't bite, they are different shaped.
non-acceptable responses are: a bird can go faster than a dog, a dog chases a bird.

As Jones (1975) points out, there are problems that exist within this framework of scoring that is used for IQ tests. Essentially, the rules and relationships of any
test of cognitive abilities need to be clearly understood, by both the tester and the testee in order to maximize the performance level. The ABC design attempted to establish the rules and relationships in the subjects of Algebra and Geometry.

SOCIAL BEHAVIORS

Research that attempts to understand and analyze social behaviors is indirectly related to this study. Much of the research pertaining to social behaviors focuses upon behaviors that facilitate competency. White and Watts (1973) define behaviors that facilitate competency as the following:

1. to get and maintain the attention of adults in socially acceptable ways.
2. to use adults as resources.
3. to express both affection and hostility to adults.
4. to lead and follow peers.
5. to express both affection and hostility to peers.
6. to compete with peers.
7. to praise oneself and/or show pride in one's accomplishments.
8. to involve oneself in adult role-playing behaviors or to otherwise express a desire to grow up.

In addition, White and Watts define distinguishable non-social competent abilities as the following:
1. linguistic competence (basically a good command of the English language through the use of a good vocabulary).
2. intellectual competence (the ability to think and formulate ideas clearly).
3. executive abilities (the ability to direct and lead others in activities).
4. attentional abilities (the ability to focus on more than one activity).

The results of the study by White and Watts of high and low competency children indicate that the home environment, particularly the maternal relationship, is the most important factor in the development of competency. Essentially, they conclude that it is the social behaviors and the interactions between a mother or caretaker and the child that significantly effect the development of cognitive skills and competency in school. They emphasize the importance of a positive mother or caretaker-child relationship upon cognitive, social and non-social abilities.

In further support of the importance of the mother or caretaker-child relationship, Hess and Shipman (1965) researched 160 Negro mothers and their four-year-old children. They were selected from four different social classes. The social classes ranged from college-educated professionals to unskilled or semi-skilled occupational levels. Essentially, the mothers were interviewed and tested for mother-child
interactions across the four groups. The mothers were taught three simple tasks by the experimenters and were then asked to teach the same task to the child. Their purpose was to analyze the patterns of experiences that mediate between the child and his environment and relate these patterns of experience to social class. In essence, this experience goes further than an attempt to discern differences between social classes. Namely, it may be viewed as an attempt to separate out and categorize those behaviors conducive to early childhood development of cognition. Their results indicate that the higher the social class the higher the child's cognitive ability. They conclude that this is a result of a better "maternal teaching style". They also viewed elaborate language communications along with social interactions as the most important early childhood experiences. The Upward Bound program consisted of social and cultural components. But these components are not the main focus of this research.

UPWARD BOUND RESEARCH

The purpose of this section is to review some research that utilized the same population of students. This research involved geographically different Upward Bound programs. But, essentially, the programs were comprised of the same type of low achieving students that made up the population of the ABC research. This research was not directly related to understanding cognitive abilities using an ABC design, but rather focused upon other psychological concepts.
One of these studies, conducted by McCormick and Williams (1974), investigated the effects of an Upward Bound program upon self-esteem. They investigated the effects of both the summer phase and the follow-up phase of the program. In addition, they investigated the effect of the number of years spent in the program upon self-esteem. They found that as self-concept increases and becomes more positive, the level of achievement will rise. They also found that greater changes in self-esteem occurred during the summer phase of the program. The Tennessee Self-concept Scale was used to assess the changes.

Aliotti, Britt and Haskins (1975), investigated the relationship between creativity and intelligence test scores of Blacks, Caucasians, and American Indian students in an Upward Bound program. They found that their test scores for creativity correlated low with the intelligence test scores. However, they concluded that because of the unequal numbers of the ethnic group tested, statistical comparisons must be cautiously interpreted.

Other research which is relevant to this population involves research into teaching techniques for the inner-city child. Lincoln (1974) emphasized the method of sequential teaching. That is, the learning of specific parts of a subject, then sequentially proceeding to learn the whole subject. The subject matter is divided up into clearly defined sections, then each section is taught until
clearly understood, prior to going on to the next section. In addition, Lincoln asserts that sequential teaching has been used successfully in his courses in Algebra, Biology, and Chemistry at the high school level. He also emphasized that essential components of a sequential teaching method are visual cues and concrete objects. The use of visual cues and concrete objects were an integral part of the ABC design.

In summary, although research involving Upward Bound students has been done, there are no available studies which directly investigate the relationship between specific curriculum methods and gain in cognitive abilities using this particular population of students.

**HYPOTHESIS**

There are a number of hypotheses for this research. They are the following:

I. Specific training procedures (ABC's) can improve the cognitive abilities in minority high school students. (See Tables 2, 4, 5, and 6)

II. Prior math exposure before the ABC procedure would be beneficial to higher performance within the ABC group. (See Table 8)

III. The amount of time spent at tutorials might lead to higher performance within the ABC group.

IV. The amount of in-class activity such as asking
questions and participating substantially in workbook activities, would lead to higher performance within the ABC group.

V. Females might perform better in Geometry than males, because of their exposure to similar spacial tasks in housekeeping responsibilities usually assigned to low-income females. (See Table 8)

THE ABC DESIGN

The nature of both Algebra and Geometry is conceptual. That is, they both require performance on cognitive tasks.

Because cognition is defined as 1) the process or processes by which a person acquires knowledge or becomes aware, or 2) the product of such a process or processes, test performances in Algebra I and Geometry can be considered measurements of cognitive skills. In Algebra, the tasks are more in terms of understanding symbolic representation. In Geometry, the cognitive tasks involve understanding spacial relationships. The following examples from each course represent cognitive tasks, and were selected from the larger pool of tasks for each course.

The following two examples were selected from Algebra I.

Example 1 - MAGIC SQUARES (Ref., Lab Act. in Algebra, p7)

The following square arrays of numbers are called magic squares. A magic square has the property, the sum of the numbers in each row, column and main diagonals are the same.
Activity 19 - Sample example

<table>
<thead>
<tr>
<th>-3</th>
<th>2</th>
<th>1</th>
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<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>-1</td>
<td>-2</td>
<td>3</td>
</tr>
</tbody>
</table>

Activity 20 - Test

<table>
<thead>
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</tr>
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<tbody>
<tr>
<td>-4</td>
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<tr>
<td>-6</td>
<td>-1</td>
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</table>

Activity 21 - Test

<table>
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</thead>
<tbody>
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</tr>
<tr>
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<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>5</td>
<td>-6</td>
</tr>
</tbody>
</table>

Activity 22 - Test

<table>
<thead>
<tr>
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<th>-17</th>
<th>-18</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>-11</td>
<td>-13</td>
<td>-8</td>
</tr>
<tr>
<td>-5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The task for this activity is to understand Activity 19, then go on to complete Activities 20, 21, and 22.

Example 2 - EXPONENTS (Ref. Lab. Act. in Alg., p 37)

Exponents furnish an efficient way to multiply and divide. When we multiply numbers in exponential form, we may do this by adding the exponents. For example:

\[2^3 \times 2^4 = 2^7\]
\[10^5 \times 10^3 = 10^8\]
\[5^4 \times 5^2 = 5^6\]
Likewise, we divide numbers in exponential form by subtracting exponents. For example:

\[
2^7 \div 2^4 = 2^3 \quad 10^8 \div 10^3 = 10^5 \quad 5^6 \div 5^2 = 5^4
\]

Activity 73

Give the following products and quotients in exponential form.

1. \(3^4 \times 3^6 = \)  
2. \(4^5 \times 4^3 = \)  
3. \(10^8 \times 10^9 = \)  
4. \(3^6 \div 3^4 = \)  
5. \(4^7 \div 4^2 = \)  
6. \(10^8 \div 10^9 = \)  
7. \(7^7 \div 7^9 = \)  
8. \(11^7 \div 11^8 = \)  
9. \(11^7 \times 11^9 = \)  
10. \(1^7 \times 1^9 = \)  
11. \(a^5 \times a^3 = \)  
12. \(3^0 \times 3^4 = \)  
13. \(a^5 \div a^5 = \)  
14. \(a^5 \div a^8 = \)  
15. \(10^0 \div 10^5 = \)  
16. \(a^0 \times a^5 = \)  
17. \(a^0 \div a^5 = \)  
18. \(a^0 \times a^0 = \)  
19. If \(a \neq 0\), what is \(a^0\) for any value of \(a\)?

In addition, ALGEXP (p. 16) an algebra card game, and VARICARD (p. 17), another algebra card game, are activities that strengthen the cognitive skills needed to understand algebraic expressions such as \(2x + 1\), \(x^2 - 2x - 1\), and \(x^4 + x + 1\). The games require substituting values for \(x\).

Also, the nature of Geometry is conceptual, and utilizes cognitive skills. Two specific measurements of cognitive skills with reference to the Activity Based Curriculum are the following:


See activities 30a, 30b, 30c, 30d, 31a, 31b, 32 and 33a.
The ABC curriculum design for both Algebra I and Geometry will be outlined. On Mondays and Wednesdays there were lectures. On Tuesdays and Thursdays there were in-class activities. Every Friday there was a quiz evaluating student learning. During the last week there was a final exam.

The lectures on Mondays and Wednesdays were designed and implemented as two-way communication between the students and the instructor. Questions were encouraged, while at the same time attending to the daily objectives outlined on the blackboard. The texts used for lecture material were *Teaching Algebra Today* and *Teaching Geometry Today*, both authored by Russell Call.

The in-class activities on Tuesdays and Thursdays were based on the texts *Laboratory Activities in Algebra* and *Geometry Laboratory Activities 1*, both authored by William Miller. The instructor acted as a facilitator for the activities. The first objective was to explain the activity in the workbook. Next, the students worked either
individually or in groups in their workbooks. Often, there was competition between groups because they wanted to complete the assigned activity ahead of each other. The instructor acted as a facilitator for guiding the students through these various activities. Figure 2 represents the overall ABC design.

**ABC DESIGN**

**CONTEXTUALIZATION**
- VISUAL
  - SIGHT OF CONCEPT
- AUDITORY
  - SOUND OF CONCEPT
- SPEECH
  - DISCUSSION OF CONCEPT
- MOTOR
  - ACTION OF ACTIVITY

**DECONTEXTUALIZATION**
- COGNITION
  - UNDERSTANDING CONCEPT
- MOTOR
  - ACTION OF TEST

**FIGURE 1**

An example of the procedure detailed in Figure 2 is as follows. The procedure used for explaining the use of equations to solve the area of a rectangle will be used as an example.
CONTEXTUALIZATION

STEP 1 - Visual, sight of concept - blackboard presentation.

STEP 2 - Auditory, sound of concept - explanation that Z and 3 are added together to obtain the length dimension of Z + 3. Likewise, Z and 2 produce the width dimension of Z + 2, for the rectangle.

STEP 3 - Speech, discussion of concept - students discuss the concept of "area of a rectangle" and are reminded that the areas of a rectangle is the length times the width. In this case, the area is Z + 3 times Z + 2.

STEP 4 - Motor, action of activity - students are assigned the problem of multiplying two terms. (Z + 3) (Z + 2) = Z^2 + 5Z + 6. Students are asked to make up additional examples of rectangles, and to arrive at area equations for the rectangles, and also for the subsections of the rectangles.

DECONTEXTUALIZATION

STEP 5 - Cognition, understanding concept - students are
assigned problem sets out of their workbooks for homework. The following are examples:

\[(X + 5)(X + 3) = (M + 2)(M + 7) =\]
\[(X + 7)(X + 9) = (Y + 10)(Y + 2) =\]
\[(N + 6)(N + 8) = (T + 8)(T + 9) =\]

STEP 6 - Motor, actions of test - students are tested with similar examples.

These steps detail simply one concept in Algebra I out of a wide range of concepts. The explanation of numerous mathematical concepts can be accomplished in a similar manner, with some variations.

THE RESEARCH QUESTION

The basic question that this research effort attempted to answer was, "Can an Activity Based Curriculum (ABC) improve the cognitive performance in high school aged minority students on conceptual tasks in Algebra I and Geometry?". It was hypothesized that an ABC design provided these students with both concrete and conceptual context which make generalized learning possible. Essentially, any increments or gains in performance which can be attributed to the ABC should show up in incremental gains between the pre-test and post-test scores in Algebra I and Geometry, which reflect acquisition of conceptual or rule-based competencies.
Therefore, the contextualization provided by the ABC design should then facilitate gain in performance because of visual and concrete stimuli designed to enhance conceptual learning. This contextualization took place through the use of algebra game cards, blackboard diagrams and relevant examples of algebra and geometry problems. The material was then decontextualized in the form of a weekly quiz on concepts, designed to test generalized learning from exposure to specific examples in class.

The results of this study are then attempts to separate out the effects of an ABC design and determine if any increase in cognitive performance had taken place. Items of importance in the results section are a) comparison of ABC and control group scores, b) the effects of prior exposure on performance in either Algebra I or Geometry, c) the effect on performance of various types of participation, such as asking questions in class, attendance at tutorial sessions, d) the comparison of males' and females' performances.

METHOD

Subjects and Design

The subjects that participated in the research were 17 high school students from low-income environments. Approximately half of the subjects were female and half were male. All of the subjects met the federal socioeconomic
criteria for participation in the Upward Bound Program. In addition, a control group of 17 students that met the same criteria was used.

All of the students were from the Western Massachusetts public school systems. Essentially, the students are randomly selected for participation in the Upward Bound program, and each year a lengthy waiting list of eligible candidates is compiled. It was this waiting list that was used to establish a control group with the same essential characteristics of the ABC group.

The experimental design was a matched group, between subjects design for both Algebra I and Geometry. In the between subjects design each subject received only one level of the independent variable, which was the ABC curriculum. The two groups were matched on sex, grade level, school, and on the prior grade point average (GPA) in previous math courses during the entire regular school year (See Table 1). This matching procedure was used to produce similar groups.

The research involved the collection of interval data over time. That is, measures of grade point average for both the ABC and the control group for the previous school year were taken. This measure was taken in order to match the ABC and the control group on a dependent variable. This method enabled the assessment of the effect of the ABC curriculum on subsequent performance in mathematics. As
stated previously, the independent variable was whether or not the student received the ABC curriculum. The dependent variable was the grade point average for mathematics courses over the school marking periods following exposure to the ABC curriculum during the summer program.

RESULTS

The following table presents the matching variables used to produce similar groups.

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Grade</th>
<th>High School</th>
<th>Prior Math GPA</th>
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<td>Coll. Alg.</td>
</tr>
<tr>
<td>Cindy</td>
<td>F</td>
<td>11</td>
<td>Hoosac</td>
<td>2.0</td>
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</tr>
<tr>
<td>Brian</td>
<td>M</td>
<td>10</td>
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<td>1.5</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Andrea</td>
<td>F</td>
<td>11</td>
<td>Commerce</td>
<td>1.5</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Ray</td>
<td>M</td>
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<td>Holyoke</td>
<td>1.0</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Wayne</td>
<td>M</td>
<td>10</td>
<td>Taconic</td>
<td>1.0</td>
<td>Algebra I</td>
</tr>
<tr>
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<td>10</td>
<td>Classical</td>
<td>0.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Ruth</td>
<td>F</td>
<td>10</td>
<td>Tech</td>
<td>0.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Frankie</td>
<td>M</td>
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<td>Algebra I</td>
</tr>
<tr>
<td>Name</td>
<td>Sex</td>
<td>Grade</td>
<td>High School</td>
<td>Prior Math GPA</td>
<td>Prior Math Course</td>
</tr>
<tr>
<td>--------</td>
<td>-----</td>
<td>-------</td>
<td>-------------</td>
<td>----------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Connie</td>
<td>F</td>
<td>10</td>
<td>Taconic</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Keith</td>
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<td>11</td>
<td>Tech</td>
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<td>Algebra II</td>
</tr>
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<td>Laura</td>
<td>F</td>
<td>10</td>
<td>Holyoke</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Wilma</td>
<td>F</td>
<td>11</td>
<td>Classical</td>
<td>1.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Beth</td>
<td>F</td>
<td>10</td>
<td>Commerce</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kevin J.</td>
<td>M</td>
<td>10</td>
<td>Commerce</td>
<td>1.5</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Sonya</td>
<td>F</td>
<td>10</td>
<td>Hoosac</td>
<td>2.0</td>
<td>Bus. Math</td>
</tr>
<tr>
<td>Diana</td>
<td>F</td>
<td>11</td>
<td>Holyoke</td>
<td>1.0</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Carlos</td>
<td>M</td>
<td>10</td>
<td>Holyoke</td>
<td>2.0</td>
<td>Coll. Alg. I</td>
</tr>
<tr>
<td>Lisa</td>
<td>F</td>
<td>11</td>
<td>Hoosac</td>
<td>3.0</td>
<td>Bus. Math</td>
</tr>
<tr>
<td>Norman</td>
<td>M</td>
<td>10</td>
<td>Commerce</td>
<td>2.5</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Olivia</td>
<td>F</td>
<td>11</td>
<td>Commerce</td>
<td>1.0</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Laurece</td>
<td>M</td>
<td>10</td>
<td>Holyoke</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Michael</td>
<td>M</td>
<td>10</td>
<td>Taconic</td>
<td>0.0</td>
<td>Coll. Alg. I</td>
</tr>
<tr>
<td>Doug</td>
<td>M</td>
<td>10</td>
<td>Classical</td>
<td>0.0</td>
<td>Gen. Math</td>
</tr>
<tr>
<td>Liz</td>
<td>F</td>
<td>10</td>
<td>Tech</td>
<td>1.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Erwin</td>
<td>M</td>
<td>10</td>
<td>Commerce</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Kimberly</td>
<td>F</td>
<td>10</td>
<td>Taconic</td>
<td>2.0</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Don</td>
<td>M</td>
<td>11</td>
<td>Tech</td>
<td>1.5</td>
<td>Algebra I</td>
</tr>
</tbody>
</table>
TABLE 1 Continued

CONTROL

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Grade</th>
<th>High School</th>
<th>Prior Math GPA</th>
<th>Prior Math Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belinda</td>
<td>F</td>
<td>10</td>
<td>Holyoke</td>
<td>1.0</td>
<td>Coll. Alg. I</td>
</tr>
<tr>
<td>Theresa</td>
<td>F</td>
<td>11</td>
<td>Classical</td>
<td>0.0</td>
<td>Bus. Math</td>
</tr>
<tr>
<td>Tawana</td>
<td>F</td>
<td>10</td>
<td>Commerce</td>
<td>0.5</td>
<td>Algebra I</td>
</tr>
</tbody>
</table>

GPA Scale: 4.0 = A 2.0 = C 0.0 = F 3.0 = B 1.0 = D

The following table presents the results of an ABC design on the GPA of 10th and 11th grade students in math courses during the regular school year, compiled over two marking periods.* Originally, the ABC and Control groups contained 29 students each. However, one student dropped out of the summer program after one week, and two students moved away after the summer ended. Another student became quite ill and had to be hospitalized shortly after entering school in the fall. And finally, an additional eight students did not take any math courses during the subsequent school year, after completing the summer program. Therefore, the two groups were reduced in number to seventeen students each. Statistical analyses of the matched groups presented in Table 1 will also be developed in this section.

* This post math GPA is pooled, and includes some Algebra and Geometry.
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Prior Math GPA</th>
<th>Post Math GPA</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kevin A.</td>
<td>18</td>
<td>1.6</td>
<td>1.0</td>
<td>-0.6</td>
</tr>
<tr>
<td>Doris</td>
<td>16</td>
<td>1.0</td>
<td>3.0</td>
<td>+2.0</td>
</tr>
<tr>
<td>Robin</td>
<td>17</td>
<td>1.0</td>
<td>1.5</td>
<td>+0.5</td>
</tr>
<tr>
<td>James</td>
<td>16</td>
<td>1.0</td>
<td>3.0</td>
<td>+2.0</td>
</tr>
<tr>
<td>Cindy</td>
<td>17</td>
<td>2.0</td>
<td>3.5</td>
<td>+1.5</td>
</tr>
<tr>
<td>Brian</td>
<td>17</td>
<td>1.5</td>
<td>2.0</td>
<td>+0.5</td>
</tr>
<tr>
<td>Andrea</td>
<td>17</td>
<td>1.5</td>
<td>2.0</td>
<td>+0.5</td>
</tr>
<tr>
<td>Ray</td>
<td>17</td>
<td>1.0</td>
<td>1.5</td>
<td>+0.5</td>
</tr>
<tr>
<td>Wayne</td>
<td>17</td>
<td>1.0</td>
<td>0.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Tony</td>
<td>16</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Ruth</td>
<td>17</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Frankie</td>
<td>16</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Connie</td>
<td>16</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Keith</td>
<td>18</td>
<td>1.7</td>
<td>2.0</td>
<td>+0.3</td>
</tr>
<tr>
<td>Laura</td>
<td>16</td>
<td>2.0</td>
<td>3.0</td>
<td>+1.0</td>
</tr>
<tr>
<td>Wilma</td>
<td>17</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Beth</td>
<td>16</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

M = 1.3       M = 1.7       M = +.4
TABLE 2 Continued
CONTROL (n=17)

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Prior Math GPA</th>
<th>Post Math GPA</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kevin J.</td>
<td>16</td>
<td>1.5</td>
<td>1.0</td>
<td>-0.5</td>
</tr>
<tr>
<td>Sonya</td>
<td>15</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Diana</td>
<td>17</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Carlos</td>
<td>17</td>
<td>1.0</td>
<td>2.0</td>
<td>+1.0</td>
</tr>
<tr>
<td>Lisa</td>
<td>16</td>
<td>3.0</td>
<td>3.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Norman</td>
<td>16</td>
<td>1.5</td>
<td>2.5</td>
<td>+1.0</td>
</tr>
<tr>
<td>Olivia</td>
<td>15</td>
<td>1.5</td>
<td>1.0</td>
<td>-0.5</td>
</tr>
<tr>
<td>Laurece</td>
<td>16</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Michael</td>
<td>15</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Doug</td>
<td>17</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Liz</td>
<td>17</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Erwin</td>
<td>17</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Kimberly</td>
<td>15</td>
<td>2.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Don</td>
<td>16</td>
<td>1.5</td>
<td>1.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Belinda</td>
<td>17</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Theresa</td>
<td>16</td>
<td>1.0</td>
<td>0.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Tawana</td>
<td>15</td>
<td>2.0</td>
<td>0.5</td>
<td>-1.5</td>
</tr>
</tbody>
</table>

M = 1.4  M = 1.3  M = -0.08

GPA Scale
4.0 = A
3.0 = B
2.0 = C
1.0 = D
0.0 = F
An analysis of variance to check for differences between the ABC and Control groups to confirm matching was performed. This test involved the use of the prior math GPA's for each group, to determine whether there existed a significant difference between the two groups. The results are presented in the following table.

**TABLE 3**

Two-Way Analysis of Variance: Effect of Prior Grade Point Average on ABC and Control Groups

<table>
<thead>
<tr>
<th>Prior GPA</th>
<th>No. of Cases</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>F-Value</th>
<th>2-Tail Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>17</td>
<td>1.31</td>
<td>.64</td>
<td>.15</td>
<td></td>
<td>1.36</td>
</tr>
<tr>
<td>CONTROL</td>
<td>17</td>
<td>1.41</td>
<td>.75</td>
<td>.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An analysis of variance to check for differences between the ABC and Control groups to determine possible effects due to the ABC design was performed. This test involved the use of the post math GPA's for each group. The results are presented in the following table.

**TABLE 4**

Two-Way Analysis of Variance: Effect of Post Grade Point Average on ABC and Control Groups

<table>
<thead>
<tr>
<th>Post GPA</th>
<th>No. of Cases</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>F-Value</th>
<th>2-Tail Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>17</td>
<td>1.73</td>
<td>1.07</td>
<td>.26</td>
<td></td>
<td>1.43</td>
</tr>
<tr>
<td>CONTROL</td>
<td>17</td>
<td>1.32</td>
<td>.90</td>
<td>.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A test for correlation between pre and post GPA's was performed, with \( r = .66 \). Then an analysis of covariance was performed using the prior GPA as the covariate, and the post GPA as the dependent measure. The results are presented in the following table.

**TABLE 5**

Analysis of Covariance: Effect of ABC on Post Grade Point Average

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>2.19</td>
<td>1</td>
<td>2.19</td>
<td>4.19</td>
<td>.049</td>
</tr>
<tr>
<td>Residual</td>
<td>16.26</td>
<td>31</td>
<td>.52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An analysis of covariance was performed using the post GPA as the dependent measure, by ABC, sex, and age with the prior GPA as the covariate. The results are presented in the following table.

**TABLE 6**

Analysis of Covariance: Effect of ABC, Sex and Age on Post Grade Point Average

<table>
<thead>
<tr>
<th>SV</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>1.45</td>
<td>1</td>
<td>1.45</td>
<td>2.57</td>
<td>.12</td>
</tr>
<tr>
<td>Sex</td>
<td>.04</td>
<td>1</td>
<td>.04</td>
<td>.07</td>
<td>.78</td>
</tr>
<tr>
<td>Age</td>
<td>1.52</td>
<td>1</td>
<td>.50</td>
<td>.90</td>
<td>.45</td>
</tr>
<tr>
<td>ABC X Sex</td>
<td>.89</td>
<td>1</td>
<td>.89</td>
<td>1.57</td>
<td>.22</td>
</tr>
<tr>
<td>ABC X Age</td>
<td>1.21</td>
<td>1</td>
<td>1.21</td>
<td>2.14</td>
<td>.15</td>
</tr>
<tr>
<td>Sex X Age</td>
<td>.33</td>
<td>2</td>
<td>.16</td>
<td>.29</td>
<td>.74</td>
</tr>
<tr>
<td>ABC X Sex X Age</td>
<td>.01</td>
<td>1</td>
<td>.01</td>
<td>.02</td>
<td>.87</td>
</tr>
<tr>
<td>Residual</td>
<td>12.44</td>
<td>22</td>
<td>.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following tables are presented to assess the hypothesis (II) that prior math exposure, particularly to Algebra I or Geometry, would be beneficial to higher performance within the ABC group.
### TABLE 7
Prior Math Course and Grade Point Average, ABC Grade Point Average, Group Means, for ABC Algebra I Group

<table>
<thead>
<tr>
<th>Name</th>
<th>Prior Math Course &amp; GPA</th>
<th>ABC GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kevin A.</td>
<td>General Math 1.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Doris</td>
<td>General Math 1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Robin</td>
<td>General Math 1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>James</td>
<td>College Algebra 1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Cindy</td>
<td>Indep. Study Math 2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Brian</td>
<td>General Math 1.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Andrea</td>
<td>General Math 1.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Ray</td>
<td>General Math 1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Wayne</td>
<td>Algebra I 1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Tony</td>
<td>Algebra I 0.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Ruth</td>
<td>Algebra I 0.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

GPA Scale: 4.0 = A  
3.0 = B  
2.0 = C  
1.0 = D  
0.0 = F

M = 1.0  
M = 2.7

### TABLE 8
Prior Math Course and Grade Point Average, ABC Grade Point Average, Group Means, for ABC Geometry Group

<table>
<thead>
<tr>
<th>Name</th>
<th>Prior Math Course &amp; GPA</th>
<th>ABC GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frankie</td>
<td>Algebra I 2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Connie</td>
<td>Algebra I 2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Keith</td>
<td>Algebra II 1.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Laura</td>
<td>Algebra I 2.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
TABLE 8 Continued.

<table>
<thead>
<tr>
<th>Name</th>
<th>Prior Math Course &amp; GPA</th>
<th>ABC GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilma</td>
<td>Algebra I</td>
<td>1.0</td>
</tr>
<tr>
<td>Beth</td>
<td>Algebra I</td>
<td>2.0</td>
</tr>
</tbody>
</table>

GPA Scale: 4.0 = A  
3.0 = B  
2.0 = C  
1.0 = D  
0.0 = F

M = 1.7  M = 2.0

SUMMARY

These data indicate that there was an overall gain in GPA for the ABC groups, and that this difference was significant in an analysis of covariance at the .05 level. In addition, the average gain for the ABC group was .4 in GPA, while the results for the Control group indicated an average decline in GPA of -.08.

DISCUSSION

In this section, the various hypotheses for implementing the research will be examined. This section will utilize as a foundation, the results section and the various statistical measurements. This section will also discuss implications from the in-class participation appendix. These implications and others such as significant student gains and losses in GPA will be evaluated.

Hypothesis I, the notion that specific training procedures (ABC's) can improve the cognitive abilities of minority high school students, is substantiated by Tables 2 and 5. The results presented in Table 2 support the hypothesis due to the following inspections of the data.
a - The mean gain in GPA for the ABC group was +.4 as opposed to -.08 for the Control group.

b - There were 9 students in the ABC group that showed a gain in GPA, as opposed to 2 students in the Control group.

c - There were 4 students in the Control group that showed a loss in GPA totaling -3.5 points, as opposed to 2 students in the ABC group showing a loss in GPA totaling -1.6 points.

Hypothesis II, the notion that prior math exposure before the ABC procedure would be beneficial to higher performance within the ABC group, will be examined here. The results presented in Tables 7 and 8 will be interpreted with reference to Hypothesis II. An inspection of the tables result in the following observations.

a - Across Algebra I and Geometry, the ABC grade (GPA) had improved for 11 students and remained the same for 2 students, for a combined total of 13 students out of 17.

b - Within the Algebra I group, the three students that had been exposed to Algebra I prior to ABC Algebra I reflected an average gain of 1.8 in their GPA's.

c - Within the Geometry group, there were none who had prior exposure to Geometry, but all had been exposed to Algebra I or II. The students reflected a net gain of 1.3 in GPA, and an average gain of .2 per student. Further research needs to be developed here as the results are inconclusive.
Finally, there was not a control group without prior math exposure. Therefore, Hypothesis II could not be confirmed within the context of this research effort.

Hypothesis III, the notion that the amount of time spent at tutorials might lead an individual to higher performance within the ABC group, could not be examined because these records were unavailable. Further research is necessary to draw any conclusions regarding this hypothesis.

Hypothesis IV, the notion that the amount of in-class activity such as asking questions and participating substantially in workbook activities would lead to higher performance within the ABC group, will be addressed here.

Within the ABC group, increases in GPA will be examined with reference to the results of teacher and counselor evaluations outlined in the in-class participation appendix. The results of Table 2 show that Doris increased her GPA by 2.0 points, from prior to post math GPA. The evaluations by the teacher and counselor indicated that Doris had a good attitude and was a responsible student who possessed a moderate to high level of motivation. Clearly, the result of a fine effort by Doris is an excellent improvement in mathematical performance.

Robin increased her GPA by .5 points and the evaluations indicated that she had a real interest in understanding the material and participated in class activities. She asked questions when necessary and volunteered to solve problems in class. Her motivation and attitude were viewed as being good to excellent.
One of the most significant gains occurred for James as he increased his GPA by 2.0 points. As indicated in the evaluations, he possessed a natural curiosity for the subject matter, and his counselor rated his motivation and attitude as excellent. James realized a fine increase in his cognitive abilities in mathematics, as a result of a good attitude and work habits.

Cindy reflected a full point and a half gain in GPA and was an excellent student in class. She received the award for the highest academic achievement in Algebra I. Receipt of the award was based upon obtaining the highest point total among the members of the class, and also maintaining a high level of motivation, attitude, class participation and peer interaction.

Brian made a half point gain in GPA. His evaluation indicated that his motivation and attitude were good to very good, and that he was trying to do the best that he could. Brian also asked questions when he did not fully understand the material, and volunteered to solve problems presented in class.

Andrea improved her GPA by a half point. However, she failed the ABC Algebra course during the summer program. During the summer, it became evident that she had made up her mind not to work. She used her excused absentees due to sickness as a "crutch" to fall back on, and failed to even attempt to make up work that she had missed.
She missed an average of two days of classes per week due to sickness, some of which was imagined rather than real. Although Andrea did not achieve during the summer program, she apparently realized some effect from the ABC design.

Ray showed a gain of half a grade point in his average. The teacher evaluation indicated that he was attentive in class and volunteered information during class. His class participation was good to excellent in terms of the activities and problems presented in class. His peer interaction was good, and with more consistent quiz scores he was seen as being capable of higher performance.

Keith gained .3 in his GPA, moving up from a prior GPA of 1.7 to 2.0. The evaluations show that Keith lacked motivation and possessed a poor attitude towards learning. He had a short attention span and usually disrupted the class in some manner. Keith also had trouble adjusting socially, and had to be reassigned to another counselor after a conflict occurred between Keith and his original counselor. He did not make any real effort in the classes he was assigned to during the summer program.

The results from Table 2 indicate a significant full point increase in GPA for Laura. However, Laura failed the Geometry course under ABC (See Table 7). The teacher evaluation during the summer program indicated that she was inattentive and did not put forth any effort to pass the course. The counselor evaluation indicated that her
motivation, attitude, class participation, and peer interaction were poor. Laura also needed to be constantly prodded. Her attitude was the same as Andrea's, making her mind up not to make any effort during the summer program. However, Laura might have gained from ABC even though she did not reflect any of the knowledge on the quizzes and the tests.

Finally, some generalization may be made for the students that showed a gain in math GPA. The nine students that gained were all moderately to highly motivated and their attitudes were positive. Also, their class participation and peer interactions were above average and they were interested in the material. Other factors that might have led to gains were positive self-esteem and self-confidence. There is substantial support for Hypothesis IV.

Hypothesis V, that females would do better than males in Geometry, will be evaluated based on the results presented in Table 8. As it turned out, there remained only 6 students from the Geometry class that were suitable for the full research design. Of these six, four were females and two were males. Two of the females showed no increase from prior math GPA to ABC grade. The third female lost 2.0 in GPA, while the fourth gained 3.0 in GPA. Of the males, one gained 2.0 in GPA, while the other declined by 1.7 points. Further research needs to be completed
in order to gain either confirmation or denial of Hypothesis V.

In conclusion, a couple of comments are in order. First, it is this teacher's opinion that the ABC design is a good design, but that there is always room for improvement in any teacher's method, style and curriculum. The factor that is missing from this study is an evaluation of the teacher's attitude and motivation, which in turn affects the student. Secondly, no matter what teaching instruments are used, student learning depends substantially upon student attitude, motivation and interest. Without these important factors, gains in cognitive abilities will be difficult to realize.
REFERENCES


Lincoln, E.A. An effective method for teaching the inner city child. Urban Education, 1974; 9, No. 1, 82-86.
APPENDIX

In-Class Participation

In-class participation was a subjective observation by myself, the teacher. All teachers, to various degrees, are able to form impressions and make observations of his or her students. As the teacher of the Algebra I and Geometry classes, I will present my candid observations of the students in each class. Hopefully, these observations will reveal a "profile" of each ABC student along two dimensions. These dimensions are observable non-verbal behaviors such as quizzes and tests, and verbal behaviors such as responding in class.

Indeed, these observations are merely the "tip of the iceberg" with reference to Freudian theory. They do not take into consideration the multitude of other factors such as personality, motivation, capacity for learning, peer pressures in class, home environment, or spending part of the summer in class. With an acute awareness of these undefined and often uncontrollable factors regarding student performance, I will present the following case studies within the two classes. In addition, counselors' evaluations will be included, and all of the evaluations are taken directly from the mandatory evaluations compiled during the summer program.
Kevin A.

(Evaluation after 4 weeks of classes)

Teacher: "His motivation and attitude are fair to good. Appears to be (and is) very quiet, well-mannered. Looks to be really trying to understand the presented material. Somewhat unsure of self as far as algebraic concepts are concerned.

His class participation is fair to good. Reflects upon thoughts before responding. If unsure, will not respond. Participation is improving.

His peer interaction is such that he appears to have the respect of peers and gets over pretty well. Gets along with others in the class very well.

His overall performance (tests) is good, with room for improvement. First quiz score was 10.5/20, while second quiz was 10/20. This is 'C' work. (19/20 and 17/20 on last two quizzes, excellent improvement)."

(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude are good to excellent. He is very quiet, but this is his personality. Well-mannered and mature."
His **class participation** is good. Usually reserves comments until he does not clearly understand the material presented.

His **peer interaction** is good. Appears to have the respect of his peers and also appears to get along well with them.

His **overall performance** (tests) was 140/220. Final grade B/C.

Kevin was a very consistent student in his academic performance. He gave his best effort."

**Counselor:**

"His motivation and attitude are good as he usually completes all of his work in class. His class participation is good and is usually a result of being called upon in class.

His peer interaction is good."

**Doris**

(Evaluation after 4 weeks of the program)

**Teacher:**

"Her **motivation** and **attitude** are good. Very quiet initially and a bit unsure of her "niche" in the program and what was expected of her. Still quiet, but now Doris is out of the quicksand and on **solid ground**."
Her class participation is good, when called upon. Will not volunteer much info, but I get it from her, which is alright too. Participation has really improved since gaining some self-confidence.

Her peer interaction is such that she appears to get along well or o.k., with others in the class. What can I say?

Her overall performance (tests) has gone from 8.5/20 to 20/20!! A fantastic improvement, from 'C' work to 'A' type work in one week's time. (17/20 on quiz #3)

I have little doubt that Doris will continue her performance over the summer. No behavioral problems in class."

(Evaluation after 6 weeks of classes)

Teacher: "Her motivation and attitude are good to excellent. Quiet in class, but this is her nature.

Her class participation is good to excellent. Appears to get along well with her peers.

Her overall performance (tests) was excellent!! 178½/220. Final grade is 'A'.

After initial quiz, her performance went up to 'A' work and remained at that level for the remainder of the program."
Counselor: "Doris has demonstrated moderate to high motivation in all work. She is responsible, and has a good attitude.

Her class participation is such that she always responds when called upon, but does not volunteer information readily.

Her peer interaction is limited, but appears to be healthy."

Robin

(Evaluation after 4 weeks of the program)

Teacher: "Her motivation and attitude are good to excellent. Always alert and will usually ask a question if something is not clear or puzzling to her. Seems to have a real interest in understanding the material.

Her class participation is good to excellent. Volunteers information, and will respond when called upon to do so. Feels comfortable speaking up in class, which is great!!

Her peer interaction is such that she seems to get along well with others in the class, although there is not a whole lot of room for interaction sometimes.

Her overall performance (tests) improved from 10/20 to 19/20!! An excellent increase
in performance level. Really made a successful effort to improve 'C' work to 'A'.

I sincerely hope that her performance continues through the rest of the program."

(Evaluation after 6 weeks of the program)

Teacher: "Her motivation and attitude was such that her motivation was good, but she had to overcome a negative attitude in terms of her own self-confidence and self-esteem. She is still working on overcoming this attitude.

Her class participation is fair, due to lack of confidence in her ability.

Her peer interaction is fair to good. Difficult to assess in this case. Appears to get along o.k. with peers.

Her overall performance (tests) is excellent, in spite of low self-esteem. 181/220. Final grade is an 'A'.

She needs to really work at developing more self-confidence. She is very capable of high academic performance, as indicated by final grade!!"

Counselor: "Robin has demonstrated moderate motivation regarding in-class activities and high motivation regarding tutorials. Robin is usually attentive and cooperative in class and seems to have a good attitude."
Her class participation is usually a result of her being called on, she infrequently volunteers information or comments.

Her peer interaction is limited, and 'testy' with males in the class, limited but 'healthy' with the females.

James

(Evaluation after 4 weeks of the program)

Teacher: "His motivation and attitude are good to excellent. Always alert and volunteers information. Seems to have a natural curiosity for the subject matter.

His class participation is good to excellent. Will volunteer and also (usually) has the correct solution to the problem.

His peer interaction is such that he appears to get along fine with peers. Has their respect.

His overall performance (tests) went from 13/20 to 20/20. An excellent improvement in performance level. Is doing 'A' work. Third quiz 20/20. Great!!

His performance should continue through the rest of the program."
(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude are good. He is very quiet in class, but is thinking and focusing on the material. His class participation is good to excellent. Will volunteer to do the more difficult problems in class.

His peer interaction is good. Appears to have the respect of peers, and also appears to get along with them quite well.

Overall performance (tests) is outstanding!! 203/220. Final grade is 'A'. Just an outstanding student."

(Evaluation after 3 weeks of the program)

Counselor: "His motivation and attitude are very good. He is hard working.

His class participation is o.k. He is not too talkative and is well-behaved.

His peer interaction is limited as he is quiet and not terribly social."

(Evaluation after 6 weeks of the program)

Counselor: "His motivation and attitude are excellent.

His class participation is excellent.

His peer interaction is very good. He is becoming more outgoing and is interacting more with the other students."
Cindy

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are excellent. She always comes well prepared to class, and takes part in the activities. One of the best students.

Her class participation is excellent. She always participates and knows what's going on in class.

Her peer interaction is good to excellent. She gets along well with the other students.

Her overall performance (tests) went from 10/20 to 20/20 to 20/20, on the quizzes so far. She has reached an excellent performance level and is doing 'A' work.

She should get an 'A' in Algebra I."

(Evaluation after 6 weeks of the program)

Teacher: "Her motivation and attitude are excellent. She is highly motivated to do well in the class. She possesses a high level of self-confidence and also has a fine attitude. She is not afraid to work at her academics.

Her class participation is excellent. She volunteers answers to problems on numerous occasions, and is usually quite accurate with her answers.
Her **peer interaction** is good, as she appears to get along well with her peers.

204/220. Just fantastic!! Final grade is an 'A'.

Cindy was an outstanding student at all levels, and was a pleasure to have in class."

**Counselor:** "She has moderate to high motivation in all areas. Her attitude is one of cooperation and responsibility. Her class participation is very good as she always responds when called upon and participates in class activities. Her peer interaction was good."

**Brian**

**(Evaluation after 3 weeks of the program)**

**Teacher:** "His **motivation** and **attitude** are good to very good. He appears to be trying to do the best that he can, and always shows an interest.

His **class participation** is very good to excellent. He asks questions if understanding is not taking place.

His **peer interaction** is good. He appears to get along well with his peers.

**Overall performance** (tests) was hampered
when he missed the first quiz, and a chance to make it up. However, his score on the second quiz was 10/20 and on the third scored 20/20. An excellent improvement to 'A' level work.

Brian can do 'A' work if he can put forth a good effort."

(Evaluation after 6 weeks of the program)

Teacher: "His **motivation** and **attitude** are good to excellent. Brian really puts forth an effort in class, and asks questions when something is unclear to him.

His **class participation** is such that he volunteers to do problems in class, even though he is a bit unsure of his solutions. But, the point is, he is not afraid or inhibited from trying. He makes a good effort.

His **peer interaction** is good to excellent. He seems to get along fine with his peers and has their respect.

His **overall performance** (test) is 151/220. Final grade is a 'B'.

Brian has the potential, as indicated on some quizzes, to achieve a higher level of performance."

Counselor: "He has low motivation in all areas. His attitude is one of uncooperativeness.
His class participation is low as he often does not respond when called upon and is inattentive.

His peer interaction is limited.

Andrea

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are fair. She seemed to be trying in the beginning of the program, but has been out sick a lot, which has affected her motivation and attitude. Her class participation is fair. She sometimes asks questions if something is not clear to her, and understanding is not taking place.

Her peer interaction is such that she appears to get along well with the peers in class.

Her overall performance (tests) is such that she missed the first quiz and a chance to make it up. She scored a 12/20 on the second quiz. She missed the third quiz, and needs to catch up on her work. Frequent sickness is hindering her academic performance."

(Evaluation after 6 weeks of the program)

Teacher: "Her motivation and attitude are poor."
She had a number of excused absences, because of sickness. However, she "stretched" her sicknesses and did not attempt to make up any of the work that she missed.

Her class participation was limited and attendance very poor, as she missed an average of two days per week over the last five weeks.

Her peer interaction was good. She appeared to get along fine with her peers.

Her overall performance (test) was 49/220, and her final grade was an 'F'.

Andrea missed four quizzes and the 50 point exam. She also missed the entire last week of the program."

(Evaluation after 3 weeks of the program)

Counselor: "Andrea has a lot of motivation, but it is in the wrong direction as she spends time asking the instructor when the class is going to be over. Andrea has a short attention span, but appears to have a fair attitude towards the course.

Her class participation is good, as she shows some interest.

Her peer interaction is minimal."

(Evaluation after 6 weeks of the program)

Counselor: "Her motivation and attitude really fluc-
tuate, as sometimes she has a 'chip' on her shoulder and some days she does not. She is lacking motivation to do assignments and study.

She sometimes participates in class, but it could be improved. Andrea seems to have personal problems, and just is not working up to her potential. Her energies are being spent on other things."

Ray

(Evaluation after 3 weeks of the program)

Teacher: "His motivation and attitude are good to excellent. He is quiet and attentive and will volunteer information during class.

His class participation is good to excellent and he responds well to problems that are presented in class. Usually has the right answer and volunteers frequently.

His peer interaction is good. He appears to get along well with the other students.

His overall performance (test) is 10/20, 10/20 and 20/20 on the quizzes to date. He has shown a fine improvement after a slow start. I look for his performance level to become more consistent through the remainder of the program."
(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude were good to excellent. He was attentive in class and asked questions when necessary. He put forth a good overall effort during the program.

His class participation was good to excellent and he continued to volunteer to solve problems in class and always had a good response when called upon.

His peer interaction was good as he seemed to get along well with his peers in class.

His overall performance (test) was 136/220, and his final grade was a 'C'. Ray has the potential as indicated by high quiz scores at times. With more consistency, he is quite capable of higher performance."

(Evaluation after 3 weeks of the program)

Counselor: "His motivation is low, but it seems that he has a good attitude and can be directed and supported as far as assignments are concerned. He participates quite a lot in class, and gets along well with his peers."

(Evaluation after 6 weeks of the program)

Counselor: "His motivation and attitude improved to very good. He knows more than he let on
during the first several weeks. He gets along fine with his peers."

Wayne

(Evaluation after 3 weeks of the program)

Teacher: "His motivation and attitude are fair. He has trouble focusing upon the classroom material. He is also easily distracted by others in the class. His energies really need to be channeled.

His class participation is such that I have to call upon him often just to get his attention focused. He seems to try hard when called upon, but does not volunteer information.

His peer interaction is at a high level when dealing with extracurricular activities such as fooling around in class or arguing with a peer.

His overall performance (test) is 10/20, 11/20, and 14/20 on the quizzes. He is doing 'C' level work in the course so far.

Wayne needs to put forth an extra effort to sustain his performance level as he faces more difficult work."
(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude were only fair at best. He was continually called upon to try and get his attention focused, and also to get responses pertaining to the material. Responses were usually poor to fair, because he was usually not paying attention.

His peer interaction was fair as he displayed a quick temper that needed to be controlled in order to get along with peers better.

His overall performance (test) was 69/220 and a final grade of 'F'.

Wayne missed quiz number six, and the 50 point exam. He took a make-up exam and was caught cheating and received a '0'."

(Evaluation after 3 weeks of the program)

Counselor: "His motivation and attitude could be a lot better. Wayne seems to have his mind on other things like basketball, sports, and play. He is not a self-starter and needs a lot of attention.

His class participation is fair.

Wayne seems to enjoy interacting with other students when there is a chance to focus on something other than academics. He needs someone to stay on his case for assignments and readings."
(Evaluation after 6 weeks of the program)

Counselor: "Wayne lacks motivation and his attitude was such that he wanted a lot of attention. He very often 'took trips' daydreaming and was definitely preoccupied with other concerns.

As far as class participation was concerned, Wayne had a very short attention span and most of his participation had nothing to do with the subject matter."

Tony

(Evaluation after 3 weeks of the program)

Teacher: "His motivation and attitude are good to very good. He is usually attentive in class and has an interest in the material.

His class participation is very good to excellent and he usually volunteers in class and can follow examples through to their completion.

His peer interaction is good, and he gets along fine with his peers.

His overall performance (test) is 9/20, 18/20, and 20/20 on the quizzes."

(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude were very good. He always volunteered information in
class and focused well on the material. He was highly motivated to do the work and had a good attitude throughout the program.

His class participation was very good, as was his peer interaction.

His overall performance (test) was 140/220 and a final grade of 'B/C' was earned."

Counselor: "He has moderate to high motivation and his attitude was one of cooperation and responsibility. His class participation was fine as he responded well when called on and frequently volunteered information and comments.

His peer interaction was good."

Ruth

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are excellent. She is very attentive and is trying hard to comprehend the material.

Her class participation is good. When she is called upon, her responses reflect careful thought and deliberation.

Her peer interaction is good. She appears to get along well with her peers.

Her overall performance (tests) is 7/20, 13/20, and 20/20. She is doing B level work.
Ruth's effort is what is paying off for her, as indicated by the quiz scores."

(Evaluation after 6 weeks of the program)

Teacher: "Her motivation and attitude are excellent, as she is quite attentive and seeks out extra help during the tutorial hours. She is quiet in class but is trying for understanding and comprehension.

Her class participation is good. I usually have to call upon Ruth for responses, but in most instances the responses are quite accurate.

Her peer interaction is good, as she gets along well with her peers.

Her overall performance (tests) was 170/220. Her final grade was an 'A'.

Ruth has worked hard during the program, and it payed off well for her. She was an outstanding student."

Counselor: "Her motivation and attitude are very good, overall. She does need extra help in completing her assignments out of class.

Her class participation is limited as she seems very insecure about volunteering information and asking questions. She works better in the group activities, and her peer interaction is good."
Frankie

(Evaluation after 3 weeks of the program)

Teacher: "His motivation and attitude are very good to excellent. He has a solid interest in understanding the material, and tries hard to complete class assignments.

His class participation is very good to excellent, as he always responds when called upon and often volunteers information.

His peer interaction is very good to excellent, as he has the respect of his peers, and gets along well with them.

His overall performance (test) is 17/20, 19/20, and 15/20. His performance is very consistent and close to 'A' level work in Geometry. If Frankie can maintain his present level of performance he should earn an 'A' grade."

(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude are excellent. He has a sincere interest in the subject matter, and always put forth a fine effort even for the most difficult problems.

His class participation is excellent and he volunteers answers to the problems presented in class and is accurate in his responses."
His peer interaction is good as he gets along fine with classmates.

His overall performance (test) is 177/220, and his final grade is an 'A'.

Frankie is an outstanding student and a real pleasure to have in class, and is a real 'plus' for the rest of the class."

Counselor: "His motivation and attitude are excellent.

His class participation is very good.

His peer interaction is such that he does not like to work in groups and would rather do assignments or problems on his own."

Connie

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are good to very good at times. Sometimes I feel that she could try harder and that motivation is not there.

Her class participation is good. She has to be called upon usually, but will respond and participate.

Her peer interaction is good as she gets along fine with classmates."
Her overall performance (test) is 19/20, 15/20, and 10/20. She has about a 'B' average, but needs to work on consistency.

Connie needs to make an extra effort to continue a good start."

(Evaluation after 6 weeks of the program)

Teacher:  "Her motivation and attitude were good. She was kind of quiet in class, and sometimes reluctant to ask questions. I usually read her face and if she looked puzzled I would ask her if she understood the material. She appeared to be much more 'open' near the end of the program.

Her class participation was fair to good. Sometimes she would volunteer to answer a question, and other times she would be very quiet in class. Some of this was due to shyness and lack of self-confidence.

Her peer interaction was good, as she got along fine with classmates.

Her overall performance (test) was 132/220, and her final grade was a 'C'.

Connie could have done much better than she did, and needs to gain more self-esteem."

(Evaluation after 3 weeks of the program)

Counselor:  "Connie has little motivation and she needs
encouragement. Her motivation and attitude are affected by the fact that she is introverted, but she is taking part in class more than during the first week.

Her class participation is limited to only when she is called on. She seems fearful of volunteering information.

She does not interact with her peers to any great extent."

(Evaluation after 6 weeks of the program)

Counselor: "Connie has fallen into an 'I don't care attitude'. No class participation or peer interaction. She also missed most of the fourth week of classes because of being in the Infirmary."

Keith

(Evaluation after 3 weeks of the program)

Teacher: "His motivation and attitude are fair to good at times. Keith is easily distracted and often interested in other things during class time.

His class participation is very poor. I call upon him constantly just to get his attention. He has a very short attention span as far as the material is concerned."
His peer interaction is at a high level, but unfortunately it is not directed towards the curriculum, as it usually involves talking in class with his peers about unrelated matters. His problem is too much peer interaction and attention towards the females in the class. His overall performance (test) is 10/20, 10/20, and 8/20 on the quizzes. He is barely doing 'D' level work, and needs to devote more time to his studies. I know that Keith can do the work, and do it well, but he just does not want to put his energy into the course, as it is not as important as other things are to him."

(Evaluation after 6 weeks of the program)

Teacher: "His motivation and attitude are poor to fair at best. He is not interested in passing the course as evidenced by his low quiz scores, and the lack of any real effort in class. His class participation was poor and I had to continually call on him to get his attention. His short attention span did not improve at all, and he continued to focus most of his attention towards the females in the class. His overall performance (test) was 89/220, and his final grade was a 'F'. Keith failed
to put forth the energy required to earn at least a passing grade. He scored a zero on quiz four, and had low scores on all the rest. He gave up on the 50 point exam, and never bothered to answer some of the questions."

(Evaluation after 3 weeks of the program)

Counselor: "Keith lacks motivation, and his attitude is one of 'you can't tell me anything'. Keith has no participation in class other than wise-cracks and unintelligible mumblings. His peer interaction consists of talking to students next to him while the lecture is going on or while other students are making points. This interrupts the class."

(Evaluation after 6 weeks of the program) - At this time a new counselor had been assigned to Keith as there was a conflict between Keith and his original counselor that almost resulted in a fist fight.

Counselor: "His attitude is negative, he does not care, and has no motivation.

His class participation is at a nonsensical level.

His peer interaction is at the distraction level as he is constantly talking to the people next to him."
Laura

(Evaluation after 3 weeks of the program)

Teacher:   "Her motivation and attitude are fair. She sometimes appears to be far away in her thoughts. She also has a short attention span.

Her class participation is very limited, in a word, fair. I need to call upon her constantly in order to get her to respond.

Her peer interaction is good, and she appears to get along well with her peers.

Her overall performance (test) is such that after missing the first quiz because she joined the class late, she scored 2/20, and 12/20 on the second and third quizzes. She is doing 'D' work so far, and there is plenty of room for improvement. Laura has to continue to catch up on her work. She appears to be capable, but time is a limiting factor."

(Evaluation after 6 weeks of the program)

Teacher:   "Her motivation and attitude are fair to good. Her attitude improved during the last two weeks of the program. Beforehand, she was not trying very hard to complete the work.

Her class participation was fair to good. She usually did not volunteer much during class and had to be called on for responses. Her
responses were fairly accurate.

Her peer interaction was good, as she appeared to get along well with her peers in the class.

Her overall performance (test) was 92/220, and her final grade was a 'F'.

Laura did not put forth enough effort within the course. She missed two quizzes and scored low on the ones that she took, and this really hurt her overall performance."

Counselor: "Her motivation and attitude are poor as she acts very tired in class and needs constant prodding. She needs to be encouraged to finish her in-class work.

Her class participation is poor and her peer interaction is also quite poor."

Wilma

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are good to excellent as she seems to have an interest in the subject matter.

Her class participation is excellent as she usually volunteers information and is quite specific and accurate in her answers and comments."
Her peer interaction is excellent and she gets along fine with her peers.

Her overall performance (test) is 17/20, 10/20, and 18/20 on the quizzes. She is doing 'A' work in Geometry so far, and has very consistent grades on the quizzes."

(Evaluation after 6 weeks of the program)

Teacher: "Her motivation and attitude were excellent. She always came to class prepared and volunteered information in class quite often. She really put forth an outstanding effort.

Her class participation and peer interaction were both excellent.

Her overall performance (test) was 184/220, and her final grade was an 'A'.

Wilma was an outstanding student and was a real pleasure to have in class."

(Evaluation after 3 weeks of the program)

Counselor: "Wilma is highly motivated and has a positive attitude towards her academic work and her life.

Her class participation was good, and the class benefits from her knowledge.

Her peer interaction is such that Wilma is not afraid to disagree with other students or the instructor if statements are made that seem
to be incorrect to her, or if she feels that additional information is needed to enhance the subject material.

Wilma is not keeping up with the assignments but is going to make a change."

(Evaluation after 6 weeks of the program)

Counselor: "Wilma's attitude and motivation slipped and I've had to get behind her and push her.

Her class participation was good when she was called upon.

Her peer interaction was quite noticeable when one of her peers said something that did not sound correct."

Beth

(Evaluation after 3 weeks of the program)

Teacher: "Her motivation and attitude are fair to good. She sometimes does not try too hard to understand the material and has a short attention span at times.

Her class participation is fair and she needs to be called on frequently in order to get her attention focused on the material.

Her peer interaction is high, but in the wrong direction as she is often interested in talking about or directing her attention to
other topics rather than Geometry.

Her **overall performance** (test) is 10/20, 20/20, and 16/20 on the quizzes. She is doing 'B' level work and is capable of handling the material if she puts her mind to the task."

(Evaluation after 6 weeks of the program)

Teacher: "Her **motivation** and **attitude** were fair to good. Only fair when she allowed herself to be distracted by others in the class, and good when she focused on the material.

Her **class participation** was fair to good. She had a short attention span and needed to pay closer attention to the material presented in class."

Counselor: "Beth had moderate motivation and attitude. Her class participation was also moderate as she responded when called upon but seldom volunteered information and had limited participation in class activities.

Her peer interaction was limited to essentially one other person in class."