DOCUMENT RESUME

ED 312 254 SP 031 624

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TITLE Effective Inservice for Elementary School Teachers: A Summer Mathematics Institute.
PUB DATE Nov 88
NOTE 17p.; Paper presented at the Annual Conference of the National Council of States on Inservice Education (New Orleans, LA, November, 1988).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Elementary Education; *Elementary School Teachers; *Inservice Teacher Education; *Institutes (Training Programs); Instructional Improvement; Knowledge Level; *Mathematics Instruction; *Program Effectiveness
IDENTIFIERS Florida

ABSTRACT

This study evaluated the effectiveness of mathematics inservice training for elementary teachers delivered in the longer-term institute format. The goal of the institute was to improve teachers' ability to provide meaningful, effective mathematics instruction to elementary school children. Specifically the investigators sought answers to the following: (1) To what extent did teachers master the mathematical content presented in the 12-day institute; and (2) To what extent did teaching behaviors change as a result of improved mathematical knowledge? The 18 participants were elementary school teachers in a rural county in West Central Florida. The program was delivered in twelve 5-hour sessions at the conclusion of the school year, The evidence gathered from post-institute analysis indicated that the teachers significantly improved their understanding of mathematical content, and appeared to have integrated this newly acquired knowledge into their everyday teaching behaviors. (JD)

Effective Inservice for Elementary School Teachers: A Summer Mathematics Institute

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Paper Presented at

The National Council of States on Inservice Education

New Orleans, LA

November, 1988

There is considerable concern about the mathematical knowledge of elementary school teachers. This concern surfaced in the late 50s and continues today (NCTM, 1985). As a result, professional organizations have developed specific guidelines for the preparation of teachers of mathematics (MAA, 1983; NCTM, 1981). These recommendations have had a positive effect on changing many teacher preparation programs; however, there is a large number of inservice teachers who have been licensed with minimal coursework in mathematics. Thus, many elementary teachers feel their mathematical knowledge is inadequate, and they are anxious about their abilities in the teaching of mathematics.

Inservice programs must focus on providing elementary teachers the opportunity to enhance their mathematical knowledge, to understand the nature of mathematics and mathematical thought, and to become problem solvers (Oja, 1980; Sparks, 1983; NCTM, 1981; James & Kuntz, 1985; Spector & Phillips, 1988). However, due to a number of confounding variables, inservice aimed at improving teachers' understanding of mathematics is often times not effective. Recently, specific guidelines and models for the planning, development, and implementation of effective inservice have been proposed (ACSD, 1981; Woods et al., 1981; Woods et al., 1982, Phillips et al., 1987). These guidelines provided the framework for the development of the Summer Mathematics Institute (funded by the Florida State Department of Education) discussed herein.

The purpose of this study was to evaluate the effectiveness of mathematics inservice for elementary teachers delivered in the longer-term, institute format. The goal of the institute was to improve teachers' ability to provide meaningful, effective mathematics instruction to elementary school children. Specifically the investigators sought answers to the following:

1. To what extent did teachers master the mathematical content presented in the 12-day institute?
2. To what extent did teaching behaviors change as a result of improved mathematical knowledge?

METHODS

Development

The institute was developed using a modified version of the model proposed by Phillips, Greabell, Bullock and Bullock-Wanus (1987) shown in Figure 1. Collaboratively, the university instructors, the county mathematics supervisor, and selected teachers developed a set of 8 general objectives covering 6 mathematical topics each of which had several specific objectives.

[insert Figure 1 about here]

The 8 general objectives and the hours of instruction devoted to each are shown in Table 1. A sample of the specific objectives for one of the general

[insert Table 1 about here]

objectives is given in Figure 2. The committee also constructed a pre-test which measured teachers' ability on each of the specific objectives both at the knowledge and application level. The pre-test consisted of 69 items, 45 multiple choice (90 pts) and 24 application (110 pts) for a total value of 200 points. A parallel form of the pre-test was developed and used as the post-test.

[insert Figure 2 about here]

Delivery

The institute was conducted in a rural county in West Central Florida. The 18 participants were selected from a pool of elementary school teachers who volunteered for the program and were paid a stipend to attend.

The pre-test was administered to the participants approximately three weeks prior to the start of the institute. At the first meeting of the institute, participants were provided a profile sheet displaying their performance on each objective. The daily schedule and operation of the institute (Table 2) and the expectations of the participants were fully discussed.

[insert Table 2 about here]

The program was delivered in twelve 5 hour sessions at the conclusion of the school year. Each 5 hour session consisted of 2 1/2 hours lecture, 1/2 hour of breaks, and 2 hours of supervised study. The supervised study involved activities to give the participants a deeper understanding of the mathematics presented in the lectures, individual help, group discussions, and time for questions and reteaching, if necessary.

The course was team taught by two university professors who attempted to relieve participants' math anxiety. The instructors served as models for the participants by promoting a relaxed, open atmosphere, encouraging participant participation, utilizing inductive teaching strategies, emphasing the language of mathematics, engaging the teachers in problem-solving activities, and asking higher-ordered questions to motivate mathematical thinking.

RESULTS AND CONCLUSIONS

The first research question was concerned with the level of mathematical knowledge acquired by the teachers at the conclusion of the institute. In order to answer this question, the post-test was administered on the last day of the institute. The results were entered on the profile sheet and a difference score was computed for each participant on each of the 8 general objectives. Table 3 presents the mean pre- and post-test scores of the

[insert Table 3 about here]

participants on the general objectives. In each of the subtests, the students showed a statistically significant increase in their mathematical knowledge at both the knowledge and application level. Therefore, one can conclude that the primary purpose of the institute, raising the teachers knowledge of mathematics, was met. In addition course evaluations completed by all participants at the conclusion of the institute indicated that they enjoyed the course and had very positive feelings about the experience. The teachers commented that the content was interesting, challenging, and appropriate for elementary teachers. They also enjoyed the camaraderie that developed and the sharing of ideas that occurred during the group sessions. The only negative comment and/or suggestion for improving the institute pertained to scheduling. Many of the participants felt they needed or wanted more time to complete the course.

The second research question was concerned with the improvement of the teaching of mathematics. To gather information regarding this question, a 12-item questionnaire was used to conduct a structured interview with participants to determine the extent to which teachers integrated the content of the institute into their classroom activities. These interviews were conducted with 16 of the 18 institute participants about six months after the completion of the program. The teachers' responses are summarized for each question.

Question 1 **In teaching your math lessons, do you define attributes, use concrete materials, use high and low level questioning techniques, provide practice and feedback?**

All but one teacher indicated yes to each of these questions. However, 7 of the teachers indicated that they did not practice high level questioning techniques. This was an interesting set of responses because these techniques were not taught during the institute, but were modeled daily by the instructors.

Question 2 Do you use visuals, overheads, films, and/or filmstrips?

The majority of the teachers indicated they were using the overhead for demonstrations and for practice activities. Very little use of films or filmstrips was reported.

Question 3 The third question dealt with the issue of ordering new mathematics materials for classroom use for this year. A new series was adopted for the 1985 school year and many materials were provided with the text book adoption. As a consequence, none of the teachers had ordered new materials.

Question 4 The fourth question asked the teachers to identify new instructional aids that they had made this year. The responses included: ; rning centers, fraction aids, borrowed materials for others, transparencies, dittos from the institute, place value materials, new tests, drill activities and chip trading. Most of the materials that were shared by the participants during the interviews were adaptations of the materials that were used to teach the participants during the summer institute.

Question 5 Do you spend more time preparing to teach math than in previous years? Eleven teachers indicated yes, 3, no, and 2 did not respond. One teacher's response seems to sum up the feeling of many in the group. "Yes, I spend more time, but it is more beneficial to both me and to the students."

Question 6 Do you feel more comfortable teaching mathematics this year? All respondents replied in a positive manner. Specific comments included: new ideas and more concrete methods, additional information and materials helped me to gain confidence, new ideas for transparencies, learned some new "tricks", I have more options open to draw from and they are workable.

Question 7 was an indirect way of looking at teacher attitudes. Specifically the question asked: Of the subjects you teach, which do you enjoy teaching the most? Five of the teachers selected mathematics, 4 selected reading and the remaining teachers indicated that they enjoyed teaching all areas. One teacher's comments sums up this set of responses when she said, "I chose elementary school because I like to teach everything."

Question 8 The next question was concerned about the content areas from the summer institute and asked: From the content covered which of the areas has proven most valuable to you? While the majority of the teachers singled out problem solving as the single most important area covered, all the other areas were considered by over half to be valuable for them.

Questions 9 and 10 Of the teachers asked whether the text and handouts given during the institute were of value as reference materials during the school year, all but one indicated they had used the text as a reference, especially the sections on materials and ideas that were not covered in the institute. Handouts seemed to also be valuable to these teachers and many wanted to know what additional materials were available.

Question 11 During the institute, a number of specific teaching behaviors were modeled but not discussed. This question asked the teachers to identify which of the following specific behaviors they had used in their teaching during the preceding 10 weeks.

The following is the percent of teachers who indicated they had used the activity in their mathematics instruction.

Chip Trading	54%
Base Ten Blocks	45%
Problem Solving Sheet	63%
Diagrams and Pictures	72%
Manipulatives for Meanings of Operations	51%
Enrichment/Motivational Activities	72%
Alternative Algorithms	63%

Question 12 The final question addressed the issue of what kind of follow up institute would the teachers desire if they could attend another institute in the future? The following are the choices offered and the percent of teachers selecting each.

High Level Content	33%
Teaching Strategies	67%
Materials (Make and Take)	83%
Integrated Institute	33%
Not interested in additional work	16%

RECOMMENDATIONS

In summary, the evidence presented supports the notion that both the specific and implied objectives of the institute were successfully met. Teachers significantly improved their understanding of mathematical content, and more, importantly, appeared to have integrated this newly acquired knowledge into their everyday teaching behaviors. One can conclude, that when institutes are well planned through the collaborative efforts of the

university and school district, that teachers and ultimately children profit from the experience.

While the results of this study are encouraging, more research and evaluations of the summer institute program is needed. Specifically, investigations should concern the following:

1. The identification and validation of the content skills and knowledge needed by teachers at a given level to be effective teachers.
2. The effects of integrating the content and appropriate teaching strategies.
3. Classroom observations of teachers before and after the institute.
4. The change in student performance as a result of teachers participation in summer institutes.
5. The long-term effects of training on teacher behavior.

With a better understanding of the aforementioned issues, universities and school districts will be in a better position to design inservice to meet the identified needs of specific teacher groups. Thus, the chances of improving the overall quality of mathematics instruction would be greatly enhanced.

References

Dillon-Peterson, B. (Ed.). (1981). Staff development/organizational development. Alexandria, VA: Association for Supervision and Curriculum Development.

James, R. K., & Kuntz, V. R. (Eds.). (1985). Science and mathematics education for the year 2000 and beyond. Bowling Green, OH: School Science and Mathematics Association.

Mathematical Association of America (1983). Recommendations on the mathematical preparation of teachers: MAA Notes #2. Washington, DC.

National Council of Teachers of Mathematics. (1981). Guidelines for the preparation of teachers of mathematics. Reston, VA.

National Council of Teachers of Mathematics. (1985). Professional development for teachers of mathematics: A handbook. Reston, VA.

Oja, S. (1980). Adult development is implicit with staff development. Journal of Staff Development, 1, 7-56.

Phillips, E. R., Greabell, L. C., Bullock, J. T., & Wanus-Bullock, D. (1987). A collaborative model for non-traditional graduate teacher education. National Issues in Higher Education, 28, 191-202.

Sparks, G. M. (1983). Synthesis of research on staff development for effective teaching. Educational Leadership, 52, 65-72.

Spector, B. S., & Phillips, E. R. (1988). Excellence in graduate education for mathematics and science teachers: A sciematics approach. School Science and Mathematics (In press).

Woods, F., Thompson, S., & Russell, F. (1981). Designing effective staff development programs. In Dillion-Peterson, B. (Ed.) Staff Development/Organization development. Alexandria, VA: Association for Supervision and Curriculum Development.

Woods, F., McQuarrie, F. O., & Thompson, S. (1982). Practitioners and professors agree on effective staff development practices. Educational Leadership, 39, 28-31.

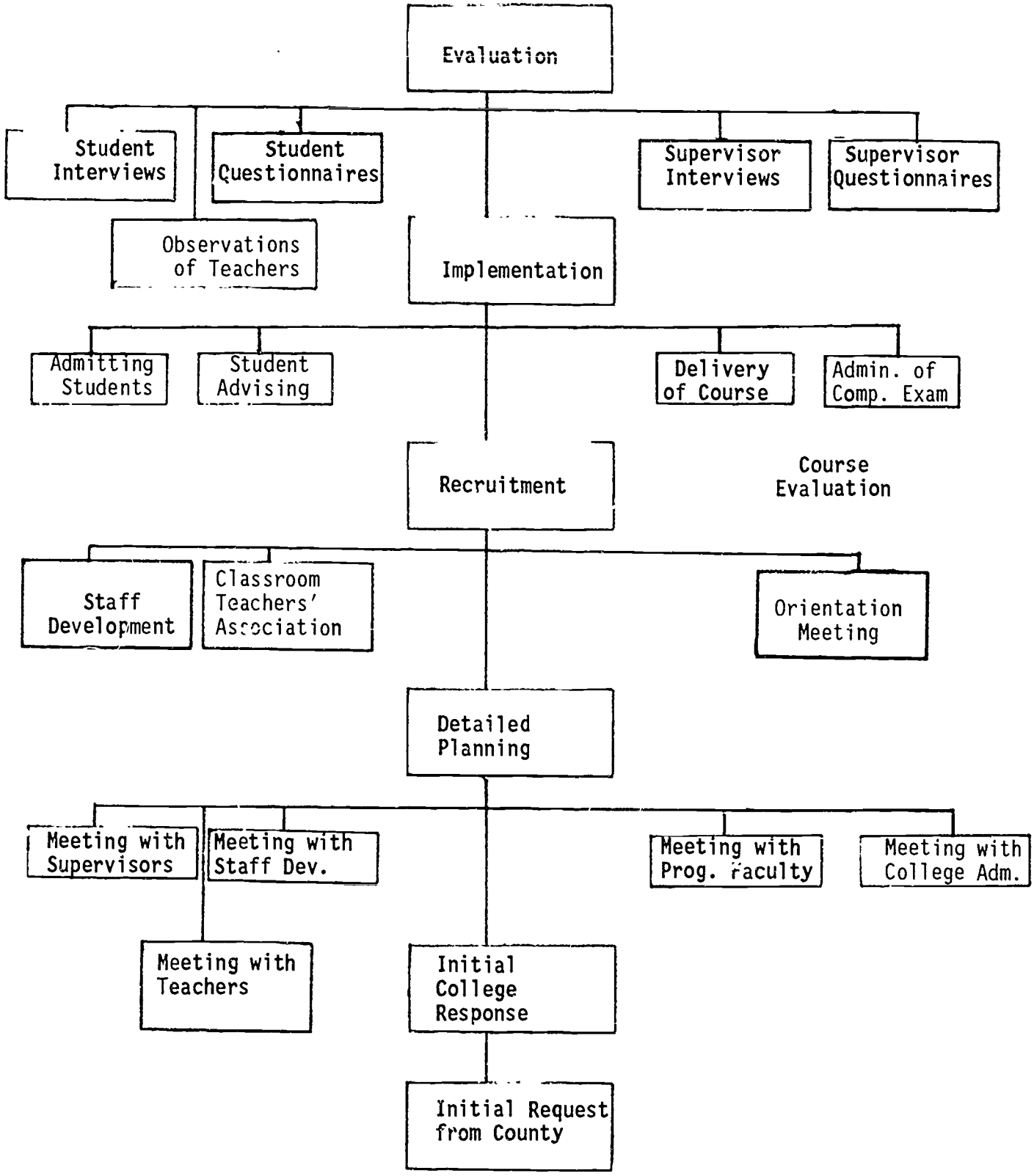

FIGURE 1
Collaborative Model for Development of Summer Institute

Table 1. Content Objectives and Hours of Instruction

TOPIC	GENERAL OBJECTIVES		HRS OF INS
Set Theory	1.	Demonstrate knowledge and understanding of set theory concepts and principles.	10
Elementary of Number System	2.	Demonstrate knowledge and understanding of concepts and principles of number systems.	6
	3.	Demonstrate knowledge and facility with number basis within the Hindu-Arbic System.	5
	4.	Demonstrate knowledge and understanding of basic whole number concepts and principles as well as alternative computational algorithms.	8
Number Theory	5.	Demonstrate knowledge and application of number theory concepts and/or principles.	5
Integers	6.	Demonstrate knowledge of the concepts and skills related to the set of integers.	5
Rationals	7.	Demonstrate knowledge of rational number concepts and performs computations using alternative algorithms.	10
Problem Solving	8.	Demonstrate knowledge and application of problem-solving techniques.	6

Mathematics Summer Institutes

Course Title: Mathematics for Elementary Teachers

Day: 6

Topic: Number Theory

General Objective: Demonstrate knowledge and application of number theory concepts and/or principles

Specific Objectives: The participant

1. Defines appropriate mathematical concepts such as prime, composite, divisor, factor, multiple, least common multiple, greatest common factor, etc.

2. States the Fundamental Theorem of Arithmetic.

3. Uses divisibility rules to determine if a number is prime or composite.

4. Finds the prime factorization of a given number.

5. Determines GCF and LCM for a set of numbers.

6. Finds GCF using the Euclidean algorithm.

7. Uses the relationship LMC $(a,b) = \frac{a.b}{GCF(a,b)}$ to find GCF or LMC when given the other.

8. Determines the number of factors of a given number.

9. Proves, formally and informally, that the sum of two odd numbers is an even number.

10. Finds the square root of a number using Newton's approximation method.

11. Gives examples of the following: square numbers, triangular numbers, twin primes, Pythagorean triples, Pascal's triangle, and Goldbach's Conjecture.

12. Translates base ten numerals into a numeral in some base other than ten and visa-versa.

FIGURE 2: Sample of Specific Objectives

Table 2: Summary Mathematics Institute Schedule
Phillips/Greabell
Hours: 8:00 - 1:00, June 10 - June 26

Day 1 - June 10	Days 2-11 - June 11-June 25		Day 12 - June 26	
1. Orientation (A) Content Objectives (B) Forms (C) Micro-Teaching (D) Home Work (E) Modules (F) Organization (G) Testing Pre/Post	8:00-9:30	Content Presentation	8:00-9:30	Review for Post Test
	9:30-9:45	Coffee Break	9:30-9:45	Break
	9:45-10:45	Content Application Planning	9:45-12:30	Post Test
	10:45-11:45	Content Presentation	12:30-1:00	Program Evaluation
2. Domain 4: Florida Performance Measurement System	11:45-12:00	Break		
3. Day 1: Content Presentation	12:00-12:30	Micro-teaching Content Application (Small Group)		
	12:30-1:00	Supervised Work Session (A) Modules (B) Home Work (C) Individual Assistance		

Table 3: Mean Pre/Posttest Results

TOPIC	POINTS	PRE	POST	DIFF SCORE	SIG.
Set Theory	31	6.2	28.8	+22.6	.01
Elem of No. System	40	14.7	37.3	+22.6	.01
Number Theory	36	10.8	33.2	+22.4	.01
Integers	30	11.3	26.0	+14.7	.01
Rationals	40	10.8	35.6	+24.8	.01
Problem Solving	23	3.2	20.8	+17.6	.01
TOTALS	200	53.9	186.5	+132.6	