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A Comparison of Student Achievement and Cost Effectiveness in Two Inservice Teacher Education Models

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A COMPARISON OF STUDENT ACHIEVEMENT AND COST EFFECTIVENESS IN TWO
INSERVICE TEACHER EDUCATION MODELS

by

Margaret Kelly Carroll

A Dissertation Submitted to the Faculty
of the School of Education of Loyola University of Chicago
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Education

January

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Loyola University of Chicago

A COMPARISON OF STUDENT ACHIEVEMENT AND COST EFFECTIVENESS IN TWO INSERVICE
TEACHER EDUCATION MODELS

This study compared two models of inservice teacher education with regard to the resulting student achievement and attendant costs. The study was conducted in 27 Archdiocese of Chicago Catholic elementary schools. The inservice training models shared components identified in the literature as contributing to successful inservice training, but differed from each other in location, participants, and type of supervision. Model #1 teachers were trained in a central location, were made up of one to four teachers from each of 26 schools, and received individual supervision for implementation of training techniques. Model #2 teachers were trained on-site, were made up of entire faculties (including principals) from three schools, and received group supervision. Training presented condensed research on five powerful influences on learning: academic time, classroom social environment, home learning environment, motivation, and the quality of instruction (Walberg, 1981). A list of instructional strategies for each of the five constructs was also provided. Teachers selected strategies and implemented them in the classroom, collecting data to verify student improvement. Student achievement was assessed using the math and science items of the Illinois Inventory of Educational Progress. The variables of student math and science ability (as perceived by teachers), teacher cooperation in training (as perceived by trainers), pretest achievement, annual

attendance, gender, grade and model were used in a multiple regression to account for posttest differences. Results indicated that student achievement was greater for students of Model #1 teachers only on science items for 13-year olds. Model #1 was significantly more expensive than Model #2 to implement due to the individual teacher supervision. Given greater student achievement for only one level of one subject, it might be concluded that the less costly inservice teacher training model could be employed without detriment to the students of trained teachers. Additionally, teacher enthusiasm and cooperation in training was a significant predictor of resulting student achievement. Teachers must be committed to improvement to achieve behavioral as well as cognitive change.

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Thanks to each and every person who has contributed to my growth and development, it will be possible for me to continue to work in the field of education with renewed knowledge and energy.

VITA

The author, Margaret Kelly Carroll, is the daughter of Walter John Kelly and Eva (Staudenmeyer) Kelly. She was born September 6, 1956, in Chicago, Illinois.

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In August 1977, Ms. Carroll enrolled in courses at Illinois State University to receive additional special education certificates. These graduate courses in special education were followed by continuing education course work in sign language from 1977 through 1979. She also accepted employment at Unit District

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Ms. Carroll successfully passed her doctoral Comprehensive Examinations in March, 1984. Since March, 1984, Ms. Carroll has co-authored eighteen articles on practical applications of instructional theory, four of which have been accepted for publication. She completed work on her Doctor of Education degree in 1984.

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Chapter I

The Importance of Inservice Teacher Education and Research

The importance of inservice teacher education derives from a variety of needs. These factors include the need for staff development; the need to raise the status of the teaching profession; the fulfillment of the goal of research, generating applications; the need to cope with an aging teaching population in many districts nationwide; and the desire to justify and efficiently use the allocated financial resources for the improvement of teaching personnel. These needs provide a powerful argument for research on effective models for training inservice teachers.

Effective inservice training is the mark of "a major change in the ecology of professional life" (Griffin, 1978, p. 1). It calls for a synergistic environment in which continuous training and study both of academic substance and the craft of teaching are a part of the fabric of teaching (Joyce & Showers, 1982). A requirement of a profession is that its practitioners continue to grow, learn and develop and that their professional practices demonstrate the use of the best knowledge and skill available to them (Griffin, 1978). Stenhouse (1975) capsulizes this concept: "The outstanding characteristic of the extended professional is a capacity for autonomous professional development through systematic self

study, through the study of the work of other teachers, through the testing of ideas by classroom research procedures." (p.144). To accommodate these goals, there is the preservice training of teachers and what is commonly called inservice teacher education. The purpose of inservice education is to continue teachers' development by applying the latest research to their skills. Teachers should be good learners continually seeking to gain new skills. ✓

Contrary to popular public opinion, teachers are interested in advances regarding teaching (Crist & Achilles, 1978) and they do want advice on pedagogy (Yager & Stodghill, 1979). The failure of past programs to capitalize on these interests has primarily been due to the failure of researchers to focus on 1) teacher needs and involvement in inservice planning (Duke, 1977) and 2) implementation of programs (Patterson & Czajkowski, 1979).

Another purpose of inservice teacher education is the application of research. Tyler and McGuire (1984) remind researchers and educators alike that educational research must result in the communication of new information or empirical results on teaching methodology and theory to teacher practitioners. The inservice teacher education program is a vehicle for the communication of research findings. Inservice teacher education programs are also vehicles for providing renewal through a liaison with recent research that explains a phenomenon or offers an alternative instructional methodology.

Declining enrollments have also produced a climate in which inservice teacher education has become more important and, in some districts, critical. With declining enrollments, the demand for teachers

decreases. This fact, in conjunction with the tenure system employed in most American elementary and secondary school settings, is resulting in an increasingly higher mean for years of service among teaching staffs. In the Archdiocese of Chicago elementary school system, more than 28% of the teachers have 15 or more years of experience. Experience is an excellent teacher and many of the faculty members remaining after reduction in force (R.I.F.) are craftsmen and artists in teaching. Yet, the need for renewal is heightened as faculty members fresh from college with new methodology and recent contact with current research are less frequently joining faculty ranks to renew enthusiasm and generate healthy articulation of teaching practices.

Finally, motivation for good inservice teacher education is the efficient use of those funds already allocated. A large budget is expended annually on inservice teacher education. The 1982 figure indicates an annual expenditure of over \$75 million by the federal government alone for the purpose of personnel development. Efficiency in the use of staff development funds is especially important in periods of economic difficulty; cutbacks in educational spending are representative of an economic climate demanding high-yield results for dollars spent.

Conducting research in the area of working models for inservice teacher education is also important. This derives from the public attitude toward education. Jenkinson (1982) and Raywid (1979) note the declining positive sentiment of the public regarding education. Educational criticism has grown to national proportions (Bell, 1984; Boyer, 1984; Goldberg & Harvey, 1983; Griffiths, 1983; Tanner, 1984; Wirszup, 1983). To regain productivity (Walberg, 1984) and, thereby,

raise status, the educational profession must use research to improve instruction and effectiveness. Given declining enrollments and a widespread tenure system, this means training and enhancing the instruction of teachers already teaching. The focus must be on inservice teacher education as well as preservice teacher education.

Current Status of Inservice Teacher Education Research

While every situation or problem should be considered unique and each educator must seek his/her own solutions for improving educational practice (Schubert, 1980), it is useful for those seeking solutions to know which components of different models have been shown to be effective in research studies. It is also helpful to have working models that can be adapted to a variety of situations. Klausmeier (1982) notes that it is unfortunate that successful models for school improvement have not been publicized widely enough to allow other schools to benefit from replicating previous successes. It is important to provide descriptions of successful inservice teacher education and school improvement programs to allow others the opportunity to use these descriptions in planning their own programs. Models of successful inservice teacher education are needed.

Duke (1977) has taken the position that researchers have turned over curriculum development to educational psychology and have ignored the realities of the classroom. As a result, theory is not closely allied with practice. This position is supported by other researchers who have

noted the failure of researchers and curriculum developers to address teacher concerns or classroom exigencies (Doyle & Ponder, 1977; Harootunian & Yarger, 1981; Jackson, 1983; Westbury, 1971). Teachers must join with researchers in a collaborative effort to improve instruction and evaluation and thereby improve student productivity. More research involving teachers in program design and implementation evaluation is necessary.

Inservice teacher education gains importance because it meets a variety of needs. Teachers need staff development as they teach. The teaching profession needs to raise status; this may be enhanced by the collaboration of researchers with teachers. Research needs to generate new applications that improve student learning in the classroom. Allocated funds need to be efficiently used in a time of scarce resources. These needs provide a powerful argument for research on effective models of inservice training. Summarily, research on inservice teacher education has resulted in two conclusions: there is a need for models, and teacher concerns must be addressed.

The Importance of the Current Study

The current study proposes to investigate two models of inservice teacher education that have been developed from research findings on inservice education. Both call for systematic teacher self-study, allow room for individual adaptation and implementation, ask teachers to collaborate to improve instruction and seek to improve the attitudes of

parents and communities toward education. The models are derived from combining the most essential components cited in the literature for effective inservice teacher education. Most components of the two models are identical with only four aspects altered for the purpose of investigating the cost effectiveness of the different models.

Model #1 involves 26 schools with one to four teachers from each school receiving training, for a total of 51 teachers plus one principal who volunteered for training in response to an invitation. This inservice took place both on and off campus. The inservice teacher training was presented by professors and research assistants from the university community at regular monthly meetings held in a central downtown Chicago location. These meetings consisted of large group presentations and small group discussions. Teachers received individual supervision in their classrooms and formed formal support groups within their schools where possible. Training lasted from October, 1983, through February, 1984. Because of the individual supervision, Model #1 was more costly than Model #2.

Model #2 involved three schools with 31 staff members, including principals. Inservice training was provided by the identical staff from the university community but ran from February to the beginning of June, 1984. Both large group meetings and follow-up meetings were held on-site. These teachers received large group presentations and participated in small group discussions on a monthly basis. However, no individual supervision was given, making this model much less personnel-intensive than the first model. A second group meeting was held each month consisting of only small group discussion to provide follow-up.

Teachers were encouraged to develop informal support networks facilitated by the principals' participation in the training.

Both models provided teachers with a theoretical base for modifying their classroom practices; both models allowed for individual personality and teaching style by permitting teacher choice among instructional strategies; and both models gave some degree of feedback to participants. The two models used identical handouts and training personnel. The differences in the number of teachers involved from each school, varying levels of principal involvement, training location, and teacher supervision differentiated the models.

Walberg (1984) demonstrates that instruction can have a great effect on student achievement. The purpose of both models was to increase students' achievement by helping their teachers provide improved instruction. The results of the comparison identified the model which produced the greater student achievement. The study also determined the costs of increased student achievement vis-a-vis a comparison of the costs of the programs to improve teacher instruction.

The following hypotheses were tested:

Hypothesis #1: Model #1 will produce significantly better student achievement as the teachers will receive individual supervision and personal feedback on implementation efforts.

Hypothesis #2: Model #2 will produce significantly better student achievement as the teachers will receive support and instructional leadership via principal involvement and whole faculty training.

Hypothesis #3: Model #1 will cost significantly more than Model #2 to implement because of the personnel-intensive nature of supervision of Model #1.

Chapter II

Review of Related Literature

Much has been written about inservice teacher education. Three types of reports are used in this chapter: narrative reviews, meta analyses and individual studies. Several narrative reviews of literature demonstrating commonalities in successful inservice teacher education programs are presented. Two meta analyses report statistically significant variables related to inservice programs. Finally, individual studies that reached specific conclusions with regard to staff development are presented within categories of the findings. Individual studies supporting techniques identified in the comprehensive inservice teacher education studies are presented in the same format.

Tyler (1984) provided a useful division for types of educational literature: he refers to large comprehensive types of studies as macro studies and individual research investigations as micro studies. The division is not meant to be artificial but rather is designed to highlight the different purposes these two kinds of studies serve in education. There are, indeed, studies that would defy exclusive classification in either realm. The benefit of the concept of macro and micro studies is in its classification of contribution and purpose for educational research.

Tyler noted that macro studies analyze masses of data and attempt to form equations that allow prediction of numerical measures of production. The "macro studies" investigated here include research that has analyzed masses of data in quantitative and in qualitative ways.

Another reason for considering educational research under the two rubrics of macro and micro studies is simply the amount of available research. The proliferation of educational journals and increasing emphasis on the research required of college and university teachers has produced a significant increase in the amount of educational literature at hand. As a result, a classification system is useful for sorting research and studying one area at a time.

Macro studies seek to identify generalizations. Tyler (1984) reminds researchers that due to the large volume of data, the generalizations are really approximations and do not indicate the variations possible in individual situations. Therefore, each type of study, which allows for specific conclusions, is essential in a

Macro Studies

Some macro studies are narrative in nature, using quantitative and qualitative techniques to obtain conclusions from a number of studies; these will be referred to as reviews. Other macro studies concentrate on the quantifiable features of numerous studies; these will be called meta analyses as that is the statistical technique employed. The macro studies will be presented in chronological order. The development of ideas and continual improvement of concepts is important.

Moffitt Review. Moffitt (1963) reviewed formats for inservice teacher education. In this historical perspective, Moffitt includes the review of 200 articles on one of the most popular methods of inservice teacher education, the workshop. As a result, these characteristics of an ideal workshop were identified:

1. It meets a need;
2. It provides expert assistance;
3. It is flexible and adaptable;
4. It provides for collecting information and sharing;
5. It provides motivation for change in the participants;
6. It gives added support to a change by allowing the group to become familiar with and accept new programs;
7. It uses group and individual problem-solving;

8. It provides an opportunity to boost morale; and

9. It strengthens working relationships with others in different status assignments.

Moffitt included several other formats for inservice teacher education but concluded that the establishment of a good rapport and the development of useful materials typical of a workshop made the workshop the most popular format for staff development.

Lawrence Review. Lawrence (1974) examined 97 studies related to inservice teacher education. This research was done prior to the advent of meta analysis and was completed by coding 14 variables and then determining programs as having significant results, showing no significant differences or having mixed results. Lawrence then drew conclusions based on percentages of each of the 14 variables present in programs that produced significant results.

Lawrence, in one of the most comprehensive reviews of literature to that date, found that successful inservice programs had the following characteristics:

1. Individualized programs in which teachers participate in differentiated training experiences;
2. Programs in which teachers play an active role such as constructing and generating materials, ideas and behaviors;
3. Programs followed by practice and feedback;
4. Programs that encourage teachers to help each other in cooperative ventures;
5. Programs that are continuous, not one-day affairs;

6. Programs in which teachers have been involved in the planning; and

7. Programs which are self-indicated or self-directed.

Later, Glass (1976) refined the statistical technique of the type used by Lawrence and termed it "meta-analysis". Meta-analysis refers to the statistical analysis of a large collection of analyses from individual studies in order to try to organize and integrate the findings. To continue with the organizing work of Lawrence regarding inservice teacher education, two meta analyses are discussed here. Meta analyses quantified the results of inservice teacher education analyses and thus corrected the shortcoming of Lawrence's work noted by Cruikshank, Lorish, and Thompson (1979). which was the lack of quantification of previous studies. The description of two inservice teacher education meta analyses follow.

Joslin Meta Analysis. Joslin (1980) completed a meta analysis of inservice teacher education, reviewing and coding 131 empirical studies. She used 71 of the 97 studies Lawrence had examined in a review of the literature six years earlier. As a result of this statistical analysis, she made these suggestions to inservice planners:

1. Inservice programs planned to change teachers are effective. Attempts to change student behavior through teacher participation in inservice programming effect small but significant change;
2. Programs directed toward changing the skills and behaviors of teachers are moderately effective. Those programs seeking to change teacher knowledge tend to be highly effective;
3. Programs designed to help teachers deal with concrete

objectives related to specific subject matter are likely to be effective;

4. Highly structured formats (training programs, laboratory experiments, mini-courses) are likely to be effective (discussion programs should be limited);

5. Participant self-instruction programs are moderately effective;

6. Inservice programs at the local level after or during school hours are moderately effective;

7. Inservice programs planned around a treatment that has been field-tested or used extensively are likely to be moderately effective;

8. Programs planned for elementary school teachers appear to be moderately effective; and

9. Greatest success is achieved with teachers of one to five years experience. Significant change can only be expected for teachers with less than 10 years of experience.

Moreover, Joslin concluded that the time, effort and money invested in inservice programs do affect change in the participants. She recommended that her findings be used by inservice education planners after conducting needs assessment within the school or district and making decisions about goals, types of outcomes desired and anticipated level of effort. Persons making decisions regarding topics, formats, instructors, and place and time of inservice programs would benefit from considering Joslin's suggestions.

Joslin further noted the poor quality of many of the studies reviewed for the meta analysis, including the failure of many to set up control groups. Future research should use controls. Even more

importantly, Joslin requested that researchers report all statistical information, particularly means and standard deviations. These features would contribute to the continuing possibility of periodic meta analyses which might propose generalizations and integration of individual works.

Joslin found that only a small part of the variance that she noted could be accounted for by each independent variable. This might suggest the same principle of diminishing returns noted by Walberg (1981). Focus on a single variable will produce good but limited results. For continuous improvement, several variables with significantly positive effect sizes should be addressed. Thus, studying all Joslin's findings may be more useful to inservice program planners than responding to a single finding.

Harrison Meta Analysis. Harrison (1980) conducted a meta analysis of 47 individual research reports based on programs involving a total of 4,132 participants. These 47 studies were classified according to location, number of participants, purpose of the program, organization macro and micro, sponsorship, leader job category, leader functions, pattern of presentation, mode of activity, schedule, content presentation, direction, participant role, nature of the plan, uses of learnings, format, goal structure, focus of the program, participation, leadership, duration, outcomes, flexibility and support. The significant results are listed below.

Similar to Joslin (1980), Harrison's meta analysis of selected studies of staff development suggested the following to staff development planners:

1. Programs are more likely to be effective if presented on-site when the objectives are cognitive;
2. Initiation of a staff development program should be made by the school or school district;
3. Programs presented by commercial consultants are likely to be less effective than those presented by teachers, school district staffs, or state department of education staffs;
4. Programs using individual supervision appear to be effective alternatives to traditional group sessions;
5. Programs presented on Saturday appear to be ineffective, otherwise schedule appears to be of small consequence;
6. Participants working toward mutually established goals appear to improve more;
7. Programs desiring cognitive outcomes appear to be more effective when long term, while affective outcomes are successfully achieved in short term programs;
8. Programs appear to be more effective when they use a combination of approaches (individualized and group);
9. Programs that sample participant progress on a regular basis seem more effective;
10. Programs with cognitive outcomes may be obligatory or voluntary to be successful but affective outcomes are better achieved with voluntary participation;
11. The ease of using printed materials appears to produce good results for cognitive outcomes;
12. Programs with performance objectives can be presented on-site

and include printed materials and individual supervision;

13. Successful programs originate from within the participating unit (i.e., school or school district) and are of a non-traditional nature (visitation, video-tape feedback, etc.);

14. Programs designed to improve curriculum seem most effective for cognitive outcomes;

15. Performance outcomes appear to increase if the participant role is both active and receptive;

16. Programs with affective expectations are more effective with fewer participants;

17. Follow-up support improves affective outcomes;

18. Programs with affective objectives are more effective using printed materials, individual supervision, and staff meetings;

19. Efforts to improve teaching practice in an affective way are effective; and

20. Programs with cognitive outcomes showed the greatest effect size for groups of 31-60 teachers.

Harrison recommended that more inservice teacher education programs conduct and publish follow-up evaluations. He further suggested the inclusion of quantitative data in reports of staff development programs.

Joyce and Showers Review. Joyce and Showers (1983) provided a comprehensive review of findings on staff development through 1983. The importance of coaching was summarized and organization of training, rehearsal, and feedback techniques were clearly defined.

Joyce and Showers noted the need for teachers to have executive

control over instructional strategies, including the ability to use strategies appropriately and the flexibility to adapt strategies to specific students and settings. Additional understanding of the strategies and their results is needed to achieve executive control.

Transfer is defined as skill in using and applying patterns previously learned to new problems with similar components (Smith, 1974). During transfer of a newly learned skill to classroom use, teachers may experience some degree of difficulty for a variety of reasons. Using new skills takes more effort than using familiar skills. New skills are less "natural" and hold some risks. Joyce and Showers noted that the more powerful the new technique the more discomfort a teacher may experience in initial implementation.

Joyce and Showers also separated vertical transfer from horizontal transfer. "Horizontal transfer refers to a condition in which a skill can be shifted directly from the training situation in order to solve problems." (p. 5) This is rarely the case in classrooms. Teachers more often use vertical transfer which, as the name implies, requires movement over to the workplace situation and up the cognitive ladder with adaptation of a new skill to a variety of classroom needs which only barely resemble the training situation. Vertical transfer means that a teacher trained in a new technique must actually retrain in the classroom. This requires additional time and possibly individual supervision.

Joyce and Showers theorized that the problem of transfer is only a problem if it is not identified. It is actually a stage in learning. They described the recognition of the need for additional practice and rehearsal in other non-educational settings.

Joyce and Showers suggested the following ways to attack the problems of transfer:

1. Design training conditions as similar as possible to those of the workplace;
2. Minimize the amount of new learning as much as possible and try to achieve overlearning on the part of the trainee; and
3. Make an effort to control the workplace context and reduce the amount of "judgment calls" with the newly learned technique.

The authors reminded readers that these techniques do not eliminate transfer discomfort but do simplify problems.

Problematic elements of training can further be addressed by:

1. Forecasting the problem of transfer during training;
2. Making overlearning a goal prior to classroom practice;
3. Providing for executive control;
4. Allowing practice in a real work situation as soon as possible following training;
5. Providing for coaching during vertical transfer; and
6. Generating a "learning how to learn" effect.

Joyce and Showers determined that overlearning, the process of learning a new skill, applying the skill repeatedly, and gaining expanded control by rehearsal, results in certain positive outcomes. The first outcome is that learning a new skill makes the learning of further new strategies and skills less difficult. This is the "learning how to learn" outcome. The second outcome is that more highly skilled learners understand the process of transfer better. This indicates that the forecasting of problems is a useful technique because it makes learners

understand possible problems and feel less discomfort when they experience problems. As learners acquire more skills, the process of transfer (and, thus, the need for forecasting) becomes less of a problem. Training with an emphasis on a positive outcome for students motivates teachers to succeed in an inservice teacher education program. The objective of specific outcomes also enhances training programs from a teacher's point of view. Finally, as teachers gain more skills, positive outcomes of "learning how to learn" result in the expenditure of less time to learn further new skills.

Micro Studies

In addition to macro studies or meta analyses, individual studies have resulted in a variety of conclusions regarding inservice teacher education. These are discussed within categories of results. The individual studies reported here parallel the same kind of conclusions as the larger analyses and provide some additional specific insights.

Level of Involvement. One of the most important features of an inservice program is that teachers must have a central role in the development of the program (McLaughlin & Marsh, 1978). Hinely and Ponder (1979) and Fullan and Pomfret (1977) noted that programs that do not consult teachers in the planning and implementation are likely to fail. Czajkowski and Patterson (1980) acknowledged that curriculum leaders often

have neglected to investigate the culture of the school and its interaction with instructional plans. Successful improvement programs involve collaboration for research, planning and implementation among program planners and teachers (Florio & Walsh, 1978; Klausmeier, 1982; Tulinoff, Ward, & Griffin, 1980). Teachers must be acknowledged as professional learners (Yaeger & Stodghill, 1979). Feldens and Duncan (1978) cautioned, however, that there is an experimental loss of control when teachers are given a choice of implementation techniques.

In addition, teachers must be encouraged to study their own work and engage in their own research (Stenhouse, 1975). Bondi (1970) stated that teachers must be able to examine their own behaviors and learn to evaluate classroom behavior objectively. Information facilitates improvement in teaching.

Another factor in the level of involvement of teachers is that there should be a critical mass of teachers to maintain program momentum (Czajkowski & Patterson, 1980). Teachers must work cooperatively and be actively engaged in learning a new process or technique (Czajkowski & Patterson, 1980; Liberman & Miller, 1981; Shalaway, 1981).

Joyce and Weil (1980) demonstrated that this collaboration feature was important. They cite four essential elements to successful teacher training:

1. The study of a theoretical background or rationale for a teaching method;
2. The observation of models who demonstrate the teaching technique relatively expertly;
3. The opportunity for practice and feedback in a supportive

environment; and

4. The provision of coaching, companionship and feedback for application and optimal implementation.

More ambitious programs and projects appeal to the teacher's sense of professionalism and contribute to active engagement (McLaughlin & Marsh, 1978). These, too, enhance the possibility of achieving executive control. Galloway, Seltzer and Whitfield (1980) stressed the need for mutuality in staff development programs. They describe mutuality as the capacity to affect one's environment as well as be affected by it. The concept of idea exchanges is important.

Mutuality and exchange are closely allied with the concept of collaborative planning and implementation which assures that teacher-perceived needs will be addressed in a program (Sanders & Schwab, 1980). When teachers generate the purpose and understand the rationale for new learning, they are more likely to gain executive control which leads to application of new techniques to subject matter, creation or modification of appropriate learning materials, integration with other instructional techniques, and development of a functional instructional plan.

Transfer. Sharan and Hertz-Lazarowitz (1982) confirmed the need identified by Joyce and Showers to spend many hours in training and rehearsal. They also noted that there can be strong resistance on the part of teachers in actually applying newly learned techniques. The use of coaching may help overcome these concerns. Coaching is a supportive

consultation or clinical supervision technique that recognizes that people learning new skills may actually appear to get worse before they get better. The positive results of coaching are supported by a variety of researchers and studies (Brandt, 1982; Joyce, Hersch, & McKibbin, 1983; Joyce and Showers, 1982; Ronnestad, 1977; Tinsman, 1981).

Coaching may be provided by teacher teams who regularly observe each other and provide companionship, technical feedback, analysis of application and ideas for adaptation to students (Joyce and Showers, 1983). There are parallels between this kind of team support and athletic training: hence, the term coaching. Brandt (1982) describes problems resulting from failing to coach. Without the benefit of coaching to encourage early attempts, teachers feel overwhelmed and incapable of duplicating the smooth comfortable delivery of a new teaching technique they have seen demonstrated at high quality inservice teacher education programs. The use of coaching eases this problem and allows teachers gradually and with support to transfer new instructional techniques from training to personal repertoires.

Training Conditions. Teachers can learn new strategies and techniques if they are provided opportunities involving modeling, rehearsal and feedback (Joyce & Showers, 1980). The organization of training must provide a good environment for expanding teaching repertoire and increase teacher ability to learn new skills and apply them in the classroom (Joyce & Showers, 1983). What training conditions make this possible?

The source of the training is a very important factor of inservice teacher education and influences results. Studies regarding the source of inservice teacher education indicate that those programs presented by a teacher, a college faculty member, or a supervisory staff person were most effective (Harrison, 1980). Harrison further noted that when the leader or presenter played the role of instructor and individual supervisor (rather than manager, organizational consultant, resource linker, demonstrator or some other role), training was more effective. It also appears to be important that higher status or peer group persons model the kinds of teaching behaviors that inservice teachers are expected to practice (Santiesteban & Koran, 1977).

Duration of the training is a second feature of training conditions that influences success. Sharan and Hertz-Lazarowitz (1982) demonstrated the need for 15-20 trials of a newly learned skill for effective implementation. This large number of rehearsals precludes one-time kinds of training. Joyce and Showers (1980) observed the failure of many inservice programs to change the behavior of teachers in the classroom. This is due to the fact that many inservice programs are one-day sessions and do not allow for feedback, rehearsal, or collaboration and coaching. These components have been found to be essential to successful inservice programming (Joyce & Showers, 1983). As a result, inservice planning should include a multiple-session plan with time allotted for intervening individual supervision and collaboration and coaching.

Joyce and Showers (1983) stressed the need for feedback for teachers in the process of learning instructional strategies. However, Johnson (1974) reported that the factor diminishing teacher effectiveness has been

the lack of valid or accurate information that teachers could use to facilitate professional growth. The need for a consistent source of feedback about teaching techniques and effectiveness is obvious. The results of micro studies, in which systematic feedback has been given to teachers, have been encouraging, confirming the value of providing feedback (Brophy, 1979; Elmeier & Good, 1979; Gage, Runkel, & Chaterjee, 1963; Good & Grouws, 1979; Moore, Schaut, & Fitzges, 1978; Stallings, 1980). As noted earlier, this systematic feedback is best provided in coaching teams or by individual supervision.

The importance of individual supervision lies in the individual differences among teachers. McNergney (1980) suggested personalized techniques for teacher education. Teachers have preferences for varying degrees of control over their own behaviors (Showers, 1982). In recognition of this, natural teaching styles must be taken into account (Murphy & Brown, 1970). When individual styles are accepted and coached, enthusiasm can result as a powerful motivator for teachers and students alike (Collins, 1978).

Summarily, responsive environments that use appropriate duration, leadership and other positive elements of training conditions, including coaching, permit teachers the opportunity to influence the process of training and adapt it with significant differences to their individual learning styles.

Content of Training. Walberg (1981) concluded, after studying the results of thousands of studies on instruction and learning and

conducting meta analyses on the results of these studies, that a comprehensive equation could be used to identify the most powerful influences on learning. This model of productivity included nine factors. Two of the factors, development (age) and ability are static, that is, they are not within the power of the teacher to change. Two other factors have less effect; they are peer and media influence. The remaining five are powerful influences on learning and can be enhanced through changes in teacher behavior. These five factors influencing learning are academic time, classroom social environment, home learning environment, quality of instruction, and motivation. Focusing on improvement in one of the five areas has been shown to improve student achievement. However, the limitation of diminishing returns has an effect on continued improvement. That is to say that increasing teacher attention and skills in one of the five areas produces better student achievement but does not produce continuously improving achievement. Student scores begin to level off after a period of time. In contrast, when all five factors receive attention, student achievement can continue to grow.

Medley and Crook (1980) recommended focusing on teaching strategies suggested by the literature when providing training to teachers. These strategies include:

1. Maintaining pupil task involvement for better use of time (Walberg's academic time);
2. Teaching in whole groups using cooperative techniques (correlated with Walberg's classroom social environment);
3. Minimizing pupil disruptive behavior (related to Walberg's quality of instruction, motivation, and academic time); and

4. Managing small group activity (related to the Walberg concept of classroom social environment and made increasingly successful by extra supervisors or parent volunteers).

Outcomes. Joyce and Showers (1983) identified the importance of the "learning how to learn" outcome and its influence on transfer. New programs are more likely to survive if they benefit and improve student outcomes (Frey, 1979). Klausmeier (1982) further discussed the need for improvement-oriented research which directly focuses on educational improvement in a classroom or school. Focusing on specific outcomes, rather than setting out to prove some generalization, results in projects that can be very successful (Schubert, 1980; Schwab, 1973). Joyce and Showers (1983) suggested that the outcome of training must be a "usable repertoire" of teaching skills, not simple preparation for implementing a set of "pre-defined operations".

Berliner (1980) emphasized that teachers should ask questions and that pace and content should receive some attention in planning instruction. The same details require attention in planning staff development sessions. Bondi (1970) also demonstrated that teachers who received useful feedback in instruction used more praise, accepted and clarified student ideas more often, asked more questions themselves, used less lecturing, and had to give fewer directions.

Evaluation. Research on implementation has demonstrated that the

effects of programs can be assessed by examining the extent of the new techniques implemented by individual teachers (Hall & Loucks, 1977). Teachers can also enrich their instruction if they are provided with feedback from outside observers about their behavior in the classroom (Ebmeier & Good, 1979; Good & Brophy, 1974; Stallings, 1980). In addition, executive control is important to actually changing classroom teaching behavior as a result of an inservice program. Self-awareness, resulting from feedback, increases teacher control of behavior and increases the likelihood that teachers will modify behavior (Feiman, 1981).

These measures are all evaluations of teacher performance to help enhance implementation of newly learned skills. Another important evaluation is that of the effect of training on teacher classroom behavior. Good and Brophy (1974) reported that teacher behavior was altered positively by providing information about past interactions with children. This is the kind of evaluation sought in an effort to provide a research-based investigation of inservice teacher education effects.

The effect of training on classroom teaching behavior is minimal in environments (schools, units) where change and growth are not emphasized (McKibbin & Joyce, 1980). Thus, teacher differences must be evaluated within the framework of the school climate. Encouraging direct leadership and allowing the influence of energized, more active teachers to permeate the school are two techniques to enhance the environment and allow for growth (Joyce & Showers, 1983).

Teacher change can be assessed by direct observation in the classroom, the report of students or colleagues, the report of the

teachers themselves, or the use of some kind of evaluation instrument.

Tyler (1984) reminded evaluators that they are seeking to define teaching procedures that are not well defined. This leaves evaluation of teachers in a somewhat more subjective realm than other kinds of measures might be. Using research to identify cues and interactional effect and engagement and then basing teacher ratings on these is the optimal goal of the evaluation of teacher performance.

The Ideal Model

A model inservice teacher education program involves teachers in a collaborative effort to improve instruction and curriculum. The inservice program is provided by experts who are practitioners, university personnel, or state board of education personnel. Time for collecting information and for sharing should be part of the training. Training lasts over a period of time rather than a one-time session. Teachers are encouraged to individualize and apply what they learn.

Training programs should be followed by practice and feedback. The training is provided in structured programs with ideas that have been field-tested. During training, participant progress is sampled and evaluated and the training is revised. Teachers in training are provided with the opportunity to play both receptive and active roles, alternately. Programs with cognitive target outcomes are best conducted with groups of 31 - 60 participants. Teachers should receive written materials that provide specific ideas for teaching behaviors and the resources for

further readings on the subject. Teachers should be coached and receive forecasts of increased difficulty and discomfort when initiating a new teaching behavior. Overlearning is important for teachers who are learning new behaviors.

Training should consist of providing a rationale or theoretical background, modeling of the new techniques, creating opportunities for practice and feedback, and providing of companionship and support (Harrison, 1980; Joslin, 1980; Joyce & Showers, 1983; Lawrence, 1974; Moffitt, 1963; and Sharan & Hertz-Lazarowitz, 1982). Inservice teacher education is designed for teachers with the ultimate goal of improving student productivity (Walberg, 1984).

Chapter III

Methodology

The following hypotheses will be tested in the analysis of the findings:

Hypothesis #1: Model #1 will produce significantly better student achievement as the teacher will receive individual supervision and personal feedback on implementation efforts.

Hypothesis #2: Model #2 will produce significantly better student achievement as the teachers will receive support and instructional leadership via principal involvement and whole faculty training.

Hypothesis #3: Model #1 will cost significantly more than Model #2 to implement because of the personnel intensive nature of supervision in Model #1.

Design

This study used a quasi-experimental pretest/posttest design to compare two inservice teacher education models. One comparison concerns student achievement; the other, cost effectiveness. The Illinois Inventory of Educational Progress mathematics and science subtests were used as measures of achievement. An equation to assess cost was used for each model to compare cost effectiveness. The study was conducted in 29 Chicago Archdiocesan Catholic elementary schools.

The objective of the inservice training was to improve student achievement through teacher study of research and teacher implementation of a productivity model (Walberg, 1981). Five constructs were studied including motivation, academic time, classroom social environment, home learning environment, and quality of instruction. Both models were designed to bridge the gap between research and practice. The implementation of research findings was necessary both in designing the models and in the training provided to teachers. The models differed with respect to location, supervision, and cost. Comparison between the two models will be made on the basis of cost effectiveness and student achievement.

The two models incorporated essential components of successful inservice programs but varied from each other in a few respects. The following table (Table 1) illustrates how the models include important components. If teachers in the two models received approximately the same experiences with regard to the component, the models are marked as equal. If teachers in the two models received variations of a component, the model receiving more emphasis or opportunity for that component is coded

as greater. The model providing fewer opportunities for a component, by design, is coded as lesser.

Table 1—Comparative Components of the Two Models

Research Findings	Model #1	Model #2
Meets needs expressed by teachers or principals	=	=
Provides expert assistance	=	=
Creates a flexible and adaptable program that changes based on teacher input	=	=
Encourages collecting and sharing information	=	=
Allows group and individual problem solving	=	=
Strengthens working relations between persons of different status	<	>
Provides individualized supervision	>	<



Table 1 (cont.)

Research Findings	Model #1	Model #2
Allows participants to play both active and passive roles	=	=
Provides practice	=	=
Consists of multiple sessions	=	=
Provides feedback	>	<
Encourages a cooperative venture between teachers and researchers	<	>
Models proposed teaching behaviors	=	=
Provides written materials	=	=
Allows for teacher choice and individualization	=	=
Enlists principal cooperation	<	>
Uses groups of 31 - 60 participants	=	=

It is possible to see from this table that the areas identified in the review of the literature have been accommodated in the two models. However, the amount of feedback, individualization, and type of supervision varied from Model #1 to Model #2. This did not violate the suggestions from research but rather attempted to fix amounts for these variables and to provide research-based information for future decisions. The perfect model does not and cannot exist. Every possible model results in trade offs. Model #2 may have cost less but it also did not provide individual supervision in the classroom. Model #1 cost more, but the teachers had the opportunity to share with other teachers the knowlege they had gained. If this benefitted other teachers, the cost may be worthwhile. This study was begun in order to ascertain the degrees of individual components optimal to promote success of inservice teacher education programs.

Subjects

Model #1. Schools in several Chicago Archdiocesan councils (similar to school districts) were suggested by the liaison in the Office of Catholic Education and the principals in these several councils were contacted by letter. Principals were required to express an interest in the program and to indicate willingness to support their teachers' active involvement in the program. This was a significant component of the reasoning behind inviting teachers to become participants through the principals in the system. The Council system has been used by the Office

of Catholic Education to tap local groups of teachers for other projects. The Chicago Archdiocesan elementary school system is very large (181,000 students in 675 schools) and it is impractical to address all of the teachers in the entire system with a single program. Some principals elected to recommend teachers for the project, while others allowed teachers to volunteer. No response was required; teachers expressed their willingness to participate in training by attending the first training session. Large group sessions were held each month from October, 1983, through February, 1984, after school at a downtown location.

At the time of the first training session, a printed timetable for the entire project was distributed. All meeting dates were noted as well as all of the responsibilities that participating teachers were asked to accept. Teachers made a decision to become participants at that first meeting. Suggestions from teachers for additional topics were solicited at this time to assure that teacher needs would be met. Teachers expressed a need for math and science content ideas and activity suggestions. As a result, in addition to the handouts already intended for training, practical lists of activities for the classroom in math and science were also distributed at subsequent meetings. Dr. Ralph Tyler, an internationally respected educator with special expertise in instruction and evaluations, was also invited in as a guest speaker on two different occasions due to teacher concerns about data collection and evaluation. Dr. Tyler's presentations were not originally planned as part of the training, but were added in response to teacher needs.

Model #2. In this model, teachers were again solicited by letters

to principals at proposed schools but with a significant difference. Teachers were asked to participate as a whole faculty. This was arranged by communication with principals at three schools suggested by the Office of Catholic Education. These three principals also met with the project directors to work out details after an interest was expressed. The principals agreed to use a half day inservice session already set aside each month for participation in training. This meant that teachers were not volunteers in the same sense as the Model #1 teachers. However, an additional training session was held after school each month during an hour when teachers were usually released from responsibilities. Presence at this training session, then, was voluntary. All of the teachers at all three schools voluntarily attended these additional training sessions.

Teachers in Model #2 also exercised the right to provide input and proposed an alternative to the survey used to assess impact of the project on students of teachers in the primary grades. The results were not investigated in this study but the revised instrument devised by the teachers is currently in use. In addition, teachers wanted samples of data collection techniques. Samples were garnered from teachers who had used the proposed strategies in the past and circulated among the teachers.

Students. The unit of analysis for assessment of achievement was the individual student. The subjects, then, were 1,238 students of trained teachers. Students of teachers in the two models were not identical in characteristics. The inability to control the factor of

student characteristics was a direct result of the liaison relationship with the Archdiocese; the recommendation of the schools for participation was not determined by the researcher.

The students from the 26 Model #1 schools were primarily white and Hispanic while most of the students from the three Model #2 schools were Black mixed with a few Hispanic students. It should be noted as well that the area in which Model #2 schools were located was more economically depressed with a lower socio-economic level. While no economic information other than qualification for school lunch programs was available, numerous other studies have identified Chicago's west side, particularly in the neighborhoods of the three schools, as an area housing some of the city's poorest families. The availability or lack of substitutes and of teaching supplies also gave evidence of economic differences between these and other schools in the project.

Schools also varied in the use of text books. A series is not adopted for the whole Archdiocesan system; each school or group of schools selects its own series of text books. Students varied in their exposure to learning resources. These factors may influence student test scores and influence results of the study.

Variables

The dependent variable in the study was the posttest score in either science or math from the Illinois Inventory of Educational Progress. The independent variables are Model #1 or Model #2 assignment, ability ratings

in math and science, teacher participation ratings, gender, pretest scores, and attendance. The student was the unit of analysis in the regression equation for the study. The regression equation follows:

$$Y = A + B + C + D + E + F + G + H + e$$

where A - pretest score

B - gender

C - model

D - teacher participation, rating by
research assistant

E - student ability in math, rating
by teacher

F - student ability in science,
rating by teacher

G - attendance

H - grade

Y - posttest score

For cost, the unit of analysis was dollars. The equation used was:

$$A + B + C + D$$

Z

where A - stipends paid to participants

B - personnel salaries expended

C - supplies

D - amenities

Z - number of teachers trained

Instrumentation

Tests. The evaluation questions used for both pretest and posttest purposes were questions no longer included in the Illinois Inventory of Educational Progress (IIEP). IIEP produces questions in all academic areas. However, due to the renewed national interest in mathematics and science, it was determined that the subtests of mathematics and science would be most interesting to study. In addition, handouts were provided with specific activities and ideas in the content areas of mathematics and science. Students were randomly assigned to take science or math items. Students in grades 3, 4, 5 or 6 took the fourth grade level test. Students in grades 7 and 8 took the eighth grade level test.

Another advantage of the IIEP test questions is that they have been piloted and validated and have already been tested for reliability. The questions tended to be of a general problem-solving and generic information type. The questions revolved around the kind of information that people need in order to conduct everyday life. A tension in test selection influenced this study. Typical achievement tests are better used for sorting as they are designed for a 50% failure rate on each item. Conversely, criterion-referenced tests would provide no means of

comparison. While not perfect, the IIEP was selected for use in the study as the best available compromise for the issues raised here. Unlike typical standardized tests which use a difficulty level of .40 - .60, the IIEP includes approximately 30% of its items at .10 - .20 difficulty level and 30% of the items at the .80 - .90 difficulty level.

Student Ability Ratings. The student ability ratings are of a numerical nature and were based on three things: student grades based on written classroom work, teacher assessment of student capacity based on oral encounters and student performance in the workings of the class. The ability ratings were 1-low, 2-average, 3-high.

Teacher Participation Ratings. Teacher involvement ratings were based on observations by the research assistant who had close contact with the teacher. The rating was based on four things: attendance at meetings (at Loyola, at the school, in the classroom, etc.), implementation of strategies observable in the classroom or via data collection, complete data collection and complete presentation at visits or meetings, and verbal responses regarding information from the handouts.

Ratings were 1-poor, 2-fair, 3-good, and 4-excellent. To rate a 4, attendance had to be at the 100% level or with only one absence, with strategy implementation evident at every visit along with completed data collection and verbal responses that indicated regular reading of the handouts. A rating of 3 would indicate another absence or minor deletions

in other performances. A rating of 2 would indicate 3 absences from the assorted meetings or more serious failure to comply with all other expectations. A rating of 1 would indicate serious failure to attend meetings and serious problems in fulfilling the other responsibilities of the project as delineated above. A rating might be improved if extenuating circumstances were noted and were followed by superior performances or by additional contacts with a research assistant initiated by the teacher, indicating a commitment to improved participation.

Procedure

Model #1. In this model, the first five months of meetings (October - February) concentrated on training in each of five construct areas (classroom social environment, home learning environment, motivation, quality of instruction, and academic time) that have been proven to have an effect on student learning. Handouts providing a theoretical background and research for each construct were written by research assistants and then distributed at each meeting. In addition, a short oral presentation regarding the rationale for each construct was given at each meeting. A list of instructional strategies derived from the literature regarding each construct was also distributed along with a bibliography on the topic for further reference.

The monthly meetings were held at Loyola University, Water Tower Campus, in the same meeting room. General announcements were made and questions were addressed in a large group meeting. Teachers then

adjourned to small group meetings which were directed by a member of the research staff who remained constant as did the composition of the group throughout the duration of the project. During small group meetings, there was time for teachers to share implementation problems, seek advice and support from each other and the group leader, and select a specific strategy for implementation from that month's handout of instructional techniques. The group leader and members of the group helped each other determine appropriate means of data collection for the strategy selected as well. The purpose of data collection was to determine whether strategy implementation was making a difference in student learning.

In addition to a monthly meeting at Loyola, another monthly meeting was held at each school. The research assistant who led a particular small group session at the Loyola meetings was the same person responsible for the schools that small group represented. Once per month, the research assistant visited the classroom of each teacher in the group. The research assistant then observed and met with the teacher to discuss successes and needs with regard to strategy implementation. Data were discussed and revisions in strategy made if necessary.

Local level meetings of teachers from the same school along with the principal (if possible) and the research assistant were held monthly. These meetings facilitated small group support and collaboration. General questions and concerns limited to specific schools were addressed at these meetings. Other topics included teacher observations, testing information, and application problems.

Two Archdiocesan elementary school teachers were involved in the original planning for this model. In addition, teacher input from large

group meetings, small group meetings and visitations were used by the team to generate new ideas and meet teacher needs. Research assistants kept anecdotal records to insure that teacher comments, requests and ideas were remembered and used.

Model #2. In this model, teachers met twice per month from February to June of 1984. At the first meeting of each month, one of the constructs was introduced by the same method as in Model #1, involving a handout and a short presentation which were identical to those given in Model #1. These meetings were held on-site at one of the three schools. (Three schools cooperate in joint administration and the site of the meeting was rotated among the schools.) After the presentation, the large group session gave way to small group sessions into which teachers were divided by grade level. Small group meetings were also held to explain strategies and suggest data collection techniques, to select and refine strategies, and to ask questions and share concerns.

A second meeting was held each month for follow-up. These meetings consisted of only small group discussions and were designed to provide research assistants with an opportunity to help with data collection, revise decisions about strategies, and address project questions. Teachers also had the opportunity to share concerns and successes, much as in the local level meetings of the first model. Each teacher reported to the group the results of each month's implementation.

No individual supervision in the classroom was given in this model by research personnel. The principals in all three buildings observed the implementation of the new strategies by teachers in their buildings and

facilitated discussion of the project content on a regular basis but the intimate relationship with a research assistant was not a component of this model. More discussion of strategy implementation as well as sharing data collection results were the foci of these follow-up meetings. Principals sat in on all of the meetings in the same group for the duration of the project.

Data Collection

Data were collected on numerous variables to try to account for the differences in IIEP student posttest achievement. Among these were the IIEP pretest scores in either science or mathematics, gender, grade, student ability ratings in math and science (based on teacher observation), teacher involvement ratings (based on research assistant observations), teacher model assignment, and student annual attendance. Other variables that might have influenced the posttest outcome must be subsumed in the error component of a multiple regression model. The data for other possible influences, such as the amount of time spent on homework in these subjects, minutes per week spent on mathematics and science instruction in each classroom, or family income, could not be obtained. It is, however, recognized that these factors may have influenced the final posttest scores.

Data on gender, student ability ratings, and student attendance ratings were obtained from teachers. Age was reported by the student on the computer form for reporting test question answers. IIEP tests were

administered by teachers from both models at intervals of four months from the pretest to the posttest. IIEP pretest and posttest scores were obtained by simply recording the number of the test items answered correctly.

Data Analysis

Data were analyzed for student achievement in two ways. Multiple regression was the statistical technique used for both analyses. Data were analyzed, looking for differences between the achievement of students of teachers in the two models. Data regarding costs were evaluated using the teachers who received training. These results will be addressed with respect to the results of achievement. Costly teacher training without improved student achievement is not useful. Conversely, improved student achievement may be worth expensive training.

Chapter IV

Results of the Study

The results of this study are reported in two categories: cost comparisons from Model #1 and Model #2; and achievement gains for students of participants. Achievement test scores are compared for intermediate and junior high students in mathematics and science. The results will be reported to facilitate conclusions with regard to the following hypotheses:

Hypothesis #1: Model #1 will produce significantly better student achievement as the teacher will receive individual supervision and personal feedback on implementation efforts.

Hypothesis #2: Model #2 will produce significantly better student achievement as the teachers will receive support and instructional leadership via principal involvement and whole faculty training.

Hypothesis #3: Model #1 will cost significantly more than Model #2 to implement because of the personnel-intensive nature of the supervision in Model #1.

following equation:

$$\frac{A + B + C + D}{Z}$$

where A represents stipends to participants, B represents the supplies budget, C represents the salaries paid to grant personnel, D represents amenities and Y represents the number of participants with students in grades 3 - 8.

$$\frac{\$5250 + \$700 + \$2150 + 250}{35}$$

35

These results indicate that the cost per teacher averaged \$238.57. Teachers averaged 27 students per class. This made the per student cost approximately \$8.84.

Cost of Model #2. The cost for Model #2 was computed using the same equation as for Model #1 with its different cost figures:

$$\frac{A + B + C + D}{Z}$$

Z

where A represents stipends to participants, B represents the supplies budget, C represents the salaries paid to grant personnel, D represents amenities and Y represents the number of participants with students in grades 3 - 8.

These results indicate that the cost per teacher averaged \$170.06.

Teachers averaged 24 students per class. This makes the per student cost approximately \$7.09.

Conclusion. Model #1 resulted in an increased cost per teacher due to the larger amount paid in teacher stipends and the higher cost of individual supervision. The reflected higher costs in amenities and supplies are due only to the increased number of participants and are roughly proportionate to those figures. Thus, the conclusion regarding Hypothesis #3 could be stated:

Model #1 cost significantly more than Model #2 to implement because of the personnel-intensive nature of supervision in Model #1.

Given that Model #2 was lower in implementation cost, it becomes important to investigate the results of teacher training on student achievement. This knowledge may help determine which model was more cost effective, not just which was less expensive.

Results of Achievement Comparison

The tests have been given abbreviated names for the purposes of the following tables. The mathematics test for the fourth grade level will

appear as Math 4, mathematics for eighth grade level as Math 8, science for fourth grade level as Sci 4 and science for eighth grade level as Sci 8.

The means and standard deviations for variables that can be meaningfully averaged were calculated. Mean days of attendance and mean teacher rating are remarkably homogeneous across groups although the standard deviations vary to some degree. Math and science ratings are homogeneous across groups as well. The means of the pretest and posttest scores vary proportionately with the number of items on the tests. (See Table 2.)

Table 2

	Math 4	Math 8	Sci 4	Sci 8
n of cases	353	413	206	266
# of items	39	42	31	41
Pretest				
Mean	19.34	25.60	16.87	22.20
Std. Dev.	7.04	8.44	5.19	6.51
Posttest				
Mean	22.34	28.41	18.71	23.04
Std. Dev.	7.05	8.37	5.63	7.16
Math Ability				
Mean	2.19	2.05	2.18	2.02
Std. Dev.	.71	.71	.68	.73
Science Ability				
Mean	2.21	2.07	2.18	2.06
Std. Dev.	.71	.70	.78	.75
Attendance				
Mean	168.14	165.95	167.87	167.06
Std. Dev.	6.52	7.44	7.92	7.21
Teacher Rating				
Mean	3.00	3.05	2.91	3.24
Std. Dev.	.57	1.10	1.02	.76

Correlations of the variables give additional information. (See Tables 3, 4, 5, and 6.) There was a high correlation between pretest and posttest scores in the case of each test, varying from .74 to .80. Prior achievement is the best single predictor of posttest achievement. Other high correlations included math ability ratings with science ability ratings on all of the tests, ranging from .66 to .75, related to the report of the teacher.

Grade was moderately correlated with pretest score for every test ranging from .40 to .56. Grade was also moderately correlated with posttest score for every test varying from .36 to .50. This is as expected since the tests were used for more than one level of students. This correlation would probably be higher if a norm-referenced achievement test had been used. Math ability rating was moderately correlated with pretest score ranging from .31 to .46. Math ability rating was also moderately correlated with posttest score varying from .36 to .56.

Another moderate correlation was found between science ability ratings and pretest scores for every test except Sci 4 which exhibited only a low correlation. The moderate correlations varied from .40 to .47 with the low correlation at .21. Moderate correlations were found between science ability ratings and posttest scores except for Sci 4. The moderate correlations ranged from .42 to .52 with the low correlation at .27. The moderate correlations may be due to the nature of the test items.

Moderate correlation was found between model and pretest for all of the tests except Math 4 with correlations ranging from $-.33$ to $-.53$. The negative direction of the correlation indicates that Model #1 students

achieved better test scores. The same pattern appears for correlations between model and posttest score. For Math 4, there is essentially no correlation while the other tests show moderate correlation between posttest score and model, ranging from $-.31$ to $-.50$. Again, students from Model #1 had better scores. This may be explained by the differing nature of the student populations. On Sci 4, the correlation was $-.31$ indicating that students in Model #1 achieved better scores. For Math 8, correlation was $-.36$, indicating the same trend. A moderate correlation of $-.50$ was found for the same relationship on Sci 8.

Low correlations were noted for teacher rating and model ($-.22$) indicating that teachers in Model #1 received slightly higher ratings in the Math 4 group. Teacher rating had a low correlation with pretest score and grade for Math 8, indicating teachers with lower ratings may have had more successful students. A $-.20$ correlation was also noted between math ability rating and model for Math 8, suggesting that teacher perceptions of students' math ability were higher in Model #1 than in Model #2. These views may be realistic.

Low correlations of $.24$ and $.28$ were noted between pretest and posttest science achievement and teacher rating on Sci 4. This would indicate that teachers with better ratings had students with slightly higher scores on Sci 4.

A low correlation was found between teacher rating and posttest ($.20$) on Sci 8. This low level of correlation would indicate a slight relationship between higher teacher ratings and posttest scores.

Table 3--Correlation Matrix for Math 4

	Pretest	Posttest	Gender	Grade	Model	Math	Science	Attend.	Rating
Pretest	1.00								
Posttest	.79***	1.00							
Gender	.06	.06	1.00						
Grade	.49**	.36*	-.03	1.00					
Model	.07	.00	.07	-.18	1.00				
Math	.43**	.47**	.12	-.01	.02	1.00			
Science	.40**	.42**	.07	-.04	.13	.69***	1.00		
Attend.	.12	.13	.11	.00	.12	-.09	.10	1.00	
Rating	.10	.15	.00	.16	-.22*	.04	-.03	-.05	1.00

Table 4--Correlation Matrix for Math 8

	Pretest	Posttest	Gender	Grade	Model	Math	Science	Attend.	Rating
Pretest	1.00								
Posttest	.74***	1.00							
Gender	.00	.06	1.00						
Grade	.41**	.45**	-.02	1.00					
Model	-.33*	-.36*	-.06	-.41**	1.00				
Math	.46**	.56**	.18	.03	-.20*	1.00			
Science	.47**	.52**	.11	.04	-.02	.75***	1.00		
Attend.	.13	.17	-.02	.06	-.01	.07	.05	1.00	
Rating	-.20*	-.16	.12	-.20*	.12	-.03	-.11	.16	1.00

Table 5--Correlation Matrix for Sci 4

	Pretest	Posttest	Gender	Grade	Model	Math	Science	Attend.	Rating
Pretest	1.00								
Posttest	.76***	1.00							
Gender	-.06	.03	1.00						
Grade	.56**	.50**	.00	1.00					
Model	-.37*	-.31*	.03	-.31	1.00				
Math	.31*	.36*	.06	.02	-.19	1.00			
Science	.21*	.27*	.12	-.05	.04	.66***	1.00		
Attend.	.03	.09	-.10	.08	.06	.19	.09	1.00	
Rating	.24*	.28*	.04	.07	-.15	.01	-.02	-.09	1.00

Table 6--Correlation Matrix for Sci 8

	Pretest	Posttest	Gender	Grade	Model	Math	Science	Attend.	Rating
Pretest	1.00								
Posttest	.80***	1.00							
Gender	-.02	-.04	1.00						
Grade	.40**	.42**	-.03	1.00					
Model	-.53**	-.50**	-.09	-.25*	1.00				
Math	.46**	.45**	-.07	-.02	-.18	1.00			
Science	.45**	.42**	-.02	-.05	-.14	.75***	1.00		
Attend	.06	.03	-.01	-.11	-.06	.14	.10	1.00	
Rating	.14	.20*	.03	.45**	-.15	-.08	-.18	-.01	1.00

All eight variables (teacher rating, science ability rating, gender, days of attendance, grade, model of training for teachers, mathematics ability rating, and pretest scores) were included as independent variables in a multiple regression with posttest as the dependent variable. The variables included in the regression equation accounted for over sixty percent of the variance. The variance for each test is indicated. (See Table 7.)

These figures indicate that while not every possible variable was included and measured (i.e., amount of time on homework) the variables selected accounted for between 63 and 69% of the observed differences between posttest scores.

The Analysis of Variance Tables computed for the various tests indicated that each had an F-value that was significant beyond the .01 level of significance. The figures are listed and indicate that the discussion of results is worthwhile because the degrees of difference in posttest scores are significant. (See Table 8.)

Table 7—R Squares for Forms of the Tests

Test	R Square	Variance accounted for
Math 4	.67825	68%
Math 8	.66679	67%
Sci 4	.63017	63%
Sci 8	.69256	69%

Table 8—F-Values and Significance of F

Test	F-value	Significance of F
Math 4	80.33911	.0000
Math 8	89.60584	.0000
Sci 4	41.95881	.0000
Sci 8	64.07592	.0000

Regression analysis of eight variables believed to account for achievement (pretest score, gender, grade, math ability rating, science ability rating, teacher rating, model, and attendance) indicated that pretest score, math ability rating determined by the teacher, and teacher rating for enthusiastic cooperation in training were significant predictors of Math 4 achievement. Attendance, pretest score, math ability rating, grade, and science ability were significant predictors of Math 8 achievement. Teacher rating, pretest score, and grade were significant predictors of Sci 4 achievement. Teacher rating, pretest score, math ability, and model were significant predictors of Sci 8 achievement.

Model was predictive only for Sci 8. This finding addresses Hypotheses #1 and #2 which predicted model assignment for teachers would have a significant effect on student achievement. In fact, the results for both hypotheses might be stated:

Model #1 produced significantly better student achievement only in Sci 8 scores.

Pretest had predictive capacity for all of the tests. Attendance was a predictor for Math 8 only. Math ability ratings were predictive for both math tests and Sci 8. Grade was predictive for Math 8 and Sci 4. Science ability was a moderate predictor for Math 8.

Significant predictors and their appropriate levels of significance are reported below. (See Table 9.)

Table 9—Significant Predictors

Variable	Math 4	Math 8	Sci 4	Sci 8
Teacher Rating	**		**	**
Attendance		**		
Gender				
Pretest	**	**	**	**
Math Rating	**	**		**
Grade		**	**	
Model				**
Science Rating		*		

**denotes beyond .01 level of significance

*denotes beyond .05 level of significance

The actual values and the reported levels of significance associated with the variables and their prediction capacities follow. (See Table 10.)

Table 10--Significance of Predictors

	Math 4		
	B	T	Sig. T
Rating	1.12	2.83	.0050
Science	.72	1.66	.1011
Gender	-.18	-.42	.6843
Attend.	.01	.19	.8506
Grade	.18	.73	.4634
Model	.15	.27	.7887
Math	1.84	4.01	.0001
Pretest	5.80	.95	.0000

	Sci 4		
	B	T	Sig. T
Rating	.74	2.95	.0036
Math	.96	1.87	.0634
Grade	1.02	3.04	.0027
Gender	.56	1.12	.2629
Attend.	.03	1.06	.2924
Model	.00	.00	.9992
Science	.54	1.26	.2110
Pretest	.63	9.72	.0000

	Math 8		
	B	T	Sig. T
Rating	-.17	-.71	.4790
Math	2.91	5.24	.0000
Grade	3.31	6.78	.0000
Gender	.13	.26	.7951
Attend.	.10	3.01	.0027
Model	-1.12	-1.53	.1257
Pretest	.43	11.40	.0000
Science	1.14	2.50	.0128

	Sci 8		
	B	T	Sig. T
Rating	1.18	1.93	.0037
Attend.	-.04	-1.11	.2688
Gender	-.75	-1.48	.1394
Pretest	.57	9.51	.0000
Math	1.54	1.87	.0044
Grade	.98	2.35	.0195
Model	-2.72	-4.02	.0001
Science	.42	.79	.4315

Although model was not predictive for most tests, the degree of teacher participation as indicated by teacher rating was a significant predictor in three of four tests (Math 4, Sci 4, and Sci 8). One explanation for this finding is the success of training regardless of the model used. Given this conclusion, the less expensive model could be employed without detriment to the participants or their students. Another explanation is that cooperative teachers are conscientious and their students benefitted from the instruction of conscientious teachers as the same students might have even if teachers did not participate in training.

These results report interesting findings from the study. Some limitations and future directions are also indicated. Discussion of these findings and their implications will follow in the next chapter.

Chapter V

Summary, Conclusions and Implications

This study focused on the costs and effects of two models of inservice teacher education. Given the annual federal government inservice education expenditure of over \$75 million, the need for verifying effective uses of the funds becomes apparent. Because this project was funded through State of Illinois ECIA Chapter II monies, it is also important to report results that justify expenditures.

The conclusions reached with regard to the hypotheses of the study are:

Hypothesis #1: Model #1 produced significantly better student achievement only for Sci 8 items.

Hypothesis #2: Model #2 did not produce significantly better student achievement.

Hypothesis #3: Model #1 did cost significantly more than Model #2 because of the personnel-intensive nature of supervision in Model #1.

Five cautions for interpretation of the results of this study must be suggested.

1. Improvement in teachers' ability to teach during the project may indeed have occurred but not filtered down to students; perhaps the effects of teacher training on student achievement are only able to be measured over a longer term.

2. Student achievement change was only sampled in two subject areas by a relatively small number of items (from 31 to 42 depending on the test). Any one student took a test in only one subject.

3. There was no indication that the test items matched the curriculum in either math or science as taught by participating teachers. This caution applies to interpreting pretest and posttest samples.

4. Given the innovative nature of some of the strategies suggested for teacher implementation during training, it is possible that student change occurred outside the parameters sampled by the achievement instruments. Test items may question areas of information not influenced by the teacher changes that occurred. This was also difficult to determine.

5. All possible influences on student change could not be accounted for by the study. Accurate records of student motivation levels, hours spent on homework, teacher skill in the classroom, and many other factors could not be obtained. These are the limitations experienced by most studies of human behavior.

The results of the cost study appear to be straightforward. Teachers received identical training (in terms of content and format) in

both models for an equivalent duration. Individual teacher supervision made Model #1 more costly than Model #2. The Model #2 budget was 71% of that spent on Model #1 training. The cost per student for Model #2 was only 80% of the budget per student for Model #1. Cost effectiveness, however, has two components. Less expensive is not better if the results of the less costly approach are negligible or negative. For all tests except Sci 8, model was not predictive. The less costly model was as effective as the more costly model for Math 4, Math 8, and Sci 4. Therefore, future study might include investigations to confirm the effectiveness of the less costly model for math gains.

Perhaps another caution about interpreting cost results is necessary. Teachers in Model #1 spent extra time providing inservice training for colleagues in their buildings. Some of the teachers just casually mentioned information they had learned in the project while some teachers formally provided inservice training to the rest of their faculties. The effects of this could not be measured. However, if these teachers really provided useful training for colleagues, the additional cost might be worthwhile.

There is also the concern of trade-offs, as in any venture. Perhaps it is easier to sustain interest and involvement in a project of extended duration such as this if the whole school is cooperating. An unanticipated outcome of Model #2 was the report of both principals and teachers that they experienced a boost in morale. Another commonly expressed positive comment was that research assistants came to the teachers, making an effort to accommodate teachers' already full schedules.

This means that the cost comparison is not as straightforward as it might first appear. The provision of inservice to colleagues has an unmeasured potential for positive outcome. Intense training may prove helpful in developing "future trainers". This might save the cost of inservice personnel in the future.

In examining the figures for all four instruments administered, it is possible to see that the students from Model 1 (coded as 0) were not significantly different from Model 2 students (coded as 1) for Math 4 but were significantly higher scoring on Math 8, Sci 4, and Sci 8. To compensate for the problems of a test that may not match perfectly with the curriculum, future research may include teacher review of the test items used for this study. Teachers could identify the items they feel that they cover in the curriculum. Teacher-developed assessment tools may also be investigated. Comparisons between students of different teachers might present reliability problems if this approach were to be used for research purposes. The International Association for the Evaluation of Educational Achievement already produces materials that might help teachers to identify which test items they have taught and to determine whether they think the teaching of some items should be included in a curriculum.

In addition, for students whose scores were significantly lower at the beginning of the project, expectations might be that those students would attain scores that increased this differential over time. Students with learning problems or with educational disadvantages frequently show the pattern of falling increasingly behind their advantaged or typical-learning peers . Since this was not the case in scores collected

during the project, it might be concluded that the project was somewhat beneficial to the education of Model 2 students, by preventing further decline.

Future research could include mixing socio-economic levels of students in model assignment. A current research project is providing a program, using features of both models, to teachers of Hispanic, Black, Oriental and White students in a variety of economic settings within the Archdiocesan system.

Pretest score is highly correlated with posttest score as would be expected. Every study of student achievement referenced here points to prior achievement as the best predictor of future achievement. Also as expected, grade had a significant impact on posttest scores, with older students achieving higher scores. Students in grades three through six took the fourth grade level test while students in grades seven and eight took the eighth grade level tests.

Math ability ratings were also significant predictors of posttest performance. Ratings consisted of teacher subjective estimation of student ability. Interestingly, math ratings were somewhat better predictors for both math and science posttest performance. This potentially causal link is not clear with regard to order. Do teacher expectations influence student performance or vice-versa or both? Walberg (1983) refers to this issue as a function of the Matthew principle. Those who have talents get more attention; these expectations and advantages influence higher achievement.

Attendance also correlated with achievement from the .03 negligible level on Sci 8 to the .17 level on Math 8. This may have been influenced

by the type of items on the testing instruments. Science items tended to be those related to practical living while math items appeared to be more strongly linked to school-taught facts and skills. Future research might include finding math problems that are more of a problem-solving nature or less curriculum-dependent.

The teacher rating on cooperation, attendance and enthusiasm for changes suggested by training appeared to be a good predictor of posttest achievement for all but the Math 8, where there is a negative relationship between student achievement and cooperation as perceived by the research assistant. This may be an artifact of the presence of an outlier. A good math teacher of four classes received a rating of one for participation in the project as she attended only two meetings and failed to fulfill other obligations that were part of the project. With 28 years of teaching experience and good teaching skills, however, her students received scores that were inversely related to her teacher rating of one. She taught 92 of the reported 413 cases, potentially accounting for the skewed results.

The interesting effect of teacher rating is that it is a good predictor for all of the tests except Math 8. This provides fuel for the argument that teachers must participate voluntarily to reap more than cognitive benefits from training. To experience behavioral change, a commitment from the teacher appears to be necessary.

It is of further note that there was no effect for model in younger students but there was predictive capacity of model for older students in science. Perhaps the effect of learning is cumulative or more interactive in older students. It may also just be that more Model #1 students have

had advantages that, in the higher grades, begin to have a more profound effect.

Future studies may provide clearer delineation if they are able to measure the effects of additional variables suggested by an educational model of productivity, such as time spent on homework, the class time allocated for each subject, the effect of student motivation to learn, etc. Quantity of instruction might include data on time on task. Motivation might be measured through a student survey. A home learning questionnaire might provide a measure of homework time and family emphasis on learning. The My Class Inventory might provide scores with regard to classroom social environment, peer influence, and media influence. These features may account for a significant amount more than 63 - 69% of the difference between pretest and posttest scores reported here.

Future studies may also wish to use the same model on several different groups of students from all ethnic groups. The study is being continued by the author and colleagues during the academic year 1984-85. The student population includes Blacks, Hispanic, Whites, and Asian-Americans. The same training is being provided for all of the teachers, controlling for any differences due to the model used.

This study provided a basis for research-based conclusions regarding the significant features of successful inservice teacher education. Inservice which incorporates these features can impact on student achievement. The degree of each component may depend on age and/or subject matter. Future research may continue to quantify the components that lead to successful inservice programs. Given that model did not have a significant effect on student achievement, the less expensive model

could be used. The feedback of teachers indicated that the individual supervision filled other needs that they shared, including the need to be complimented and to feel successful and accomplished in their work. As a result, the study currently in progress uses on-site training of whole faculties but provides them with some individual supervision. The results of this study, the study in progress, and those of others in the field of inservice teacher education will help develop it into a useful tool that will have a significant effect on teacher instructional behavior and on student learning behavior.

An improved inservice program will make better use of the educational dollar, which is in increasingly short supply, by utilizing the experience of the long-time classroom teacher, and coupling this experience with the current advances and research in the field. In this way, the teacher is involved in inservice education and its planning, inservice expenditures are more likely to produce successful programs, and teachers gain in self esteem. These positive outcomes, in turn, may result in productive teachers who achieve a higher status in the view of the community.

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Approval Sheet

The dissertation submitted by Margaret Kelly Carroll has been read and approved by the following committee:

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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

Date 12/20/84 Director's Signature Diane Schiller