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ABSTRACT

This study reports evaluation data from a statewide inservice project to retrain mathematics teachers to implement a new algebra curriculum required by all students for high school graduation. The new course places more emphasis on problem solving, use of graphing calculators, and real-life applications. Pretest and posttest data were collected from (n=477) teachers attending seven-day inservice programs at 16 sites across North Carolina. Results indicated a positive shift in teachers': (1) knowledge of the new curriculum; (2) support for algebra as a course for all students; (3) opinions toward using more relevant topics in algebra; and (4) opinions that students would be able to succeed with new topics. In addition, teachers felt more prepared to teach the new ideas and use new methods. Implications for developing similar projects to implement curriculum reform are discussed. (Author/MKR)

Algebra For Everyone: A Statewide Project for Implementing the NCTM Standards in Algebra I

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Abstract

This study describes evaluation data from a statewide inservice project to retrain mathematics teachers to implement a new algebra curriculum required by all students for high school graduation. The new course places more emphasis on problem solving, use of graphing calculators, and real-life applications. Pretest and posttest data were collected from 477 teachers attending a seven day inservice programs at 16 sites across North Carolina. Results indicate a positive shift in teachers': (a) knowledge of the new curriculum; (b) support for algebra as a course for all students; (c) opinions toward using more relevant curriculum topics in algebra; and (d) opinions that students would be able to pass new topics. In addition, teachers felt more prepared to teach the new ideas and use new methods. Implications are discussed for developing similar projects to implement curriculum reform.

From past reform efforts, many proposals to redirect the teaching and learning of mathematics have come and gone with little effect on the classroom (Weiss, 1986). Studies have shown that most teachers teach what they understand, what they believe is important and what they can teach successfully (Thompson, 1985). To implement new curriculum topics and new teaching methods proposed by the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics, changes will be necessary in both teachers' beliefs and classroom practices. Teachers exercise great control over the decisions of whether or not to implement a curriculum change. Therefore, reform efforts need to recognize the classroom teacher as a necessary agent of change.

In 1991, North Carolina adopted a policy requiring three years of mathematics for high school graduation, with successful completion of Algebra I as part of this requirement. (The course may be taken over a two year period). In response, state mathematics supervisors redefined the state algebra curriculum to be aligned with the NCTM Standards and to better meet the needs of all students. This new course places less emphasis on skills with more emphasis on problem solving, data analysis and real-life applications. Students across the state would be tested on the new curriculum. Thus, teachers faced a tremendous challenge, not only to teach a new curriculum, but to teach the curriculum to all students.

Mandating change may seem like an attractive, easy method to enforce curriculum reform. However, a mandated change can easily fail if teachers do not have the skills, motivation, and commitment to implement successfully the new proposal. Also, mandated change may reduce teachers a sense of control or autonomy. Teacher-change literature emphasizes that the process of change must focus on providing new knowledge of the innovation, eliciting teacher support and gaining teacher commitment. In addition, change is a highly personal experience for each teacher. Within all attempts to facilitate change, teachers' feelings and concerns need to be addressed (Crawford, 1995, Friel & Gann, 1993). Teachers must be given a chance for ownership and reflection on how the new practices will affect their classroom (Fullan & Miles, 1992).

To facilitate the process of change, cooperative efforts of the Center for Mathematics and Science Education at the University of North Carolina at Chapel Hill and the North Carolina State Department of Public Instruction established the NC MATH Algebra Project. This project provided inservice training for algebra teachers across the state in the summers of 1992 and 1993. Three goals of the project were to be met: 1) provide teachers with knowledge of new curriculum changes and effective ways to teach all students, 2) elicit greater teacher support for the move to teach algebra to everyone, and 3) prepare teachers who felt equipped to teach the new curriculum ideas and use new teaching methods. To accomplish these goals, sixteen workshops were conducted during summer, 1992 and summer, 1993. This study describes evaluation data collected before and after the seven day sessions during summer 1992 and the extent that the inservice facilitated teachers to be able to make curriculum changes. Approximately 477 teachers attended these seven day awareness inservice programs.

Teachers Participating in the Inservice

In January, 1992, brochures and applications were sent to each school system in the state announcing the project. School systems supported the $150 materials fee per participant to provide a graphing calculator, curriculum manual, manipulatives, and other supplementary materials. Originally, the project was designed to include 325 participants. However, an overwhelming response came from teachers desiring to attend. Three additional sites were added. Of the 679 applications, 480 were accepted. In the state, approximately 2750 secondary teachers teach mathematics at least fifty percent of the day. Of these teachers, approximately fifty percent teach one or more classes of algebra (or a combination course such as Algebra IA or IB) (Crawford, 1991).

From the demographic data, 60% of the participants taught high school algebra during the previous year and 24% taught algebra is the middle grades. Only 16% of the teachers had not been teaching algebra. The average number of years of teacher experience for the sample was 13.6 years with a standard deviation of 6.7 years. Teachers reported previous inservice training in which they had participated to help prepare them to teach the new algebra curriculum. Thirty-two percent had no previous training and thirty four percent had participated in a calculator workshop. Approximately seven percent of the teachers had major training such as the Hawaii Algebra Workshop or Woodrow Wilson Workshop. Thus, the teachers can be described as mostly experienced, with a primary interest in algebra and a wide background with regard to new curriculum topics.

Description of the Seven Day Workshop

The workshop curriculum was designed to provide hands-on-experience with topics and teaching methods in the new algebra curriculum. Sessions integrated four strands: problem solving, use of manipulatives, data analysis, and applications. Graphing calculators were introduced on the first day then applied throughout the workshop. In addition, teachers discussed cooperative learning, methods to encourage discourse, meeting diverse needs among algebra students, and new assessment methods. Topics in data analysis included data collection and graphing, interpreting graphs and their slopes, and finding the line of best fit for the data. The new algebra curriculum also involves graphing calculators to introduce quadratic and exponential equations. Workshop participants investigated methods to teach quadratic applications involving maximum and minimum values and exponential applications such as compound interest, inflation, and depreciation (Crawford & Shotsberger, 1995).

To aid teachers with topics not currently in their textbooks, a curriculum manual was developed for use at each workshop site across the state (Crawford, 1992). This manual was initiated by the North Carolina Department of Public Instruction in spring, 1991 and piloted at two five day institutes with 200 teachers that summer. The NC MATH Algebra Project was designed to model the 1991 Institutes but to focus efforts toward teachers who may not have been as willing to change their algebra curriculum and methods of teaching. During fall, 1991, the NC MATH Algebra Project director met with mathematics educators and talked with many teachers who attended the 1991 institutes in order to develop the workshop curriculum for the 1992 project. The original set of materials were rewritten for the seven day sessions in a format that teachers would find easy be implement into their classrooms.

Workshops were taught by a team of two instructors, one a mathematics education specialist (college, university professor or mathematics specialist) and one secondary teacher who had used some of the new algebra curriculum materials in their classes. (At two sites, instructors included former secondary teachers now teaching at the college level). Three of the research team members were among the instructors. For some special topics, outside presenters were included. The instructors met to discuss the workshop curriculum in January, by teleconference in March, and again in May. Instructors commented that the workshops were well planned and well organized.

On the last day of the workshop, participants also completed an evaluation form rating their opinions on a four point scale of the instruction, organization, and usefulness of material. Table 1 depicts these results. There were 130 write-in comments, 94 were positive and 36 were negative. Teachers wrote: "This workshop truly exemplifies what staff development means. It was relevant, important, necessary, yet conducted in a way that was actually pleasant," "One of the most useful workshops that I have ever attended," "tremendously helpful!," "Thanks for planning and implementing a good workshop," "This is the best workshop that I have been in during the last 10 years," "Instructors were great, they were well prepared, knowledgeable and patient. I've enjoyed this experience

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Insert Table 1

Evaluation Instrument

A team of six mathematics educators designed a four-part pretest/posttest evaluation instrument to investigate the project goals. Results from part II, III, and IV will be reported in this paper. (Part I is a Likert belief scale and is not included in this paper due to the length involved in reporting development and analysis of results). Part II of the instrument included two paraliei scales with twelve curriculum topics to ascertain: a) teachers' opinions concerning the importance of these topics in Algebra I, and b) the percentage of all students that teachers believed could successfully pass each topic. Ten open ended questions were used in part III to determine teachers' readiness to teach the new curriculum. Part IV collected demographic data.

To design the two scales with twelve curriculum topics for Part II, an initial pool of items was generated by two of the mathematics educators based upon recommendations in the NCTM Standards (topics to be emphasized and de-emphasized), the new algebra curriculum for North Carolina, and the workshop curriculum. This pool was then reduced and modified by the entire research team, resulting in the final set of twelve curriculum items representing both the more "traditional" Algebra curriculum and the "new" curriculum being presented in the workshops. For the importance scale, teachers were given 100 points to allocate to the twelve topics based upon the perceived importance of the topic being included in Algebra I. With the percentage pass scale, teachers recorded the percentage of all student that they believed could pass each topic.

Ten open ended questions were developed for Part III from a pool of questions based upon the three project goals. Two questions pertained to the move to teach algebra to all students, four related to the new curriculum content, and two asked teachers if they felt "equipped" to teach the new topics or the low achieving students algebra.

In order to reduce the length of the instrument, two forms were administered, with half of the participants at each site completing form A and half completing form B. Items in Part II were on both forms while the ten open ended questions were split with five on each form. The workshop instructors gave the evaluation instrument to participants to complete on the first day of each workshop and again on the last day.

Analysis

A total of 464 teachers completed a pretest evaluation and 449 a posttest form. Teacher responses for the open ended questions were coded 0, 1, or 2 as to the strength of the response, then analyzed by computer. For the knowledge questions, 0 = no knowledge, 1 = limited answer, and 2 = correct response. For questions that asked teachers if they felt equipped to teach the new curriculum, responses were coded 0 = no, 1 = somewhat, and 2 = yes. Responses were coded for support as 0 = no, 1 = not sure, and 2 = yes. Percentages were calculated for each category. Teachers' responses were also categorized by reason or comment type to better identify why teachers responded in the manner they did.

With the importance scale and percentage pass scale, means and standard deviations were calculated for each curriculum item. Importance scores summed to 100 for each teacher, which the percentage pass score for each item could range from 0 to 100. Tests for significant differences were computed between pretest and posttest means utilizing paired t-tests.

Results

Teacher Support and Readiness to Teach a New Algebra Curriculum

Results show that at the conclusion of the workshop 67.5% of the teachers supported the move to teach algebra to all students (Table 2). When asked why, teachers felt that with the growing importance of technology, students needed to learn more mathematics, especially algebra. They expressed that it was important to develop reasoning skills through algebra and that algebra would give more students better career opportunities. Many teachers who supported the move to teach algebra to all students also expressed their concern that there would be some students who would not pass the course. For teachers still not supporting algebra for everyone, many felt there were students not capable of learning algebra. Some felt that algebra was not needed by all students.

Insert Table 2

When teachers were asked what percentage of all students they believed would pass Algebra in their school, there was a significant difference between the pretest and posttest means (p=.0001). The mean percentage before the workshop was 77.5 with a standard deviation of 14.2. Posttest mean increased to 81.9, standard deviation 11.2. When teachers were asked to explain their answer, they expressed that exceptional students would have difficulty passing algebra and that some students were unprepared or not motivated. Table 3 presents the results of the four knowledge questions. It should be noted that results from the data analysis question appear to be low because of the wording of the question. Some answers were coded as limited mainly due to the fact that the information was not specific to examples in the algebra curriculum. For example, a response of "real life applications" was coded as a limited response. The researchers felt that many teachers whose answers were coded "limited" actually knew the concepts taught in the workshop but did not give an extended answer. Teachers were asked how equipped they felt to teach the new algebra curriculum; Table 4 depicts these results. When asked about their greatest need, teachers responded: more calculators, more manipulatives, more materials on exponential functions, practice with calculators and manipulatives, instruction on when to use manipulatives, and time to plan and prepare materials.

Insert Table 3

Insert Table 4

Importance of Topics in Algebra and Teacher Expectations

Data were collected to investigate the importance teachers placed on old and new topics in Algebra. Table 5 reports mean and standard deviations for the importance of each curriculum topic. The differences in pretest and posttest means were tested with a two-tailed t-test using the value $p \Gamma .0004$ for significance at the .01 level. (For a conservative test, the importance scale and percentage pass scale were considered as one scale with p-level for each item, $.01/24 = .0004$.) Four items increased significantly in importance from pretest to posttest. The items were topics emphasized in the workshop: problem solving methods, data analysis, graphing linear and nonlinear functions, and exponential equations and functions. All other topics decreased in importance, and all but two topics, (solving systems of equations and inequalities, and applications with matrices) exhibited significant change. For ease of interpretation, the results are represented graphically in Figure 1.

Insert Table 5

Insert Figure 1

Using the same curriculum topics, teachers were asked what percent of all students they believed could successfully pass each topic. Table 6 reports the mean and standard deviations for each of the items. Seven of the items displayed a significant increase (p Γ .004). These included four of the topics emphasized in the workshops: problem solving methods, data analysis, graphing linear and nonlinear functions, and exponential equations and functions. Figure 2 shows the results graphically. The graph shows an increase across the board for all topics from pretest and posttest for the percent of students teachers felt could pass each topic.

Insert Table 6

Insert Figure 2

Since the topics used for the Importance and Pass Scales were the same, it was possible to combine the results shown, graphically in Figure 3. For the graph of Importance Points vs. Pass Points (pretest to posttest), the bold arrows represent those topics emphasized in the workshops. These arrow are clearly increasing for both importance and the percentage of students that teachers believed could pass the topic. The other topic arrows indicate a decrease in importance with an increase for the pass percentage.

Discussion

The results of this project have many implications for the design of other similar projects to implement curriculum reform. Components of the project will be discussed in relation to the above results and other research findings.

Results of the four knowledge questions indicate that a seven day awareness workshop can provide teachers with new knowledge concerning graphing calculators, data analysis, manipulatives, and exponential applications. The low percentages on correct responses before the workshop (15.8%, 6.6%, 39.4% and 21.1%, respectively) give a clear indication that teacher retraining is mandatory in order to meet recommendations of the NCTM Standards. In North Carolina, the number of teachers attending the 1992 workshops was only approximately 36% of the teachers at the secondary level who teach algebra classes. Multiple-year federal support for awareness workshops is desperately needed.

Data showed a positive shift in the percent of teachers who agreed that algebra should be taught to all students. However, this still appeared to be a difficult concept for many after the workshop (16% disagreed and 18% were not sure). There was also a small positive shift in the percentage of all students that teachers felt could pass algebra. These results agree with other research showing that for some teachers, their views can change within a seven day workshop, while for others, change will take longer or will not occur at all. It is encouraging that three out of every five teachers who attended the workshop subsequently felt that algebra should be taught to all students. Teachers hold strong beliefs about student expectations and ability grouping. In order to allow all students equal opportunities in mathematics these beliefs will need to change.

The changes in importance of the topics in Algebra and the percentage of students the teachers felt could pass each topic is another indication that teachers' views on Algebra and student abilities shifted as a result of their workshop experience. These teachers were mostly classroom teachers with years of experience with the traditional algebra curriculum. In order to implement a new curriculum, teachers need to formulate a clear definition of what is to be implemented (Guskey, 1986). Staff development focused on implementing changes from the Standards needs to assure that the inservice does indeed focus on the specific desired curriculum issues.

Although teachers felt more equipped to use manipulatives and graphing calculators after the workshop, only 41% felt equipped to teach exponential applications and only 30% felt equipped to teach low achieving students. There were many teachers who responded "somewhat" to these two questions. As teachers had not yet tried the new curriculum ideas in their classes, they were not sure what their needs would be. Many teachers expressed the need for graphing calculators, manipulatives, time to plan and more practice with new ideas. These results support the concept that change is an evolving process (Friel & Gann, 1993). Teachers may have a new knowledge base, yet they may not be at a stage where they can comfortably implement a new curriculum. Inservice beyond awareness is essential in order to provide continued support for positive change. A seven day workshop will not assure that implementation is ongoing. Funding must be available for follow-up efforts to monitor and continue positive changes.

A seven day inservice workshop has limitations; however, the cost of providing two to three weeks of training for 480 teachers would be prohibitive. Many teachers do not have the available time to attend which could result in an inservice project attracting only the "workshop-goers." In implementing curriculum reform to meet the NCTM Standards, short "awareness" projects serving greater numbers of teachers can have positive results and should be funded. As noted above, such projects should also provide follow-up and support to assure teacher commitment and implementation.

Key components of this project may be of value to other inservice projects focusing on implementing the Standards. The sixteen workshops followed a curriculum sequence that began with the more familiar topics. For example, topics covered during the first three days included problem solving, cooperative learning, and manipulatives, which could easily be carried out within a traditional curriculum. Topics such as data analysis and exponential applications which are new and unfamiliar curriculum topics were taught during the last four days. Research has shown that teachers will more often agree to implement a new idea which is closer to their existing beliefs (Crawford, 1991). Thus, teachers in the workshops experienced a gradual move from topics that were close to their traditional beliefs to the new potentially more threatening topics.

Effective inservice should place a strong emphasis on practical classroom applications as well as on the theoretical premise of a new innovation (Richardsons, 1990). Most instructor teams for this project consisted of a university or college mathematics education specialist teamed with a classroom teacher who had used the new curricula activities with their own students. This balance led to a blended approach, and teachers appeared to relate well to their workshop team leaders (overall instructional ratings was 3.7 out of 4 points).

Workshop instruction was designed to model the new teaching methods and classroom activities being proposed (Guskey, 1986). Rather than telling teachers the "how-to's", teachers personally experienced new problem solving techniques, cooperative learning, and data analysis activities. Methods were discussed that would allow teachers to easily adapt an activity to their own students. Each participant received a curriculum notebook with class activities that could be immediately implemented.

Noting that change can bring about anxiety, reluctance, and many concerns (Hall & Hord, 1987), at the end of each day teachers were given time to write their reflections of the day. The following morning, instructors addressed concerns and made adjustments to meet the needs of the participants. Research has shown that during the initial stages of implementing a new innovation, teachers hold self-concerns such as "how will this affect me?' (Friel & Gann, 1993). Much discussion throughout the seven days involved teacher concerns about the new curriculum and teaching algebra to all students.

Data from the workshops reveal that after the seven days most teachers felt prepared to use the graphing calculator in algebra. The calculator was introduced on the first day of the workshop, then used each day in sessions with problem solving, cooperative learning, data analysis and applications. The many uses of the calculator as a tool for instruction were demonstrated. By integrating the calculator into the entire seven days, teachers felt more comfortable with this new technology.

There are several limitations of this study that should be noted. Although the reported data show growth with regard to teacher knowledge of the new algebra curriculum, the use of only four questions is very limited. Knowledge depth is not measured nor knowledge of the scope of the new curriculum. Teachers' views have changed from the inservice training; however, teacher commitment to implementing the new curriculum is unknown. Although data is being collected in regard to implementation of workshop ideas, at present, the extent of the implementation is unknown.

Conclusion

A well planned seven day inservice experience can make a positive impact on teachers implementing new curriculum topics and teaching methods from the Standards. The experience should be sequenced to relate new content topics to current experiences of teachers, with a gradual move to more threatening content. Instruction should include modeling of new teaching methods with discussion time allotted for teachers to reflect upon their own plans for implementation. Inservice instruction should be driven by both the theory behind the new innovation and practical classroom applications. Finally, the inservice should consider the stages of concern of teachers as they share and discuss new ideas.

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Table 1

Participants Ratings of Instruction, Organization, and Curriculum
(4 point scale)

Item	Rating
Organization	3.9
Intent to Use the Information	3.8
Opportunity for Discussion	3.8
Instructor Quality	3.8
Instructor Responsiveness	3.7
Relevancy of labs	3.7
Appropriateness	3.5
Timeliness	3.2

Table 2

Teacher Support for the Move to Teach Algebra To All Students

Question	Test	N	No	Not Sure	Yes
Do you support the move to teach algebra to everyone? Why or why not?	Pre	243	40.4	18.8	40.8
	Post	233	16.3	18.0	65.7

Table 3

Teacher Knowledge of New Topics In Algebra I

Question	Test	N	Percent Incorrect	Limited	Correct
Explain how an algebra student can solve the equation .6x - 4=7 using graphing capabilities of the TI-81.	Pre Post	221 216	79.9 16.2	4.3 10.6	15.8 73.6
Give an example of a real-life application using exponential functions in Algebra I.	Pre Post	221 216	76.6 19.9	2.4 3.2	21.1 76.9
Explain how data anlaysis activities are incorporated into the new curriculum.	Pre Post	242 233	85.2 31.4	8.2 22.1	6.6 46.5
Give an example of how manipulatives can be used in Algebra I.	Pre Post	242 233	39.8 8.1	20.9 10.5	39.4 81.4

Table 4

Teacher Readiness to Teach the New Curriculum

Question	Test	N	Percent No	Somewhat	Yes
Do you feel that you have enough good activities for using graphing calculators in algebra?	Pre Post	242 231	86.1 12.3	4.1 15.8	9.8 71.9
Do you feel equipped with activities and proper materials to teach exponential equations in your algebra class?	Pre Post	242 232	87.7 38.4	2.5 22.7	9.8 39.0
Do you feel prepared to teach algebra concepts using manipulatives such as algebra tiles?	Pre Post	221 214	72.7 5.6	13.9 29.9	13.4 64.5
Do you feel equipped to meet the needs of the low achieving student in algebra?	Pre Post	221 213	77.1 23.5	4.8 43.2	18.1 33.3

Table 5

Importance of Curriculum Topics in Algebra
As Rated by Teachers (n=396)

Curriculum Topic	Pretest Mean (S D)	Posttest Mean (S D)	t-value
Real Number Operations, including order of operations, properties of real numbers, evaluating and simplifying expressions.	12.4 (6.5)	11.0 (5.2)	-4.297*
Solving word problems such as coin, mixture and digit problems.	6.5 (3.6)	5.2 (3.7)	-7.060*
Operations with rational expressions and simplifying rational expressions.	8.3 (3.5)	6.9 (3.1)	-7.574*
Operations with radical expressions and simplifying radical expressions.	6.9 (2.8)	6.2 (2.6)	-4.895*
Data collections and analysis, including real-world data, and making predictions.	9.6 (4.9)	12.2 (5.1)	9.306*
Problem solving methods and techniques, including guess and check, working backwards and other nonroutine methods.	10.9 (5.2)	12.8 (5.7)	6.105*
Graphing linear and non-linear functions, including absolute value and quadratic functions, and using applications of functions.	8.3 (3.1)	10.0 (3.8)	7.688*
Solving equations and inequalities in one variable.	11.0 (4.4)	9.8 (3.9)	-4.050*
Solving systems of linear equations and inequalities.	8.3 (3.2)	8.0 (3.0)	-0.435
Factoring polynomials.	8.6 (3.7)	7.5 (3.2)	-4.920*
Applications with matrices.	4.1 (3.0)	4.0 (3.0)	-0.394
Exponential equations and functions.	5.1 (3.1)	6.5 (3.0)	7.079*

*significant at the .01 level where $p \leq .0004$ (.01/24)

Table 6

Percentage of All Students The Teachers Believed Could Pass Each Topic (n=396)

Curriculum Topic	Pretest Mean (S D)	Posttest Mean (S D)	t-value
Real Number Operations, including order of operations, properties of real numbers, evaluating and simplifying expressions.	87.4 (13.4)	88.7 (12.3)	1.430
Solving word problems such as coin, mixture and digit problems.	56.1 (23.4)	57.4 (23.8)	1.478
Operations with rational expressions and simplifying rational expressions.	67.7 (20.0)	69.0 (20.0)	1.516
Operations with radical expressions and simplifying radical expressions.	65.0 (19.7)	66.7 (19.1)	2.216
Data collections and analysis, including real-world data, and making predictions.	70.2 (22.9)	78.2 (19.3)	8.642*
Problem solving methods and techniques, including guess and check, working backwards and other nonroutine methods.	66.8 (23.0)	78.2 (18.3)	10.986*
Graphing linear and non-linear functions, including absolute value and quadratic functions, and using applications of functions.	60.3 (22.2)	70.0 (20.7)	10.230*
Solving equations and inequalities in one variable.	82.4 (15.5)	84.0 (14.8)	2.600
Solving systems of linear equations and inequalities.	70.1 (19.1)	75.7 (17.2)	6.880*
Factoring polynomials.	70.4 (18.9)	74.7 (16.6)	5.569*
Applications with matrices.	54.2 (25.4)	58.2 (24.3)	3.931*
Exponential equations and functions.	54.2 (23.9)	62.0 (22.7)	7.881*

*significant at the .01 level where $p \leq .0004$ (.01/24)

Figure 1 Importance Mean By Objective - Pretest vs. Posttest

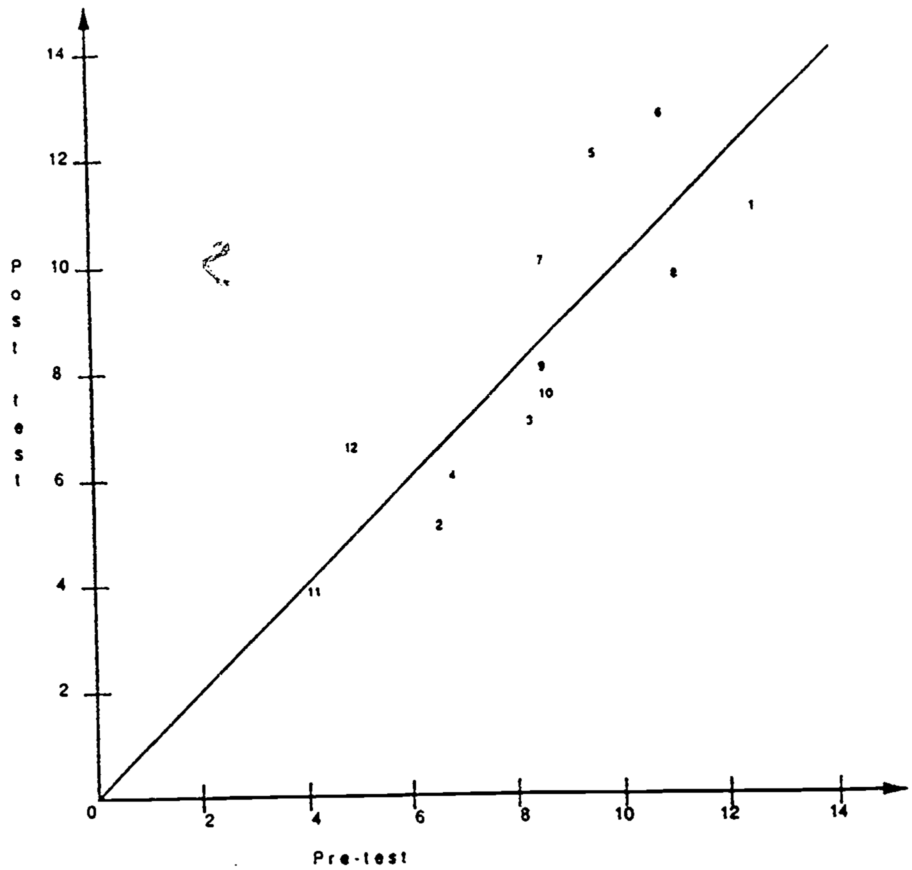

Figure 2 Percentage Pass Mean By Objective - Pretest vs. Posttest

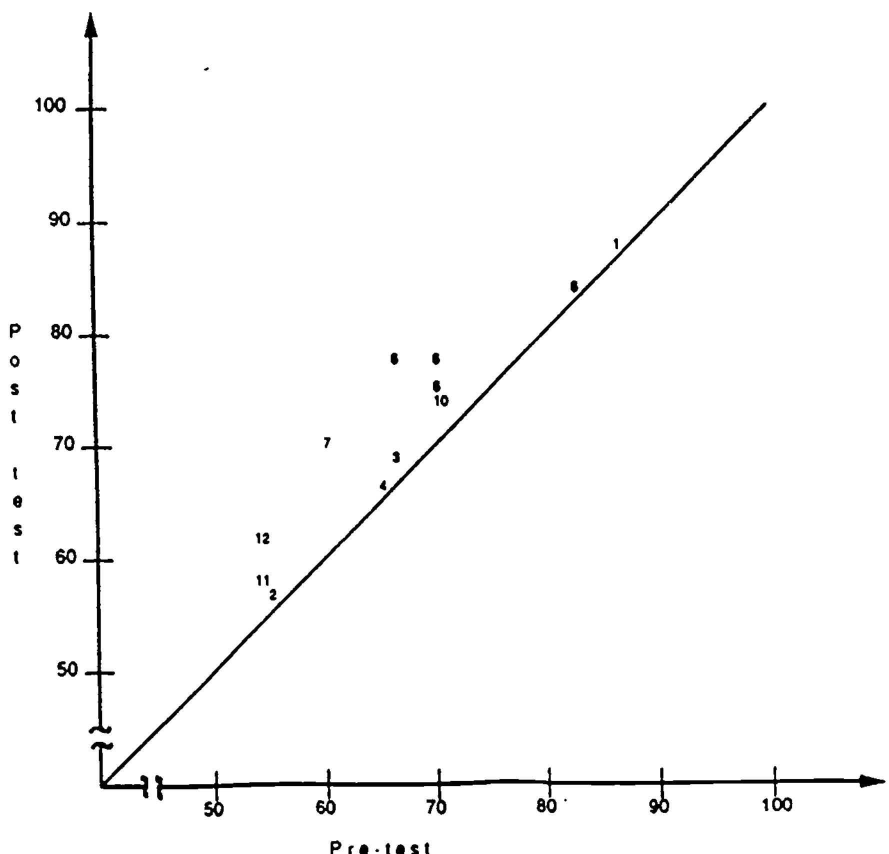

Figure 3 Importance Points vs. Percentage Pass Points
(Pretest to Posttest)