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ABSTRACT

During 1988-89, the Staff Development Program in Mathematics, Science, and Computer Science provided turnkey training programs, workshop sessions organized and conducted by community school districts, and training activities jointly undertaken by borough-based assistance centers and district personnel. This report describes the program background, scope of the evaluation, and evaluation procedures. Overview of the major activities and findings of following six programs are reported: (1) Staff Development Program for grade six mathematics; (2) Mathematics Resource Center; (3) Science Technical Assistance Centers program; (4) District Staff Development program for science; (5) Computer Leadership Training; and (6) Computer Repair Program. Based on the findings, seven recommendations are made. (YP)

OREA Report

EVALUATION SECTION REPORT

Staff Development Program in
Mathematics, Science, and
Computer Science
1988-89

EVALUATION SECTION
John Schoener, Chief Administrator
February 1990

EVALUATION SECTION REPORT

Staff Development Program in
Mathematics, Science, and
Computer Science
1988-89

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EVALUATION SUMMARY

The Staff Development Program in Mathematics, Science, and Computer Science is funded by the New York City Council, and administered by the Office of Program and Curriculum Development (O.P.C.D.) and the Division of Computer Information Services (DCIS). It was first implemented in 1982. During 1988-89, the program continued to provide staff training and curriculum development support to a wide range of New York City school personnel. This included turnkey training programs, workshops provided by centrally managed resource centers, staff development sessions organized and conducted by community school districts, and training activities jointly undertaken by borough-based assistance centers and district personnel.

To implement the program, O.P.C.D. and DCIS each designed and administered discrete program activities aimed at common goals. These goals were to:

- assist teachers in upgrading their subject area knowledge and instructional skills;
- offer training in teaching new curricula;
- help administrators and supervisors provide management and instructional support to other school staff; and
- provide updated curriculum materials.

Some computer science activities were directed at providing computer repair services for schools and career training opportunities for students.

MATHEMATICS

The O.P.C.D. undertook two major initiatives during 1988-89--the Staff Development Program for Grade Six and the Mathematics Resource Centers (M.R.C.s). Continuing the emphasis on district-based training begun in 1986-87, districts organized and implemented their own staff development programs. These programs, which had to meet O.P.C.D. standards, were expected to provide 18 hours of instruction to participating staff responsible for teaching or supervising grade six mathematics. However, O.P.C.D. adopted a new approach in 1988-89 for supporting participating districts--i.e., twelve hours of orientation during August 1988 for a cadre of turnkey trainers selected by each district to constitute a Mathematics Leadership Team (M.L.T.), which would implement the locally based programs during the 1988-89 school year.

Twenty-eight of the 32 community school districts provided staff development in grade six mathematics. A total of 2,503 individuals participated, although the levels of participation varied from district to district. While it was not feasible to determine the number of hours trainees attended because of problems encountered with O.P.C.D.'s computerized database, it was estimated that half of those eligible to attend the program did so.

M.L.T. roles varied from district to district, but usually included developing program plans, conducting training sessions, and selecting materials. In some districts, however, these teams did not function, primarily because individuals could not attend the summer training or did not get release time to serve as turnkey trainers during the school year. M.L.T. members who attended the orientation provided by O.P.C.D. said that it should have focused on teaching strategies rather than on plan development. O.P.C.D. had anticipated that individuals selected as M.L.T.s would have strong backgrounds in teaching mathematics.

Districts customized the content, format, scheduling, and target audience of their programs to meet local needs. A majority of the trainees who returned questionnaires said that they attended the requisite 18 hours of staff development and that the program had a positive effect on their attitude toward mathematics as well as their approach to teaching it.

The three Mathematics Resource Centers (M.R.C.s) continued to provide assistance to school and district staff, including workshops, help in using reference materials, and editing of curriculum materials. The M.R.C. staff reported that they made progress in establishing supportive relationships with teachers, despite the handicaps of staff shortages and other constraints attributable to funding limitations.

SCIENCE

The major emphasis in science staff development was on the new grade four curriculum. District superintendents had the option of having selected staff attend the program conducted by the centrally operated Science Technical Assistance Centers (STACs) or conducting their own training programs.

Attendance data indicated that the Brooklyn and Queens STACs offered a total of 2,740 days of training for teachers and 249 days for supervisors. Not known, however, is the total number of individuals who participated or how many days they attended. (A series of three- and one-and-a-half-day workshops were offered for teachers and supervisors, respectively). However, a majority of both groups of trainees who returned questionnaires reported attending the number of days provided.

Participants' assessment of the training, and particularly its hands-on approach, was strongly positive. The program was especially successful in instilling enthusiasm for science and confidence in teaching it among teachers without strong science backgrounds. Although a majority of both teachers and supervisors reported devoting more time to science this year than last year, most teachers said that they did not receive assistance from school supervisors in putting what they had learned into practice.

Six community school districts developed and implemented their own grade four science program. (Another district hired STAC staff developers to conduct workshops for its teachers at the Brooklyn STAC on Saturdays.) The programs varied widely with regard to both conceptual approach and utilization of resources.

Attendance data from four of the six districts indicated that 222 individuals attended the district-based programs. The number of hours they attended ranged from 12 to 19 with a mean of 16.6 hours. (Questionnaire responses from a sample of trainees, however, indicated that more than one-third received fewer than 12 hours of training.) The percentage of grade four teachers that reportedly participated in each district was considerable, ranging from 60 to 87 percent.

Like participants in the STAC workshops, most of the participants of local programs who completed questionnaires judged the training favorably, and reported spending more time on science in 1988-89 than during the previous school year. They also believed that the quality of instruction had improved. Requests for additional assistance centered around more materials and help from science specialists in applying what was presented.

COMPUTER SCIENCE

Two of the activities sponsored by DCIS during 1988-89 were the Computer Leadership Team (C.L.T.) and Computer Repair (C.R.) programs.

A total of 26 community school districts accepted the invitation extended by their borough Technical Assistance Centers (TACs) to help them identify specific computer education objectives and implement a staff development plan to meet them.

In the five sample districts investigated there was considerable diversity not only with regard to computer education priorities, but the respective responsibilities assumed by the TACs, districts, and schools in carrying out the various staff development plans. These differences generally exemplified differences in the availability and/or utilization of resources, and seemingly varying levels of commitment to computer education.

Overall, participants believed that the training they received was appropriate to their level of experience and would prove useful. Criticism focused on the initiation of the training late in the school year, which offered little opportunity to integrate what was presented into classroom practice during 1988-89. District personnel applauded the leadership and support provided by the TACs.

The C.R. program serviced more than 5,000 computers in 121 high schools, and repaired 1,185 machines in selected community school districts. The student career component provided 73 high school students with paid hands-on work experience. Both lead technicians and students expressed overall satisfaction with the program. Problems included insufficient staff and equipment, an inefficient student payroll system, and lack of assistance to students in obtaining entry-level jobs.

RECOMMENDATIONS

Based on the findings reported here, and other information presented in this report, the following recommendations are made:

- In order to help trainees integrate into practice what is presented at staff development sessions, districts and schools need to find ways to increase the level of in-school support. This might include having science cluster teachers serve more as resources to classroom teachers than as providers of instruction, utilizing M.L.T. members to make on-site visits to support teachers, and encouraging teachers to collaborate in planning lessons and sharing materials. In addition, follow-up assistance should emphasize demonstration lessons, classroom observations, and feedback directed at providing practical help in applying the concepts and strategies presented in training sessions within the context of the classroom. Previous program efforts to involve school supervisors in staff development activities, which have met with some success, should continue.

- Given persistent problems in implementing turnkey models of staff development, program staff need to reconsider the feasibility of this approach. If it is to be used in the future, more rigorous criteria for selecting turnkey trainers need to be established, with roles and responsibilities more clearly delineated and communicated prior to selection, and the necessary release time assured in advance. In addition, commitments to cooperate in making the necessary arrangements for school staff to attend turnkey training activities must be secured from appropriate district and school administrators.

- Program, district, and school staff need to explore strategies for providing release time in ways that minimize the burden it poses for school administrators. One way of doing this might be to pair teachers who would periodically cover each other's class so that each could attend various staff development sessions, and otherwise assist each other.

- In view of districts' diverse training needs and resources, both central and local staff development options should continue to be provided. Resource center programs that provide opportunities for the same group of individuals to meet over an extended period of time during the school day and establish a collegial spirit should be continued and, to the extent possible, expanded. If funding permits, the role of these centers should be extended to include follow-up assistance to schools, and even greater support to locally developed programs.

- To promote attendance at staff development activities, training sessions should be held at more than one location and scheduled on different dates, to the extent possible; to this end, neighboring districts might collaborate in developing and conducting some workshops--e.g., sharing space, staff developers, and resources.

- Efforts to provide trainees with the materials necessary for teaching a new curriculum or instituting innovative instructional strategies should be continued and, to the extent possible, extended. Given limited financial resources, this responsibility should be shared by the program, the districts, and the schools.

- To encourage district and school support for computer education staff development programs, TAC staff need to familiarize superintendents and principals with the diverse ways in which computers can be used to promote the achievement of their educational objectives, as well as with the assistance that is available from the TACs.

ACKNOWLEDGMENTS

This report is the result of a collaborative effort on the part of full-time staff and consultants. In addition to those whose names appear on the title page, the unit is grateful to the following people for their able assistance: Maria Cheung, Bernadette Russek, and Meryl Schildkraut.

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I. INTRODUCTION

PROGRAM BACKGROUND

The Office of Program and Curriculum Development (O.P.C.D.)--then called the Division of Curriculum and Instruction--first implemented the Staff Development Program in Mathematics, Science, and Computer Science in summer 1982 with funds provided by the New York City Council. The overall program goal has been to improve the quality of instruction in New York City's public schools. To this end, the program has provided staff training and curriculum development support to instructional, supervisory, and administrative staff at all grade levels. Assistance has been given in many areas--e.g., using effective teaching and management strategies, understanding and implementing new curriculum mandates, developing computer literacy, and integrating computer use into subject area instruction.

A wide variety of courses and workshops have been offered at different sites, including the central Board of Education, district offices, schools, and satellite centers, and in collaboration with colleges and universities throughout the metropolitan area, sometimes for in-service or college credit. Beginning in 1986-87, community school districts have been afforded the opportunity to develop and implement, with support from O.P.C.D., training programs customized to meet self-perceived local needs.

PROGRAM GOALS

During the 1988-89 school year, the Mathematics and Science units of O.P.C.D. and the Division of Computer Information Services (DCIS) each designed and administered discrete staff development program activities, utilizing various approaches, that were aimed at several common goals. These goals were to:

- assist teachers in upgrading their subject area knowledge and instructional skills;
- offer training in understanding and teaching new curricula;
- help administrators and supervisors in providing management and instructional support to other school staff; and
- provide updated curriculum materials.

Some computer science activities were also directed at providing computer repair services for schools and career training opportunities for students interested in this field.

SCOPE OF THE EVALUATION

The evaluation conducted by the Office of Research, Evaluation, and Assessment/Instructional Support Evaluation Unit (OREA/I.S.E.U.) focused on the Mathematics Staff Development Program in Grade Six, the Mathematics Resource Centers (M.R.C.s), the Grade Four Science Staff Development Programs, the Computer Leadership Training (C.L.T.) Program, and the Computer Repair Program (C.R.P.). Evaluation activities were directed at documenting the extent of each program's implementation, and participants' assessment of its usefulness.

EVALUATION PROCEDURES

The following data sources were used in evaluating the Mathematics, Science, and Computer Science Staff Development programs.

- O.P.C.D. and DCIS memoranda announcing program components and describing major goals, activities, requirements, and eligibility criteria;
- program documents containing information about training dates, hours, sites, topics, and attendance;
- interviews conducted by OREA with a stratified random sample of district math coordinators and leadership team members, M.R.C. site supervisors, Science Technical Assistance Center (STAC) staff, district science coordinators responsible for local training programs, and key administrators of the mathematics and science program components. Questions focused on program implementation, accomplishments, problems encountered, and suggestions for improvement;
- interviews with TAC supervisors and computer coordinators in selected districts regarding the implementation of the C.L.T. program and its impact on computer science education;
- interviews with lead technicians and a sample of students participating in the C.R.P., and with a sample of computer coordinators in high schools that received computer repair services about their experiences with the program, and their assessments of its strengths and weaknesses; and
- questionnaires distributed to participants of grade six mathematics, grade four science, and C.L.T. program activities asking about the extent of their participation, assessment of the training provided, use of the strategies presented, and recommendations.

SCOPE OF THIS REPORT

This report of the 1988-89 Mathematics, Science, and Computer Science Staff Development program consists of four chapters. Chapter I describes the program background, scope of the evaluation, and evaluation procedures. Chapter II provides an overview of the major activities. Major findings are presented in Chapter III. Conclusions and recommendations are included in Chapter IV.

II PROGRAM OVERVIEW

MATHEMATICS

Two major initiatives undertaken by O.P.C.D. in mathematics during 1988-89 were the Staff Development Program for Grade Six and the Mathematics Resource Centers. They are described below.

Staff Development Program for Grade Six

In order to afford community school districts greater flexibility in scheduling staff development activities, selecting training sites, and using district staff developers, district superintendents were invited to design and implement an 18-hour staff development program customized to meet the needs of teachers and supervisors of grade six mathematics.

To ensure the consistency of content citywide, all district plans had to meet course requirements specified by O.P.C.D. These included instruction in using manipulatives to present mathematics concepts, developing problem-exploration strategies, encouraging student verbalization, the use of collaborative learning, and planning spiralled homework. All teachers, supervisors, and teacher trainers having responsibility for grade six mathematics during the 1988-89 school year were eligible to participate; those working with special education and bilingual students were encouraged to attend.

All participants were expected to attend the 18 hours of staff development to be provided by the district; the entire program was to be completed no later than March 15, 1989. The

decision to offer full-day (six-hour) workshops on school time, after-school sessions (for two, three, or four hours), or some combination of both was left to the districts. For after-school sessions, O.P.C.D. paid participants and trainers at their respective contractual rates ($10 and $23.45 per hour); for training conducted on school time, O.P.C.D. provided funds for substitute coverage. All participants received copies of the state syllabus, the revised state and city scope and sequence of instructional objectives, a manual of resource materials, and a kit of manipulative materials for classroom instruction.

In implementing mathematics staff development programs in previous years, the central Board of Education typically offered workshops in August for school staff who preferred to attend the training (or certain phases of it) during the summer. Districts that planned to implement their own customized programs during the school year were encouraged to have their staff developers attend these summer sessions in order to become acquainted with new curriculum topics and instructional strategies to be emphasized. The Mathematics Unit has also provided additional assistance to district staff responsible for implementing locally developed programs--e.g., orientation for staff developers and newly assigned mathematics coordinators.

A different approach was adopted in implementing the grade six program during 1988-89. Each participating district was asked to select up to five turnkey trainers to attend three days (12 hours) of orientation provided by O.P.C.D. during August

1988. Those individuals, designated the Mathematics Leadership Teams (M.L.T.s), were responsible for designing and carrying out the staff development program in their district during the 1988-89 school year. O.P.C.D. suggested that team members might include the mathematics coordinator, district administrator for special education, mathematics supervisors, and teacher trainers, and that one member serve as the "team leader" responsible for overseeing the program's implementation. Individuals were paid for attending the summer sessions at the contractual trainee rate and for conducting sessions in their district (including preparation time) at the trainer rate. In addition to the kit of manipulatives, a resource manual, and scope and sequence of instruction, they also received a trainer's "script" or guide.

The orientation sessions included a review of the revised Grade Six Scope and Sequence and successful teaching strategies, effective use of manipulatives, the responsibilities of turnkey trainers, and assistance in developing a customized staff development plan. Follow-up support from the Mathematics Unit was available to M.L.T. members upon request.

Mathematics Resource Centers

During 1987-88, the Mathematics Unit created three Mathematics Resource Centers (M.R.C.s)--one in upper Manhattan, one in lower Manhattan, and one in the Bronx. These centers are outreach satellites of the Mathematics Unit; their major purposes are to provide school and district staff with local staff development support, access to instructional and resource

materials (e.g., professional journals, manipulatives, model lesson plans), and opportunities to network with colleagues. In addition to regularly scheduled workshops conducted at the centers, plans included the provision of in-school and district-based assistance by center staff upon request, as well as services and activities in support of mathematics education for students and parents.

Each center was to be staffed by a full-time site supervisor, teacher trainer, and secretary, and was to remain open from 9:00 A.M. to 5:00 P.M. so that individuals could utilize the available resources during or after school.

SCIENCE

A major focus of the science staff development activities sponsored by O.P.C.D. during the 1988-89 school year was to provide assistance to school and district staff responsible for implementing the new grade four science curriculum, including preparation for administering the New York State Elementary Science Program Evaluation Test (ESPET) in May 1989.* District superintendents had the option of having selected staff attend the staff development program conducted by the centrally-

*This is a performance-based test of science process skills such as observation, classification, and measurement skills; it was administered citywide for the first time in May 1989.

operated Science Technical Assistance Centers (STACs)* during the school day (Option 1), or conducting their own training program, either during or after school, with funds provided by O.P.C.D. (Option 2). Following is a brief description of these two options.

STAC Program (Option 1)

Districts selecting this option received an allocation to hire substitutes to cover the classes of grade four teachers selected to attend the three-day series of workshops given at the STACs. A minimum of two teachers per school was required, and participants were expected to attend the entire series. Sessions were staggered throughout the school year, and since each workshop in the series was offered repeatedly (in order to accommodate the number of participants), principals did not have to release more than one teacher on any given school day. In addition, one supervisor of grade four science from each participating school was expected to attend one-and-a-half days of training designed to complement the teachers' training. The rationale for this "team approach" was to promote both peer and supervisory support.

The program emphasized the inquiry approach to science and the use of readily available materials for hands-on activities

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**During 1987-88, O.D.P.C. (then called the Division of Curriculum and Instruction) established two science resource and training centers--one in Brooklyn and one in Queens--in order to provide district and school staff with expanded opportunities for ongoing, locally based staff development.

and science demonstrations. All teachers received a kit of science materials (worth approximately $25 for each workshop attended) to assist them in implementing the new grade four curriculum.

District-based Staff Development (Option 2)

Districts electing to develop and implement their own grade four science training program had to submit detailed proposals and budgets to the Science Unit for review. While districts were encouraged to be innovative in their program designs, they were expected to emphasize a problem-solving inquiry approach and the use of readily available materials for hands-on activities and science demonstrations. These plans were to provide for 15 hours of training--to be conducted during or after school--for at least two teachers from every school with fourth grade classes, and training (the number of hours were not specified) for one principal or assistant principal from each of these schools.

In addition, districts received authorization to spend an amount equal to $25 multiplied by the number of training days allocated to them by the program (based on school registers) for science supplies necessary for implementing a hands-on instructional approach. These were to be distributed to all program participants. (Each district was responsible for ordering and distributing the materials.)

COMPUTER SCIENCE

During the 1988-89 school year, as part of its continuing efforts to support districts and schools in their use of

computers, the Division of Computer Information Services (DCIS) sponsored the Computer Leadership Training (C.L.T.) Program and the Computer Repair Program. They are described below.

Computer Leadership Training Program

In order to provide community school districts with assistance in integrating computers into their instructional strategies, the Technical Assistance Centers (TACs) offered to meet with the community school district superintendents (or their designees) in their borough to help them identify their computer education needs, and design (in collaboration with appropriate district personnel) a staff development plan to meet specific related objectives. Major emphasis this year was to be on intermediate and junior high schools.

Services offered by the TACs included loaning computers and software for school or home use, developing and providing curriculum bulletins, helping districts develop criteria for selecting appropriate school staff to attend training sessions, conducting workshops on the use of hardware and related instructional materials, and providing on-site and telephone assistance to schools as needed. In addition, DCIS provided funds for substitute coverage for training conducted during the school day or to pay trainees for attendance at after-school sessions.

Participating districts and schools were expected to actively support the plan--e.g., by releasing teachers to attend staff development activities, providing computers and school time

for participants to practice newly learned skills, and designating a teacher in each school to serve as a computer resource person.

Computer Repair Program

In February 1988, DCIS implemented a pilot program in collaboration with the Division of High Schools to service the IBM PC, Apple IIe, and Tandy 1000 computers (not including printers) installed as part of the computer education program funded by the Municipal Assistance Corporation (MAC) and Vocational Improvement Program (VIP). During this first phase of the program, repair services were limited to high schools in Queens and Manhattan.

Repair centers were established in two high schools--one each in each of these boroughs. Each was staffed by a lead technician, who was responsible for the operation of the program, and two assistant technicians. To the extent possible, repairs were made at school sites (individual schools were responsible for providing secure rooms with adequate electricity); in those instances where the machine had to be removed to the repair center, the defective equipment was replaced with a working computer.

Also initiated in spring 1988, on an experimental basis, was a student career component designed to provide selected seniors at two high schools with a vocational interest in microcomputer repair and some background in electronics an opportunity for a paid, hands-on-training experience. A total of 16 student

technicians were selected by school personnel to work--i.e., to observe and, when possible, assist the repair center technicians. They worked at the center (eight per site) after school three times a week from 2:30 P.M. to 4:30 P.M. for eight weeks (48 hours) under the supervision of the lead technician, for which they were paid $3.50 per hour, the minimum wage. (Funds were provided by the Training Opportunities Program.) They were expected to assume good work habits and attitudes.

A teacher coordinator* at the student's home school was responsible for: assisting in the selection of students for the program; observing students at the repair center; coordinating instruction provided at the home school with the hands-on experience at the repair center; and performing various administrative tasks, such as maintaining records of student attendance and number of hours worked.

During the 1988-89 school year, repair centers were established in Brooklyn, the Bronx, and Staten Island,** and services to high schools were extended to include selected computer models not purchased with MAC/VIP funds. In addition, the student component was expanded to include a greater number of students from additional high schools.

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*Teacher coordinators were paid by the Division of High Schools on a per session basis for hours served beyond the school day.

**However, since the Staten Island center was not operational until March 1989, the Brooklyn center also serviced Staten Island schools for most of the 1988-89 school year.

Community school districts were offered the opportunity to participate in one of several pilot service plans covering selected microcomputers. They included:

- Per Call Service--charge for service based on the time and materials needed to repair the equipment, plus the cost of parts;
- Repair Warranty Contract--a fixed charge of $100 for each working computer to cover the cost of all repairs and replacement parts for one school year;
- Resource Service--hands-on training for school personnel with digital electronic experience and supply of parts for districts having or wanting to establish in-house repair facilities.
- Writing to Read Labs Contract--maintenance and repair of Writing to Read PCjr computers, monitors, and printers at school sites for one year for $300 per lab.

III. FINDINGS

MATHEMATICS

Staff Development Program for Grade Six

According to the assistant director of the Mathematics Unit, 28 of the 32 community school districts (plus C.S.D. 75, which is managed centrally and is responsible for the more severely disabled special education students citywide) designed and implemented a staff development program for teachers and supervisors of grade six mathematics during the 1988-89 school year. A total of 2,503 individuals participated. However, since O.P.C.D. encountered difficulties in generating a computerized attendance database, it was not feasible to examine the number of hours individual trainees attended. (Some districts did not provide the requisite 18 hours of training and not all trainees attended all sessions offered.)

In documenting the extent to which the program was implemented, another consideration is the proportion of the target population that actually attended. Accordingly, the Mathematics Unit directed district mathematics coordinators to complete a form indicating the number of individuals in their district who were responsible for teaching or supervising grade six mathematics and the number who attended the program. Only 19 (of the 28) participating districts provided the information, and in some cases, it was incomplete. Nevertheless, the data provided some indication of participation levels.

For all districts combined, approximately half (54 percent) of those eligible to attend this staff development program did so, although the proportions ranged widely, from a low of eight percent in one district to a high of 100 percent in another. Overall, greater proportions of general education and Chapter One teachers (63 and 61 percent, respectively) than other categories of school staff participated--e.g., special education teachers (46 percent), supervisors (45 percent), and bilingual teachers (41 percent).

Perceptions of district mathematics coordinators. In order to get a more complete picture of the districts' experiences in implementing the Grade Six Mathematics Staff Development Program, OREA staff interviewed math coordinators in a sample of participating districts in May and June 1989.

Some districts had also submitted plans to replicate the Grade Four/Five Program (which had been conducted during the 1987-88 school year). Since the Mathematics Unit was also interested in obtaining information about these replication efforts, a stratified, random sample was selected to represent districts implementing both programs during 1988-89, as well as those opting only to provide the grade six training.

Interviews were obtained with mathematics coordinators in 13 out of 29 participating districts. Questions covered such issues as: the role of the Math Leadership Team; the content, timing and amount of training provided; how activities were customized; the coordinator's assessment of the program; and in the case of those

districts that also implemented the grade four/five training, reasons for doing so, and ways in which the program was modified in view of their experiences the previous year.

All of the mathematics coordinators reported that Math Leadership Teams (M.L.T.s) were organized in their districts to work in collaboration with the district mathematics coordinators in implementing the grade six program. They were chosen by the mathematics coordinators, sometimes in consultation with the superintendent or other district administrators. All had staff development experience, although the extent varied: some districts selected only staff developers or teacher trainees as M.L.T members, whereas some teams also included teachers and administrators with strong training backgrounds. However, in three districts, these teams did not function, and the coordinator alone assumed responsibility for implementing the program. Reasons for the "collapse" of the team strategy in these districts varied: in some instances, individuals who agreed to serve as team members were unable to attend the August training specifically designed for M.L.T.s; in other cases, those who did participate in the summer training could not subsequently fulfill their M.L.T. responsibilities, sometimes because they were not given release time to do so.

In the ten districts where the teams did function, the number of members varied from three to nine, but even these numbers did not remain constant in all districts--either because of attrition or the addition of new members.

The responsibilities of the mathematics coordinators in the grade six program were wide-ranging. For the most part, they oversaw all aspects of program planning, selected the topics to be presented (in most cases with input from other members), decided who would be responsible for different aspects of the program, and scheduled the workshops. All of the mathematics coordinators also led training sessions, although the extent of their involvement in these activities varied; in the three districts where the teams were not operational, they provided all of the training. The roles of the M.L.T.s, however, varied considerably from district to district. In almost half (n=7) of the districts, team members had input into developing program plans, selecting materials, and conducting workshops (or parts of workshops) on selected topics. In three districts, their involvement was limited to conducting some sessions. (In the three other districts, there was no functioning team.)

Not surprisingly, then, some teams met more often and for longer periods of time than others. In several districts, since the team was comprised of staff developers who met routinely and for whom this assignment was part of their regular job, there was no need to schedule special M.L.T meetings. In the ten districts that had functioning teams, the mathematics coordinators reported that the teams met for at least the required one hour per training session. In a few districts, the coordinators arranged for additional payment to compensate members who had put in more

time than that for which payment was provided by the program--e.g., by getting "prep time funds" or "hiring them part-time."

There was no explicit expectation or requirement that the M.L.T.s assume staff development responsibilities beyond those related to the grade six math program, (unless, of course, such responsibilities were integrated into their regular school or district position). However, Mathematics Unit leadership did consider that such a cadre of individuals might become a new resource which districts might use to meet other staff development needs. Apart from those who already had staff development responsibilities (e.g., mathematics coordinators, staff developers), M.L.T. members did not play a leadership role in other district training activities, according to the mathematics coordinators.

With regard to the staff development models adopted by the districts, eight of the 13 mathematics coordinators interviewed said that their districts opted to offer the training after school; the rest chose to give it during the school day. Those who adopted the after-school model, however, explained that it was not their preference, but that they settled for it because of problems in obtaining substitutes and/or because of principals' refusal to give teachers release time. Their objections centered around the typically low attendance and fatigue level of participants at after-school programs. In fact, one district revised its after-school design after the first few months of the program's operation because attendance was exceedingly poor.

Ten of the 13 districts provided the 18 hours of training required by the program. Of the three that didn't, two had elected to give after-school sessions but encountered serious attendance problems. Since it was too late in the school year to make major design changes, these districts scaled down their plans (with permission from the central Board) to a 12-hour program. In the third district, the coordinator explained that since the sixth grade was going to be incorporated into the junior high school during the 1988-90 school year, at about mid-year the district decided "not to invest so much time on a grade that these teachers won't be teaching next year. So we used that time to train (at the district's expense) junior high school teachers who will be teaching sixth grade next year."

Ten of the 13 districts completed the program by the March 15, 1989 deadline. Of the three districts that missed the deadline, one completed the training by the end of March and the other by early April. Reasons for the delays included schedule changes (necessitated by holidays and school conferences) and the scheduling of additional workshops in outlying locations to promote attendance. The third district gave the last workshop at the end of April, without completing the intended course of instruction. Cited as reasons were the need to cancel some sessions because of bad weather and "too many other after-school courses."

The districts customized the program in a variety of ways reflecting different needs and past experiences. Generally,

these fell into three categories: workshop content or format, scheduling, and target audience. Some examples:

- One district provided trainees with opportunities to observe how manipulatives can be used to teach new mathematics concepts by bringing students into training sessions in order to "show them how curriculum and materials are applied in reality."
- Workshops covered curriculum topics in addition to those stressed by the program.
- One district with a large Hispanic student population stressed teaching second language students.
- Training was given at the schools to encourage attendance; where possible, schools were paired by proximity and the ability to release teachers without disrupting class schedules.
- Training was provided at more than one location in a district that encompasses a large geographic area.
- The same workshop was offered on at least two alternate dates to promote attendance and minimize disruption in schools where more than one teacher participated in the program.
- Training for assistant principals and special education supervisors was scheduled first in order to secure their support.

In view of the importance of follow-up assistance to help teachers incorporate the concepts and strategies presented at workshops into their classroom practices, districts were expected to encourage school supervisors to attend staff development activities and provide subsequent in-school support to teachers. According to the mathematics coordinators, the extent of supervisor participation in program training sessions varied substantially from district to district: three coordinators reported that supervisors' involvement was minimal; five said it

was virtually non-existent; and five characterized it as considerable.

Among the strategies adopted in those districts that were successful in securing high levels of attendance by supervisors were the following:

- efforts by the mathematics coordinator to obtain the understanding and support of the principals and grade supervisors in the district--e.g., one coordinator sent letters explaining changes in the sixth grade mathematics curriculum "so that supervisors would know what to look for"; another sent principals copies of the Staff Development Resource Book and Scope and Sequence;
- the M.L.T designed workshops and meetings expressly for supervisors*; and
- the superintendent mandated attendance by supervisors and, in some cases, provided release time from regularly scheduled conferences.

In the opinions of all but one mathematics coordinator, school principals were supportive of the program. This was demonstrated, for example, by their attending the first day of training with the teachers, purchasing manipulatives and other materials, encouraging teachers to participate, requesting help from the mathematics coordinator in designing class observation lists, and reviewing lesson plans. Several coordinators mentioned principal support in implementing the concept of spiraling homework--important in their view because "teachers are

*One of the drawbacks to this approach, according to some math coordinators, was that supervisors did not know first-hand what was presented in teachers' workshops and were consequently less equipped to support them.

much more willing to change if they know the administration supports this."

Most of the mathematics coordinators (n=10) believed that the program had a positive impact on grade six math instruction in their district this year; one thought that it would have such an effect over a long period of time. The remaining two coordinators judged the impact to be moderate because the training had reached only a small proportion of district teachers. Several maintained that the final test of the program's effectiveness would be improved student test scores, but said they had observed improvements this year in classroom teaching. Some coordinators noted that even experienced teachers, reputedly less inclined to try new techniques, had begun using manipulatives and teaching new topics.

Factors that mathematics coordinators most often cited as having facilitated participants' use of what they learned in the program were: support by district superintendents, principals and supervisors, particularly the mandated attendance of certain groups, and willingness to give release time (n=9); the provision of appropriate, readily usable instructional materials to teachers (n=11); and the generally high quality of the training sessions (n=13)--specifically, the enthusiasm and skill of the presenters, the hands-on approach, and the opportunities provided for peer support and collaboration.

Among the things that impeded classroom implementation were the following: insufficient manipulatives (they wanted class

sets); inadequate number of trainers to do the requested follow-up; and lack of support from administrators in some schools. Other problems related to program implementation included poor attendance associated with after-school scheduling, inability to get substitutes, too much material to be covered in the time allowed, and difficulties in integrating training for special education teachers.

Of particular interest in evaluating this program was the M.L.T. turnkey training model that was adopted for the first time during the 1988-89 school year. The ten mathematics coordinators whose districts had functioning M.L.T.s were unanimous in their judgment that this staff development strategy had been successful and recommended that it be continued. (The other three coordinators endorsed the approach based on their observations of the model in other districts.) Asked specifically about the orientation provided by the central Board for M.L.T.s in August 1988 (prior to the programs' implementation during the 1988-89 school year), the nine mathematics coordinators who had attended the summer training believed that it had prepared them for their role of overseeing the program's development and implementation, largely by acquainting them with citywide requirements and providing a useful framework for structuring the program. However, some said that too much time was spent devising the district plan and not enough was devoted to hands-on subject matter training. Three half-days, in the opinion of several coordinators, were not sufficient to cover the required material.

Of the four coordinators who did not attend the August orientation session, two received condensed "mini" versions of the training through one of the Mathematics Resource Centers, the satellite facilities of the Mathematics Unit. Other ways in which the resource centers supported some districts, (i.e., those who requested assistance) in implementing their local training program included making presentations at some workshops and providing information on particular topics.

Suggestions by district mathematics coordinators for providing more effective mathematics staff development in their districts centered around the following: making attendance by teachers and supervisors mandatory; modeling all teaching techniques using actual classroom situations (not a hand-picked class); setting aside a day for training when children are not in school; addressing the needs of special education teachers separately; and developing strategies specifically for ESL teachers.

Finally, three of the mathematics coordinators interviewed said that their districts also replicated the grade four/five training during the 1988-89 school year. It was directed at teachers who had not participated in the program during the previous year--i.e., teachers new to the district or newly assigned to grade six. Among the ways the program's implementation was different this year were the focus on a specific population and the use of more than one presenter at full-day sessions, which exposed participants to a greater

variety of ideas and more opportunities for sharing. In addition, the staff developers were more experienced. The mathematics coordinators agreed that the program was more successful this year, although one commented on the on-going problem of getting release time for teachers.

Perceptions of mathematics leadership teams. In order to better understand how the M.L.T. model functioned, OREA also interviewed a sample of other team members in the same sample of districts in which mathematics coordinators had been interviewed. (Two individuals were selected at random from the names of team members provided by the mathematics coordinators.) A total of 18 M.L.T. members in the 13 districts sampled were available for interviews. For the most part, they were seasoned educators with strong math backgrounds and some staff development experience.

Overall, team members were more critical of the August 1988 training provided by the central Board of Education than were the mathematics coordinators. Of the 13 M.L.T.s who attended, almost half (n=6) said that it had not adequately prepared them for their role as turnkey trainers. Their criticism centered on the excessive amount of time devoted to designing a district plan and the failure to provide adequate direction in how to teach the sixth grade curriculum. While they were generally dissatisfied with the training, however, they indicated that they were able to perform their training tasks because of their previous staff development experience. Some of those who viewed the summer training favorably also expressed disappointment about the

emphasis on plan development instead of strategies for teaching. (The program's design had anticipated that those selected as M.L.T members would have strong backgrounds in teaching mathematics.)

With regard to the role they played in implementing the grade six math program, nine team members reported that they had input into decisions about what topics would be covered, what materials would be used, and who would present which segments of the training. For the most part, the teams functioned as resource and support groups: they shared ideas; collaborated in compiling and developing materials; and rehearsed and critiqued each others' presentations. In some instances, more experienced team members supervised the workshop presentations of less experienced members. About half of the M.L.T.s reported that they also had other duties, such as ordering and distributing materials, taking attendance for payroll purposes, and maintaining records.

Two of the respondents did not serve on the team after the August training because in September they were given new assignments from which they could not get release time. The role of two others was limited to making workshop presentations because they had joined the team after major planning decisions had been made.

Most of the respondents (n=14) served as trainers, although the level of their involvement varied. For example, some M.L.T.s presented only one segment of a workshop, whereas others conducted full-day sessions.

Since districts were expected to customize the training to meet the needs of those responsible for grade six mathematics, one interview question asked M.L.T.s how their team identified these needs. Among the strategies cited by the 13 respondents who knew how district staff development needs were determined were the following: team members' overall familiarity with teachers' competencies and weaknesses, topics with which teachers were typically comfortable and those with which they needed help; team members' understanding of the major themes covered in the new grade six curriculum; students' test scores on various topics on citywide tests; feedback from surveys asking teachers to specify those topics with which they wanted help. According to the M.L.T.s, training in their districts stressed cooperative learning, problem solving, and the use of manipulatives, as well as specific topics such as probability and statistics. One M.L.T mentioned the use of modeling--using students in actual classroom situations to show teachers how to teach a particular topic or use a specific instructional strategy; another cited the use of "string art" to motivate students.

Most of the M.L.T.s (n=14) judged the resource kit and other instructional materials provided by the central Board positively. Eight, however, expressed the opinion that materials should be distributed in numbers approximating class sets, or at least in sufficient quantity for two students to share each of the items.

Overall, the M.L.T.s concurred with the mathematics coordinators regarding the factors that facilitated participants'

ability to integrate what they had learned into their classroom instruction of mathematics, although they emphasized different factors. While the mathematics coordinators stressed the importance of administrators' support, the M.L.T.s tended to credit the content and quality of the workshops--specifically, the hands-on approach, the modeling of teaching new topics, and peer support. Also valued was "not being lectured to by outsiders" and presentations by different staff developers during a one-day workshop.

The most notable impediment to successful use of the training, cited by one-third of the M.L.T.s, was the large amount of material to be covered.

Like the mathematics coordinators, the M.L.T.s were positive in their assessments of the program's impact on math instruction in their district. They based their judgments mainly on classroom observations, but also on feedback from teachers. Some observations by M.L.T.s: "Teachers were now teaching subjects they couldn't and wouldn't teach before..."; "teachers were using new materials, new approaches,... much improved instruction." One M.L.T. reported that teachers valued the training because it reduced their "math anxiety." M.L.T.s also agreed with mathematics coordinators that the turnkey model is an effective approach to staff development. One reason cited for this was that "it brings teachers training from teachers in their own district who they can call on at any time." It also provides, in

the opinion of another respondent, "a cadre who know what the philosophy of instruction in math is."

Generally, suggestions made by M.L.T.s for providing effective staff development focused on continuing and improving the turnkey model, finding ways for teachers to attend training during the school day (e.g., allowing closing of schools during the school year for staff development days), and giving more support to new teachers.

Trainees' assessment of mathematics training. In order to provide an indication of how trainees in the 1988-89 Grade Six Mathematics Staff Development Program viewed the training and to gauge the extent to which they utilized it, OREA developed a participant reaction form in collaboration with the Mathematics Unit. Staff developers distributed the questionnaire to participating teachers and supervisors at the conclusion of the workshops. OREA received responses from 791 of the 2,503 trainees, a response rate of 32 percent. These came from 20 of the 28 participating districts.

Almost three-fourths (72 percent) of the questionnaires were from elementary school staff, with the remainder coming from junior high or intermediate schools. The majority of respondents (56 percent) were general education teachers, while an additional one-fifth (18 percent) were special education teachers. Only three percent were general or special education supervisors. The rest held various other staff positions.

On the whole, the participants were experienced in mathematics teaching. Almost half (49 percent) had taught or supervised mathematics for more than ten years; for only 10 percent was 1988-89 their first year teaching mathematics. Asked to rate their background in mathematics, a large majority (82 percent) judged it to be "good" or "excellent."

Most respondents (58 percent) received the requisite 18 hours of staff development, with two percent attending even more than the required amount. Approximately a third (29 percent) attended between 12 and 17 hours. Roughly one-tenth (11 percent) attended 11 hours or less. Most (87 percent) had not attended the Grade Six Mathematics Staff Development program offered during the 1986-87 school year.

Trainees were asked to rate the staff developers with regard to three criteria. More than 95 percent of the respondents rated trainers as "good" or "excellent" in their knowledge of curriculum topics, presentation of subject matter, and responsiveness to participants' questions. Almost all participants (95 percent) found the training to be appropriate to their teaching or supervisory responsibilities.

To help gauge the extent to which the training content reflected the program's objectives, participants were asked to indicate how effective the workshops were in providing assistance with each of eight teaching strategies. For every listed topic, most respondents reported that the training was "moderately" or "very" effective, although the size of the majority varied from

topic to topic (from 64 to 79 percent). Over 90 percent noted that the program provided effective assistance in basing instruction on the New York City Scope and Sequence of Objectives, helping students to develop problem exploration strategies, using manipulatives to develop mathematics concepts, and promoting collaborative learning. In the case of only one topic, providing multicultural learning experiences, did fewer than 80 percent of the respondents find the program to have been effective, with only 64 percent believing that it promoted that goal.

Participants were also asked to indicate the extent to which they integrated these topics into their mathematics teaching or supervision. The majority of respondents reported that they had integrated them "moderately" (64 percent). Among the factors contributing to the application of the training were the availability of hands-on materials and the stimulating nature of some of the strategies, such as problem exploration and journal writing. Impediments to the classroom integration of the ideas presented were teachers' unfamiliarity with new materials and lack of comfort with newly acquired skills (attributed to the provision of training too late in the school year), and the inappropriateness of what was presented for "difficult" student populations--e.g., those below grade level, lacking motivation, or with behavior problems.

A series of open-ended questions asked respondents to assess the impact of the training on their attitudes and classroom

practices, and to comment on any additional assistance needed. A 25 percent sample of the questionnaires (n=200) was analyzed; the findings reported here are based on this subsample.

Only 38 percent of these respondents cited ways in which the district or school could help them to make better use of the training. These focused largely on providing more manipulatives and other instructional materials (n=42), in-depth training on particular mathematics topics (n=12), and demonstration lessons in real classroom settings (n=8).

Most respondents (63 percent) indicated that the program had a positive effect on their attitudes toward mathematics and approaches to teaching it. Mentioned in particular were an improved understanding of mathematics topics and ways of teaching them (n=84), increased self-confidence (n=20), heightened enthusiasm for the subject (n=12), and recognition of the importance of "making math fun to learn" (n=10).

Mathematics Resource Centers

In March and April 1989, OREA staff conducted interviews with the supervisors of each of the three M.R.C.s. All centers had been fully operational since the beginning of the school year, although budget cuts at the central Board of Education precluded the hiring of a teacher trainer at either the Bronx or City College of New York site. (Professional staff at each center was supposed to consist of a full-time supervisor and teacher trainer.) In addition, original plans called for a full-

time secretary at each site; however, during 1988-89, this position was filled only on a half-time basis.

Both the lower Manhattan and Bronx M.R.C.s are located in public schools. The lower Manhattan center occupies two large, former classrooms. One room is used for administrative tasks, another contains a resource center and primary teaching/training center. The Bronx M.R.C. has the most space, occupying about one-third of the top floor of the building. Rooms are used for storage, administrative tasks, an informal lounge area for teachers, and a large classroom for training. OREA staff visited the Bronx M.R.C. when a training workshop was in progress. There were about 40 elementary teachers present from at least three boroughs, experimenting with a newly-developed mathematics game for classroom use. This all-day workshop was presented by the vendor involved, and teachers were served refreshments including lunch, and so had an opportunity for informal interaction. The upper Manhattan M.R.C. is located at the School of Education of the City College of New York, and consists of one large room, used for training and the display of resources, as well as one small room used for administrative tasks. All M.R.C.s have endeavored to create an attractive, comfortable environment conducive to sharing and learning.

All centers provided a wide range of activities and services during the 1988-89 school year. These included the following:

- staff development workshops and conferences held two to five times a week, typically attended by 20 to 40 individuals; participants have included a wide variety of school and

district staff, college personnel and students, and vendors of educational materials;

- drop-in services, such as assistance in the use of reference materials and individual consultations;
- programs for parents and students, such as PTA presentations, and sessions on consumer and family mathematics;
- off-site presentations, including workshops and demonstration lessons at district offices and schools; and
- other mathematics-related activities, such as editing curriculum, evaluating computer software, and supervising mathematics leagues.

M.R.C. supervisors generally considered working with teachers and building a "teacher alliance" to be the most significant accomplishment of the centers. Also mentioned was the opportunity to reach out to new teachers and "plant seeds" for their involvement in future staff development activities. They pointed to their record of activities as an indication of how much their services are utilized and valued.

A major reason for establishing the upper Manhattan center at C.C.N.Y was to promote a cooperative relationship with the faculty and students of its School of Education. This is reflected in several ways: members of the college faculty have participated in various M.R.C. training activities; the supervisor of the M.R.C has taken part in various college faculty meetings and workshops and has, as a result, secured college support for special M.R.C projects; and the center's collection of current reference and instructional materials, including manipulatives, computer software, and videotaped conferences and

lessons, serves as a source of mathematics education information for faculty and students.

All of the M.R.C supervisors experienced the need for a teacher trainer (in the case of the lower Manhattan center, an additional teacher trainer), and at least two more professional staff. This, they maintained, would enable the centers to serve more teachers, and would provide much needed opportunities for collegial exchange and support among M.R.C staff.

Asked what problems they encountered this year, all center supervisors mentioned security, a special concern at the lower Manhattan center where there had been a previous break-in. At the lower Manhattan M.R.C., problems centered around inadequate parking facilities, securing release time for teachers, and timing workshops to coincide with their schedules. The supervisor of the upper Manhattan site referred primarily to problems relating to temperature control, mail delivery, lack of storage space, and shortages of office supplies. The Bronx center supervisor complained about inadequate supplies and manipulatives. There are plans at all three locations to obtain more materials and equipment: manipulatives, software, an answering machine, security devices, and equipment for taping demonstration lessons.

With regard to future program plans, all M.R.C. supervisors talked about expanding their activities. However, funding concerns and uncertainty about the future status of the

M.R.C.s--whether they would continue to be administered centrally or would be managed by individual districts--overshadowed these plans.

SCIENCE

STAC Program

Grade four attendance data provided to OREA indicated that the Brooklyn and Queens STACs offered a total of 2,740 days of training for teachers and 249 days for supervisors. Not known, however, is the total number of individuals who attended the program, or how many days they attended (teachers were expected to attend three days of training and supervisors for one-and-a-half days.)

Such information is important for formulating realistic expectation of program impact and interpreting evaluation findings.

Perceptions of STAC staff development specialists. In June 1989, OREA staff interviewed the four elementary staff development specialists at the Brooklyn and Queens STACs (two at each center) about the grade four science program offered at the centers during the 1988-89 school year. Questions focused primarily on the program's implementation, the nature and extent of the support provided by participating schools, and the staff developers' assessment of the program's impact on science instruction.

At both STACs, the staff developers' responsibilities were wide-ranging, and went beyond conducting the program's all-day

workshops. These duties included developing "STAC packs" of curriculum activities and hands-on materials, ordering supplies, attending to administrative tasks, maintaining reference materials and equipment, and responding to telephone requests for assistance. In addition to help from central Science Unit staff, which provided support in devising staff development strategies and duplicating materials, the staff of the Brooklyn and Queens STACs sometimes worked collaboratively, sharing ideas and otherwise helping each other. This team effort extended to the junior high school level STAC specialists, who often had knowledge about content areas in which elementary staff did not have expertise, and occasionally to program participants, who made useful suggestions.

In its memorandum inviting schools to participate in this program, the Science Unit required that each teacher selected attend the three days of training, that each school send a minimum of two teachers, and that one supervisor from each attend two days of staff development designed to complement the training provided for teachers. The rationale for these requirements was manifold: to ensure that teachers would have an opportunity to meet with their peers over an extended period of time and establish a collegial spirit; to lend continuity to the training; and to provide a basis for in-school support and assistance--among teachers, and between teachers and supervisors. (Workshops for supervisors stressed the concept of science as a process for solving problems and not merely a body of knowledge, encouraged

the tolerance of noise and use of unsophisticated equipment, and offered techniques for supervising science lessons.)

The staff development specialists at both STACs reported that there was greater compliance with these requirements this year than there had been during 1987-88 with the Grade Five Staff Development Program. Some principals sent more than two teachers; others asked that those who attended the STAC training make grade level presentations for their colleagues. They attributed this improved school cooperation largely to the positive feedback principals received about the program last year, while acknowledging that the administration of the Elementary Science Program Evaluation Test (ESPET) citywide in grade four this year undoubtedly spurred interest in attending the STAC training. Other STAC policies, whereby teachers from the same school did not have to be out of the building on the same days for training (an important issue for principals), and dates could be rescheduled if necessary, also encouraged greater participation, according to the staff developers.

In view of the program's recognition of the importance of follow-up support to assist teachers in integrating what was presented during the STAC training into their classroom practices (and the incorporation of strategies to promote such support into the STAC staff development design), the staff developers were asked about follow-up activities. The Brooklyn STAC staff developers said that on-site support by school supervisors who attended the program varied, and depended largely on the

priorities of principals; in Queens, the staff developers inferred from the lack of negative comments by teachers, and from requests from superintendents and Parents Association members for help in obtaining materials, that there was in-school support for grade four science education in participating schools.

The STAC staff development plan originally included follow-up visits by staff developers to monitor the extent to which training was being put into practice and to provide additional assistance as needed. However, according to all four staff development specialists, the scope of their responsibilities (which included conducting workshops three to four days a week) precluded their making such on-site visits. In addition, they reported resistance from some school administrators, who even discouraged the presence of district science coordinators in their schools.

Nevertheless, STAC staff were available to program participants (and other district and school personnel) who came to the centers or telephoned for help. Such requests, however, were minimal, as was utilization of the resource facilities of the STACs by elementary schools staff in general. In part, the staff developers attributed this to the disinclination of teachers to come to the STACs after school, particularly in the case of those for whom the Queens and Brooklyn locations are not convenient. Apart from the "ideal" situation--i.e., "having a STAC in every borough, if not in every district"--some of the staff developers believed that as more people attended STAC

workshops, and as other staff development activities were conducted there by organizations such as the Audubon Society, more individuals would become aware of the resource facilities of the STACs.

Another factor, in the opinion of the staff developers, is that elementary level staff generally perceive less of a need for extensive science resources than do intermediate or high school teachers. Lack of easy access to telecommunications systems in elementary schools, moreover, limits their ability to use the science education computer bulletin board STACNET. While elementary staff apparently made little use of the resource facilities of the STACs themselves, the staff developers indicated that the reference materials were valuable resources for them in providing assistance to school and district personnel.

When asked what impact the program had on grade four science instruction, all of the elementary STAC staff specialists commented on the enthusiasm for science it engendered on the part of teachers and their excitement upon observing the reactions of their students to the hands-on science lessons. This reaction was especially gratifying to the STAC staff because it came largely from individuals who previously were afraid of science and uncomfortable teaching it. As one staff developer put it, "It's very exciting for teachers to be able to teach a period which kids love."

Another issue that was addressed was the role of the science cluster teacher. Although this staff position is supposed to supplement classroom instruction, in actuality the role varies from school to school, according to the STAC staff developers. In some cases, the cluster teaches most or all of the science lessons depending, for example, upon the size of the school, the science backgrounds and interests of the classroom teachers, and other teaching or administrative responsibilities the science cluster may be asked to assume, such as providing substitute coverage. In other schools, the classroom and cluster teachers share instructional responsibilities, although in some schools there was little time for them to collaborate. The STAC staff developers reported that while they encouraged classroom teachers to assume primary responsibility for science instruction and view cluster teachers as "adjuncts" or "resources," they noted that this was really an administrative issue, and expressed the belief that acceptance of this perception of the respective roles of classroom and science cluster teachers would have to "evolve over time." To further support teachers in becoming more actively involved in science instruction, the STAC program included strategies for integrating science with other subject areas, areas with which elementary teachers are more comfortable and which they are more accustomed to teaching. The message conveyed to teachers, as one staff development specialist put it, is that "science is everywhere." In addition, classroom teachers are

better able than cluster teachers to integrate science with other subject areas.

Among the major science staff development needs of school staff, in the opinion of the STAC staff developers, were the following: perceiving science as a process for solving problems and not just a body of knowledge; recognizing that their life experiences account for a greater understanding of basic science than they realize; assistance in using everyday materials for hands-on activities; and knowledge of science content.

According to the STAC staff developers, problems specific to science clusters include lack of a permanent classroom, which necessitates their walking around like "shopping bag ladies," carrying their materials around from classroom to classroom; and having to serve as "utility infielders," providing substitute coverage as needed for different subjects and grades (sometimes resulting in cancellation of their science classes).

In addition to mounting their own science education programs, STAC staff participated in, or otherwise assisted with, other staff development initiatives. These included activities sponsored by non-public school programs, early childhood projects, bilingual and special education programs, and training initiatives requested by community school districts. The STACs also served as host sites for presentations by science organizations such as the Audubon Society and National Aeronautics and Space Administration (NASA).

With regard to implementation of the Grade Four Science Program this year, the STAC staff developers agreed that one of the major problems was obtaining needed materials and supplies because of the complex bidding process required by the Bureau of Supplies. Although the decision to allow STAC staff to purchase supplies out-of-pocket and apply for reimbursement eased the problem somewhat, this procedure could not be utilized for buying the large quantity of materials to be given to program participants for classroom use. Further, budget delays and other restrictions regarding the use of vendors under contract to the Board of Education meant that the STACs could not always distribute "take-away" materials to participants at the conclusion of workshops.

Much of the program's success, in the opinion of the staff developers, was attributable to the support provided by the central Science Unit, and the commitment and cooperation exhibited by the STAC staff. Their concerns about the future operation of the STACs, in light of the central Board's plan to shift responsibility for their administration to the community school districts in which they are located (the host districts), focused primarily on personnel issues (such as reclassification of STAC staff positions), procedures for securing equipment and supplies, and the duplication of instructional materials. One staff developer expressed misgivings about the potential for host districts to require special services of the STAC under their

jurisdiction, leading to a "citywide vs. local tug-of-war that could destroy the STAC as it is."

Trainees' assessment of STAC training. Questionnaires developed by OREA, in collaboration with the Science Unit, were distributed to grade four STAC participants by staff developers at the conclusion of the training. These questionnaires were designed to assess trainees' perceptions of the program and its impact on their science attitudes and instructional practices. A total of 800 individuals from 30 districts (including C.S.D. 75) returned questionnaires. (The response rate cannot be calculated because the total number of program participants was not provided to OREA.)

Most of the respondents (76 percent) were general education teachers; of the remainder, the largest group (16 percent of the total) consisted of science cluster teachers. About half of all respondents (51 percent) reported having taught elementary science for eight or more years; for relatively few (13 percent), 1988-89 school year was their first year training the subject.

Less than half of all respondents (42 percent) had some graduate or in-service credits in science. (However, a higher proportion of science cluster teachers than classroon teachers had such training--68 vs 37 percent). Of those who had such advanced training, the majority (51 percent) had taken between three and six credits; more than one-third (39 percent) had taken more than six credits. Asked how comfortable they felt teaching elementary science prior to participating in the STAC program,

almost half of the respondents (47 percent) answered "minimally" or "not at all." Only 15 percent claimed that they were "very comfortable" teaching science.

The STAC program consisted of three days of training held on school time; participants were expected to attend all three days. (Different groups of trainees attended different three-day cycles throughout the school year.) A large majority (84 percent) reported that they fulfilled this expectation.

In order to determine the extent to which the topics covered in the STAC training were consistent with the program's objectives, one questionnaire item listed a series of science concepts and strategies that Science Unit administrators considered to be the major program objectives. Participants were asked to indicate which of the items had been included in the sessions they attended. More than 90 percent of the respondents said that five of the six topics had been addressed; in the case of one item, approximately three-fourths (76 percent) said it had been included.

The overwhelming majority of participants praised the staff developers highly. They were asked to rate trainers according to three criteria: knowledge of curriculum topics; presentation of subject matter; and responsiveness to participants' questions. On each of these counts, virtually all trainees (99 percent) rated the trainers as "good" or "excellent."

In order to ascertain the degree to which participants actually used the STAC training, those who provided grade four

science instruction this year (not all program participants had science teaching responsibilities) were asked to indicate to what extent, overall, they had integrated into their science instruction the major concepts and strategies presented in the workshops. The vast majority of respondents said "moderately" or "extensively" (49 and 45 percent, respectively); only six percent said "minimally."

One of the major objectives of the STAC program was to help classroom teachers, who typically do not have strong science backgrounds and consequently do not feel comfortable teaching this subject, to have more confidence in their ability to teach it. One hoped-for outcome of the training, therefore, was that classroom teachers would devote more time to science. Teachers were asked, first, how many hours of science instruction per week their fourth grade students had received this year. Approximately three-fourths (74 percent) replied that students had received from two to three hours per week; 15 percent reported that their students had received four or more hours of science instruction; and 11 percent reported that students had received only one hour per week. Another question asked who provided this instruction and what percentage of the total instructional time each provided. Approximately half of the respondents (53 percent) said that both the classroom teacher and science cluster teacher had provided instruction in their schools this year; one-third indicated that teachers had assumed this responsibility entirely; and 12 percent reported that science

instruction had been handled by the science cluster teacher alone. (Other school staff were involved in some instances.)

When these school situations were considered together, classroom teachers provided, on average, more than half (62 percent) of the total instructional time, and cluster teachers provided the rest. However, in those schools where the responsibility for grade four science instruction was shared, respondents estimated that it was divided equally.

Asked to compare the amount of time they devoted to science instruction this year with that devoted last year, approximately two-thirds (68 percent) of classroom teacher respondents said "more", close to one-quarter (23 percent) said "about the same", and about 10 percent said "less."

Previous OREA evaluations have pointed to the importance of follow-up assistance to help participants put what they have learned into practice. While the STAC staff development plan called for in-school monitoring and assistance by the staff developers, as has been noted earlier in this report, their wide-ranging responsibilities precluded such on-site follow-up visits. As would be expected, therefore, only a small proportion (13 percent) of the trainees reported receiving such help. Nor, did most STAC participants (80 percent) receive any follow-up assistance from their school supervisors, despite the program's efforts to support supervisors in fulfilling this responsibility.

A series of open-ended questions focused on participants' overall assessment of the program's impact on their attitudes

toward or instructional approach to science, and any additional assistance needed. For all of these questions, a 25 percent subsample of questionnaires, selected at random, was analyzed (n=200).

Most of these respondents (84 percent) affirmed the usefulness of the training. Its greatest influence appeared to be in instilling trainees with a confidence and enthusiasm about teaching science that they had previously lacked; a majority (53 percent) of those who responded noted their more positive attitude. In one representative comment, a trainee explained: "I'm much less afraid of teaching science lessons and leading experiments. I'm beginning to love and enjoy science." A third of the respondents noted that the program had strengthened their skills in using hands-on teaching methods. Specifically mentioned was the helpfulness of the program's stress on using everyday materials rather than relying on expensive and elaborate supplies. Wrote one, for example: "My school provides nothing in equipment. STAC gave ideas for inexpensive ways to do experiments." In addition, some (13 percent) answered that the training had improved their understanding of the fourth grade science curriculum content.

Also indicative of the program's popularity was the fact that virtually all respondents answered that they would recommend it to their colleagues. The answers of most of those who elaborated on their reasons for recommending the program fell into three categories: the range of teaching techniques

introduced (20 percent); the usefulness of the hands-on strategies presented (12 percent); and increased confidence in themselves as science teachers (11 percent). One wrote, for example, that she would recommend the program because "many of us--particularly women--were never made to feel comfortable in science." Of the 90 teachers who said they could have used additional assistance in making effective use of the training, close to half (41 percent) expressed the desire for more materials. Interestingly, almost a third (31 percent) of the respondents saw no need for additional assistance.

The high level of satisfaction with the program was also reflected in the trainees' recommendations for improving it. Of the 46 individuals who provided suggestions, the majority (62 percent) asked only for more training, while almost one-fifth (18 percent) called for more follow-up assistance. Close to 15 percent thought there was no need to change the program at all.

Supervisors' assessment of STAC training. At the conclusion of training sessions for grade four supervisors, staff developers distributed questionnaires developed collaboratively by OREA and the Science Unit in order to assess school supervisors' perceptions of the training and its impact on the teaching of science in their schools. A total of 79 individuals (46 from

Brooklyn, 33 from Queens) returned questionnaires.* Most respondents (89 percent) supervised general education, and two percent were special education supervisors. The remaining nine percent included science specialists (e.g., district science coordinators, cluster teachers) and one principal. Three-fourths had eight or more years of elementary science teaching experience; less than five percent had just completed their first year; and the rest had between two and seven years of experience.

While a majority (56 percent) had graduate or in-service credits in science, a sizable proportion (44 percent) did not. Of those who had earned credits and reported the number of credits earned, most (61 percent) had completed from six to twelve credits. Approximately one-quarter (24 percent) earned fewer than six credits, while 16 percent earned 15 or more. A majority (69 percent) of the respondents reported that prior to participating in this staff development program, they had felt "moderately" or "very" comfortable supervising elementary science, while about one-third (31 percent) of the respondents had felt "minimally" or "not at all" comfortable.

The STAC program offered one-and-a-half days of staff development for grade four supervisors. The majority (62 percent) attended the full day and a half, and the rest claimed attendance for a half day only.

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*Since the number of supervisors who participated in the STAC training was not available, a response rate could not be calculated.

The questionnaire asked supervisors to rate the staff developer(s) with regard to knowledge of curriculum topics, presentation of subject matter, and responsiveness to participants' questions. Nearly all of the respondents (91 percent or more) rated developers as "good" or "excellent" in each of the three areas.

One questionnaire item listed eight science concepts or strategies that, according to the director of the Science Unit, pinpoint the program's major objectives. In order to determine the extent to which these topics matched program objectives, participants were asked to check all topics that were included in the training sessions they attended. Three-quarters or more respondents said that all but one of the topics listed were included in the training; for five of the eight concepts and strategies listed, 90 percent or more said they were included.

In order to determine the extent to which participants utilized the STAC training, another item asked them to rate how helpful the training was in view of their responsibility to assist fourth grade teachers in planning and implementing effective science lessons. Supervisors overwhelmingly found their training helpful in this respect, with 99 percent rating it "moderately" or "very" useful.

In an open-ended question, participants were asked to share their perceptions of the impact that the STAC training had on the classroom practices of those fourth grade teachers in their respective schools who attended staff development sessions.

(Only one supervisor reported that no teachers in his school had attended the STAC program.) Among the effects reported by those who answered (80 percent of participants) were a more extensive use of the hands-on-approach (37 percent), the generation of an interest in science
(32 percent), and an attenuated fear of science (19 percent). Most supervisors' assessments of STAC training's impact on teachers were of a general rather than specific nature: "It exposed teachers to new ideas"; "sharpened scientific thinking"; and "improved teaching strategies." Five respondents reported that "more" science was being taught by STAC-trained teachers.

Another open-ended question asked supervisors for a brief description of the support they provided to teachers of fourth grade science during the 1988-89 school year. Of those who said that they did offer support (n=69 out of 79), the greatest number said that they made materials and supplies available
(55 percent). A sizable number of respondents arranged for meetings of various types: workshops and demonstration lessons were utilized by 46 percent; and 23 percent organized grade/staff conferences. Fourteen respondents (20 percent) observed teachers' science classes, and 13 percent reviewed lesson plans. Ten percent reported preparing teachers for administering the ESPET.

When asked to compare the amount of time they devoted to supervising science instruction during the 1988-89 school year

with the amount of time devoted to it the previous year, three-quarters of the respondents said they devoted more time in 1988-89. One-quarter said that they devoted about the same amount of time each year. Significantly, none said they devoted less time to supervising science instruction in 1988-89.

Another question asked respondents for suggestions for improving the STAC training. The responses of a subsample comprising those participants who attended the one and a half days of training offered (62 percent of participants) were analyzed.* Exactly one-quarter of this subsample offered no suggestions. Of the participants from the subsample who did offer suggestions (n=34), ten said that there should be more/longer sessions and eight pointed to a need for follow-up. Five believed that more topics should be covered, while four suggested field visits from STAC personnel. One thoughtful recommendation was that "values" be included in the teaching of science, with an aim toward dealing with social problems.

*Limiting the sample to those who had attended the entire program provided for a greater level of confidence in respondents' judgments about its overall strengths and weaknesses, and suggestions for improving it.

District Staff Development Programs

The Science Unit provided attendance data for four of the six districts that implemented their own grade four science program. A total of 222 individuals attended these locally developed programs. The number of participants in each district ranged from 30 to 75, and the number of hours of training they attended ranged from 12 to 19, with a mean of 16.6 hours. (Districts were required to offer 15 hours of training.) The percentage of grade four teachers in each of these districts that participated in the program was considerable, ranging from 60 to 87 percent.

District science coordinators' perceptions. In order to better understand districts' experiences in implementing the Grade Four Science Staff Development program, OREA staff conducted interviews in April and May 1988 with science coordinators in the six districts that elected to provide training locally, and with the coordinator in another district that opted to hire STAC staff developers to provide workshops for their teachers.* Questions focused on the rationale for choosing this option, the major responsibilities of key participants, the timing and amount of training offered, ways in which activities were customized, and coordinators' assessment of the program.

Four of the science coordinators whose districts chose to implement their own grade four science training expounded upon

*In one district, the science coordinator provided written responses to the interview questions.

their districts' long-standing commitment to and involvement with science education. One district had an environmental resource center (housed in a former fireboat house on the East River) staffed by a science coordinator with extensive curriculum and staff development experience, and two additional full-time science personnel. Another district had been awarded a three-year grant from the National Science Foundation (NSF). This grant included a plan for training elementary and middle school staff, and provided for the establishment of a professional resource center, collaborative relationships with other educational and cultural institutions, and a mentor science program. The science coordinator of the third district cited the success of previous on-site staff development programs implemented by the district that included in-classroom demonstrations and modeling of small group instruction. Another district had developed a comprehensive, multidisciplinary staff development program for teachers of kindergarten through grade six that utilized a turnkey approach; during 1988-89, the emphasis was on science. The science coordinator also commented on the history of support for science education in this district on the part of the superintendent, who had a strong background in science.

In two of the six districts that opted to implement their own grade four science program, the coordinators did not know the reasons for this decision--both were new to their position and had not been involved in the decision-making process; one

coordinator, however, speculated that the Brooklyn and Queens STAC locations were not convenient for teachers, and noted that the district had community resources, such as zoos, at its disposal.

In another district in which the science coordinator was newly appointed, the superintendent had not originally planned to mount a district-based program for elementary level teachers because of past problems in obtaining substitute teachers. This district subsequently arranged to pay the STAC staff developers per session (with district funds) to provide half-day workshops for teachers on two Saturdays at the Brooklyn STAC. Although the Science Unit considered this a district-based program, its reliance on STAC facilities and staff sets it apart from the other locally developed programs. Consequently, in order to distinguish this program from the other district programs, it will be referred to hereafter as the "local STAC" program.

The strategies employed by the districts in implementing grade four science training varied widely, with regard to both conceptual approach and utilization of resources. Following is a brief description of the models adopted in each of the seven districts.

- The science coordinator, assisted by two full-time science educators, designed and conducted a series of workshops at the district's environmental center, a resource and training facility sponsored jointly by the Board of Education and the local community. Two other district-based personnel provided in-school help with the administration of the ESPET.

- Staff development for grade four teachers was part of the district's major science education commitment, funded by a

three-year NSF grant. The elementary level plan, which targets ten schools per year, during 1988-89 included training for teacher mentors (one per school) at the district's newly established professional science center, and opportunities for graduate study with staff scientists at the Museum of Natural History for mentors (as well as other teachers and supervisors). Other resources in this district included five scientists from the City College of New York who served as program consultants and five master teachers who provided some staff development sessions and on-site support.

- A school-based staff developer with a good science background and curriculum writing skills assisted the science coordinator in developing instructional materials and training a cadre of "science phobic" teachers from each participating school, who in turn, trained their peers. These turnkey trainers (who received 11 hours of training) were to serve as models for other teachers without strong science backgrounds, demonstrating that teaching elementary science does not require mastery of complex scientific concepts or use of sophisticated equipment.

- The science coordinator, together with a language arts and a mathematics coordinator, implemented a staff development program that emphasized the integration of science with other subject areas.

- A district staff developer (formerly, a science cluster teacher) with expertise in small group experimentation gave classroom demonstration lessons, individual and grade level conferences, and other in-school assistance. The program stressed on-site, experience-based training tailored to the needs of individual teachers and their students. In addition, two assistant principals with extensive science education experience provided staff development sessions for school administrators, supervisors, and teachers.

- The science coordinator, in collaboration with a district special education teacher trainer with expertise in mathematics and science, designed and conducted all program workshops. Also included were presentations by individuals from community organizations involved in science education--e.g., a representative from the local zoo familiarized t achers with educational programs, and a spokesperson from the Navy's Adopt-a-School Program described in-school marine and boat visiting opportunities.

- STAC staff developers conducted workshops on two Saturdays for district teachers at the STAC; one of the trainers had previously worked in the district and was therefore familiar

with its student population and limited science resources. The science coordinator gave a workshop on the administration of the ESPET for one representative from each participating school, who was to serve as "elementary science mentor" for his or her colleagues.

The responsibilities assumed by the science coordinators in implementing these programs were wide-ranging and typically included developing curriculum materials, designing and conducting all or some of the workshops, supervising staff developers, reviewing and ordering materials, and attending to administrative tasks such as scheduling activities, arranging for sites, registering participants, and developing budgets.

Although districts were required to offer a total of 15 hours of training, the actual number of hours reported by the science coordinators varied considerably--from four to 90 hours. In four of the districts, participants could have attended the requisite 15 hours of staff development (and in some of these cases, even more). In two of the three districts that gave less than 15 hours, the science coordinator was new to the position; the district that gave the least amount had utilized a turnkey training approach. The turnkeys (one per school) gave three hours of training for their colleagues in September 1988 on a designated staff development day, but the follow-up expected during the school year, according to the science coordinator, was "minimal." The coordinator attributed this, in part, to problems encountered by principals in providing adequate school time and substitute coverage.

Four of the districts scheduled staff development activities throughout the school year, one offered them primarily in September, and the other two districts provided sessions only in April. (In the latter two instances, the science coordinators were new to their position.) One science coordinator, in whose district training was given throughout the school year, commented on the desirability of having the same group of teachers attend training over an extended period of time. This approach afforded them a chance to establish a rapport with each other, as well as opportunities to try out ideas presented and discuss any problems encountered in implementing them. As in previous years, some districts elected to give workshops after school, while others provided them during the school day.

District staff development plans were required to include provisions for training one principal or assistant principal from every school with fourth grade classes in order to promote in-school follow-up and support for classroom teachers. Responses from science coordinators regarding attendance by school administrators and supervisors indicated that levels of participation in training activities differed, as did the extent to which districts themselves emphasized such involvement. Some districts, for example, conducted sessions related to preparing for the ESPET specifically designed for supervisors (or others, such as science cluster teachers, responsible for administering the test); others invited supervisors to attend sessions held primarily for teachers or made presentations at a principals' conferences, but did not otherwise seek to involve them directly

in grade four science education activities. One science coordinator explained that while school supervisors were generally supportive of the program--e.g., they assumed responsibility for distributing materials--they were "inundated with administrative tasks and involved with discipline problems"; another said that one school principal came to a demonstration lesson and left "because school principals don't like to attend workshops with teachers, and are also concerned about credit and payment." The local STAC district coordinator, however, indicated that some assistant principals attended STAC-sponsored staff development workshops provided for supervisors,* and that others were eager to attend the Saturday sessions held for district teachers at the STAC but couldn't because there was limited space and money and because priority was given to classroom teachers. Districts that had an extensive commitment to science education--e.g., had established science resource centers or instituted comprehensive educational programs--seemed more successful in involving school supervisors.

For the most part, when asked to describe how their district customized the local training program, the science coordinators referred to the staff development model adopted and/or the

*It should be noted that while districts implementing their own program (option 2) were expected to provide staff development for supervisors, the STACs provided training for supervisors of districts electing to participate in the central program (option 1); supervisors of both options 1 and 2 were invited to attend the STAC training.

instructional approaches emphasized.* They mentioned, use of peer mentors or turnkey trainers, in-classroom demonstrations tailored to individual needs, integration of science with other subject areas, teaching content through process, using local resources, promoting the idea that "science is everywhere", and stressing an "easy-to-do" approach to teaching science. Other ways districts customized the program related to logistical matters, such as scheduling staff development sessions and providing instructional materials.

Recognizing that teachers need science supplies in order to implement a hands-on curriculum, the Science Unit allocated money to districts ($25 x the number of training days) for the purchase of appropriate supplies for all program participants. However, six of the seven science coordinators reported problems in obtaining these materials in a timely manner, which they attributed largely to cumbersome Board of Education purchasing procedures. Most districts allocated funds from other sources to supplement the central Board's allotment. The local STAC district received materials directly from the STAC staff developers.

In order to better understand the level of each district's commitment to science education, one interview question asked if there was any district requirement regarding the amount of

*It should be noted, however, that most of these approaches were emphasized in guidelines provided by the Science Unit, and do not therefore represent unique responses to individual district needs.

science instruction to be provided to grade four students. Four science coordinators said that their district's requirements were consistent with New York State Education Department regulations, although in specifying these, the coordinators' responses varied slightly, from two to three periods per week. One science coordinator said that the district required one period per week, and another indicated that three-and-one-half periods were "recommended"; still another science coordinator said that there was nothing in writing from the superintendent indicating any official district requirement.

Another issue that has important implications for the delivery of science instruction in New York City's elementary schools is the prevalence of science cluster teachers and the nature of the roles they assume. Estimates by science coordinators of the percentage of elementary schools in their districts that had science clusters ranged from 25 percent to "most." In discussing the staff development needs of cluster teachers, science coordinators commented on the fact that not all of them have strong science backgrounds or experience at the elementary level, where the emphasis is on "science as a process." Consequently, they need training in how to use hands-on activities to promote the inquiry approach to science education, and strategies for effectively integrating science with other subject areas. Moreover, as their role evolves more into that of supporting classroom teachers rather than actually providing science instruction, science clusters need help in

becoming "mentors" and in refining their "modeling" and "coaching" skills.

In view of the importance of subsequent on-site assistance to help trainees in making use of the ideas and teaching approaches presented at staff development sessions, science coordinators were asked about follow-up activities. All but one of the coordinators said that their district provided some follow-up for program participants, although the nature and extent of this support varied--e.g., from school visits by the science coordinator at the request of individual teachers, to presentations at faculty or grade level conferences, to regular meetings with school supervisors to plan and monitor program activities.

Schools, too, were expected to provide follow-up support. While the science coordinators were not in a position to know in detail the level of assistance provided by schools, their answers suggest that this varied from school to school, and that, overall, more is needed. One science coordinator commented on school supervisors' need for more help in evaluating science instruction, but noted the lack of time available for this in view of the numerous other responsibilities supervisors have. Another science coordinator noted with optimism school principals' increased awareness this year of the importance of science, a view echoed by still another science coordinator who observed that some principals had ordered additional science equipment on their own.

Asked about the services or resources available through central Board offices that were helpful in implementing the district's grade four science staff development program, the science coordinators pointed mainly to money provided for substitutes and materials, and to the suggestions and technical assistance offered by Science Unit personnel. Three coordinators specifically mentioned the STACs--as described earlier, in the local STAC district, the STAC staff developers actually provided the training for grade four teachers; in two other districts, those who conducted the local training sessions (e.g., staff developers, science clusters) themselves attended some STAC activities.

All but one of the science coordinators interviewed cited positive effects that they believed the program had on grade four science instruction in their districts. These included more positive attitudes toward science (n=3), more instructional time being spent on science (n=2), increased confidence in teaching this subject (n=2), and improved quality of science instruction (n=1). Although mentioned by only one coordinator, increased enthusiasm for science on the part of girls as well as boys seems especially noteworthy. In the opinion of one respondent, however, classroom teachers are largely still phobic about teaching science and more time will be required to overcome their fears.

Finally, all of the coordinators offered suggestions for ways in which the staff development needs of those responsible

elementary science can best be met. Most (n=4) referred to the importance of on-site assistance. Also mentioned were: participation of school administrators and supervisors in staff development activities (n=2); demonstrations of effective science teaching (n=2); involvement of other resources such as colleges and universities (n=2); increased opportunities for networking (n=2); provision of more information of about how to obtain materials (n=2); and scheduling of staff development activities throughout the school year (n=2).

Trainees' assessment of local science training.

Questionnaires developed by OREA, in collaboration with the Science Unit, were distributed to participants of the grade four science program by district staff developers at the conclusion of the training in order to assess trainees' perceptions of the program and the extent of its impact on their science teaching. OREA received completed questionnaires from 139 participants in three of the six districts that had developed and implemented their own grade four science program.* Most of the respondents (79 percent) were general education teachers; 12 percent were science cluster teachers; and the rest had other school or district positions (although only seven percent were school supervisors).

*In one additional district which also selected Option 2, teachers attended workshops conducted by STAC staff developers on Saturdays. The responses from program participants in this district are not included with those of respondents from the three districts who mounted their own programs, since the training was not developed or implemented by the district.

Most participants had considerable experience teaching science. The majority (55 percent) had taught the subject more than ten years; only ten percent had taught it for only one year. In addition, over half of the participants (52 percent) had some graduate or in-service science credits. A majority of those with some advanced training (52 percent) had earned between three and six credits; most of the rest (45 percent) had earned more than six credits. In more than half the classrooms (56 percent), teachers provided all of the science instruction. In most of the other cases (40 percent), classroom and science cluster teachers shared this responsibility.

Despite the fairly substantial prior experience in science teaching of many respondents, only about one-third (36 percent) said that they had felt "very comfortable" teaching elementary science prior to their participation in this program. Less than half (42 percent) had been "moderately" comfortable, while more than one-fifth (23 percent) reported being "not at all" or "minimally" comfortable.

Districts opting to implement their own programs were expected to provide 15 hours of training. However, as reported earlier in this report, while some districts offered the requisite number of hours, some gave more and some less. In addition, not all participants attended all the grade four science training given in their district. More than two-fifths of the respondents in the three districts in this sample reported attending 15 or more hours of training, but more than one-third

(37 percent) attended less than 12 hours. Expectations of program impact on science teaching need to take such findings into account.

Asked to rate the staff developers with regard to their knowledge of curriculum topics, presentation of subject matter, and responsiveness to participants' questions, 96 percent or more of the respondents judged them to be "good" or "excellent" on each count.

In order to determine the extent to which the topics covered in the locally developed science training were consistent with program objectives, one questionnaire item listed a series of concepts and strategies that Science Unit administrators considered to be the programs' major objectives. Participants were asked to indicate which of the items had been included in the sessions they attended. For all of the items listed, a majority of respondents (ranging from 57 to 96 percent) said they were included. (For six of the seven items, that majority was greater than 70 percent.)

Since a major theme of the grade four science training was that science is an integral part of the world around us, teachers were encouraged to integrate science instruction into the teaching of other subject areas. The great majority (82 percent) of trainees reported that they had done so either "moderately" or "extensively," particularly by incorporating science with lessons in the following subjects: mathematics (55 percent); reading (34 percent); and social studies (34 percent).

Asked about the extent to which they had received follow-up assistance in implementing the strategies they had learned, two-thirds (67 percent) of the respondents answered that they had received some form of assistance after the conclusion of the training. Almost one-third (29 percent) noted help from outside the school, in the form of consultation with the district staff developer or others. One fifth of the respondents (22 percent) reported demonstration lessons. It should be noted, however, that all those who attended demonstration lessons were from C.S.D. 21. In that district, over a third of those who had received assistance of any kind noted that the district staff developer had come to the school to give demonstration lessons.* Approximately one-sixth (17 percent) of the participants reported consulting with principals, assistant principals, or supervisors. One trainee cited, for example, "a conference with the assistant principal to discuss curriculum content, effective teaching approaches, and preparation for the citywide test." Other respondents mentioned that they had consulted with other classroom teachers (9 percent) or with the science cluster teacher (9 percent). Of the 27 who had not received any follow-up assistance, the majority (63 percent) reported that they hadn't needed any.

Compared to the previous school year, the majority of respondents (52 percent) reported that they had devoted "more" or

*Since the staff development plan in this district consisted of on-site visits by a district staff developer, it is difficult to distinguish between program and follow-up activities.

"considerably more" time to teaching grade four science during the current (1988-89) school year. About a third (34 percent) spent the same amount of time, while very few (1 percent) had cut back on science instruction. Of those who noted that they were teaching more science, the most common reason given (by 25 percent) was the training they had received. About 20 percent mentioned the school system's increased emphasis on science.

Asked to assess the impact of the district training on fourth grade science instruction, 119 of the teachers (86 percent) indicated that in various ways science instruction had improved. One fifth of those who responded to this question cited their increased confidence in teaching science. "The enthusiasm of the trainers was translated to the teaching staff," explained one; "it made me less fearful to try different things," answered another. One-fifth noted their greater understanding of the curriculum. Another fifth specifically stressed the value of the hands-on teaching techniques they had learned. As one respondent put it, the training "shifted science instruction from 'reading about' to 'doing'." Others (12 percent) explained that the program enabled them to better prepare students for the ESPET.

Teachers were also asked what additional assistance they could have used. Of the 79 who responded, two-thirds expressed the need for more materials. It should be noted, however, that 73 percent of <u>all</u> trainees returning questionnaires acknowledged receiving science supplies from their districts (program funds

had been provided to the districts expressly for this purpose.) Nevertheless, many regarded the quantity of supplies as inadequate. In addition some complained that materials needed for implementing the activities presented should have been distributed earlier in the school year. Another need voiced by over a third of those who wanted more assistance (37 percent) was for more contact with science specialists (i.e., the science coordinator, district science trainers, cluster teachers). Some specifically mentioned demonstration lessons as a useful form of assistance. Wrote one trainee, for example, "I'd enjoy seeing a model lesson in each area to be taught for grade four." Others noted the need for more space (e.g., a supply room for science materials) and more time for preparing and teaching science lessons.

Almost all of the participants (96 percent) said that they would recommend the program to colleagues. Their reasons centered around the help it offered them in strengthening their skills and confidence in teaching science. The generally positive view of the district training was also reflected in the fact that the most frequently suggested improvement (noted by over a third--35 percent--of the 44 individuals who offered suggestions for improvement) was that more sessions be given. The fact that more than a fourth (26 percent) asked for more follow-up assistance points to the need for ongoing support in putting what was presented into practice.

COMPUTER SCIENCE

Computer Leadership Training (C.L.T.) Program

A total of 26 community school districts accepted the January 1989 invitation extended by their borough TACs to help identify specific computer education objectives consistent with their instructional goals, and to design and implement a well-focused staff development plan to meet these needs. In order to evaluate the program's success in meeting its objectives, OREA (in collaboration with DCIS) selected a sample of five districts--one in each borough--for investigation.

The districts were chosen primarily to reflect the variety of ways and purposes for which computers were being integrated into the classroom--e.g., for telecommunications, desktop publishing, and team teaching activities. In the five C.S.D.s chosen (2, 10, 14, 26, and 31), a total of 160 staff from 26 schools participated.* Of major interest in OREA'S evaluation of this program were: the process by which C.L.T. plans were developed; the respective roles and commitments of the TACs, districts, and schools; and participants' assessment of the assistance afforded by the program.

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*In one district, parents and paraprofessionals also attended some training activities.

Description of staff development plans. Following is a brief description of the computer education plans developed in each of the five districts.

- C.S.D. 2: This plan focused on training teachers in the use of word processing and desktop publishing (in three school), and telecommunications (in two schools). These programs were directed at teachers in two elementary and three middle schools, and were extensions of existing computer education activities.

- C.D.S 10: A major emphasis of this plan (implemented in one school) was to support teachers and paraprofessionals in integrating computers in the early childhood classroom. The plan also sought to familiarize parents with the role of computers in promoting literacy (in English and Spanish), entry level computer career opportunities, and local adult education programs. These training activities were integrated with other computer-related programs, including a software fair (held earlier in the year) and a continuing home loan program.

- C.S.D. 14: This plan, directed at middle schools, had two parts. The first part called for pairing a language arts teacher with a computer teacher (in five schools) for training in team teaching. This team teaching aimed to integrate subject area instruction with technology in order to help students develop writing skills through the use of word processing. Computer lab activities were to reinforce classroom learning. The second part involved training mathematics, language arts, and special education teachers (in two of the five schools) in the use of computers and software in their respective subject areas.

- C.S.D 26: Different plans were developed, tailored to the specific interests of the five participating middle schools. In some schools, emphasis was on incorporating computers in subject area instruction--language arts, social studies, and science - in order to upgrade students' writing and critical thinking skills. In other schools, teachers received training in the use of telecommunications to facilitate student research activities.

- C.S.D. 31: This plan was designed to help language arts, social studies, and science teachers in ten middle schools integrate computers into their instructional practices.

Plan development and implementation. In order to learn how district plans were developed and implemented, OREA staff conducted interviews with all borough TAC supervisors and the computer coordinators in each of the five districts selected for study.

Each district currently uses computers for subject area instruction in grades kindergarten through nine in all elementary and middle schools. Computer-related skills taught in each district include computer literacy, keyboarding, programming, and the use of various software programs. In sum, all five districts had used computers as a tool in subject area instruction prior to any involvement in the 1988-89 C.L.T. program.

While all of the district personnel reported that they had received assistance from their borough TAC, and had participated in some of their TAC's programs prior to their 1988-89 C.L.T. participation, conversations with TAC personnel indicated that the districts' level of involvement varied. Some districts had shown more enthusiasium, taking part in many TAC offerings, while others had been less eager to participate. School staff from C.S.D. 10 in the Bronx, for example, had participated extensively in prior TAC offerings, while those in C.S.D. 2 in Manhattan had only limited involvement until this year.

Computer coordinators in all five districts indicated that their participation this year in the C.L.T. program differed in some respects from their previous involvement with TAC offerings. Three of the five districts said that the current program was

different in that it targeted a particular population of teachers (Bronx, Queens, and Staten Island) and, in the case of the Bronx, a specific population of parents. One district coordinator said that the current program was in keeping with their existing computer education goals (Manhattan), while another indicated that the current program was used to redirect their efforts from a school-based approach to a more comprehensive districtwide approach (Brooklyn).

Key personnel from the TAC, district, and participating schools were involved in the planning and implementation of the various programs. TAC personnel included the TAC supervisor and staff; at the district level, personnel included the district superintendent and computer coordinator; at the school level, principals, assistant principals, and computer coordinators all took active roles.

Since a major focus of this evaluation of the C.L.T program was on documenting how the TAC, districts, and schools worked together, several questions probed the specific commitments and responsibilities assumed by these three groups in designing and implementing a customized computer education staff development plan. Their respective roles in key aspects of the program are summarized below:

- In all five districts, the TAC, district, and participating schools were involved in formulating the computer education objectives for their respective plans.
- In three of the five districts, all groups participated in developing course outlines for the training sessions (Bronx, Brooklyn, and Queens); in Manhattan and Staten Island, only the TAC and the district were involved.

- In all districts except Manhattan, the TAC provided the needed software and other instructional materials; in Manhattan, the district, along with the schools, assumed this responsibility.

- In three of the five districts, the provision of computers for training sessions was shared--by the schools and the district (Brooklyn), by the TAC and the district (Bronx), or by the TAC and the schools (Staten Island). In Manhattan, the schools supplied the computers, in Queens, the district made them available.

- Criteria for selecting program participants were developed by the districts exclusively (Manhattan and Queens), the schools exclusively (Brooklyn and Staten Island), or by the district and the schools collaboratively (Bronx).

- Arrangements for releasing teachers to attend training sessions were made by the district exclusively (Manhattan and Brooklyn), by the schools alone (Queens), and cooperatively by the district and schools (Staten Island). (Bronx sessions were held after school.)

- The actual training was provided by the TAC exclusively (Queens and Staten Island), the schools with assistance from the TAC (Brooklyn), the TAC and school (Bronx), and the TAC, district, and schools (Manhattan).

- Training was conducted in the schools exclusively (Manhattan and Brooklyn), at the TAC exclusively (Staten Island), and at the schools as well as the TAC (Bronx and Queens).

- Follow-up support was provided by the TAC, district, and schools (Manhattan and Brooklyn), by the district and schools (Bronx), and by the district exclusively (Queens and Staten Island).

From the foregoing descriptions of the various staff development plans and the roles assumed by the TACs, districts, and schools in developing and implementing them, it is evident that the five districts differed not only with regard to their computer 1988-89 education priorities, but in the strategies adopted, in collaboration with the TACs and schools, to accomplish these objectives. One of the most striking differences appears to be the nature and extent of the

involvement of the three groups in carrying out the plan, reflecting overall differences in the availability and/or utilization of resources and personnel.

In some cases, TAC and district personnel had prior working relationships and were familiar with each other's strengths, capabilities, and computer education resources. In three cases, however, TAC supervisors or district computer coordinators were new to their positions, and so had fewer previous contacts. (Manhattan TAC and C.S.D. 2, and C.S.D. 31 and the Staten Island TAC).

In Brooklyn, the excessive travel time between the TAC location and C.S.D. 14 necessitated that TAC programs be offered to district personnel at a more convenient location within the district. In keeping with this on-site emphasis, school and district personnel, with assistance from the TAC, provided all the training necessary for this program at their local schools. As Brooklyn TAC personnel pointed out, this on-site emphasis has spin-off effects, since it allows teachers to become more familiar with their own school's computer facilities.

Other differences relate to variations in the status of personnel and equipment. While all other district computer coordinators were full-time employees, one district's computer coordinator was a part-time consultant (Queens). Regarding equipment, Staten Island TAC personnel said that the district is attempting to correct the problem of outdated or insufficient

numbers of computers in their classrooms, but that this continues to be a factor that limits computer education efforts.

Assessment by TAC supervisors and district computer coordinators. In general, both the TAC supervisor and district computer coordinator in each of the five cases agreed that the staff development program was successful. When asked to comment on what they believed was "most successful," respondents typically pointed to the fact that training programs gave teachers an opportunity to meet and work with each other and with TAC and district personnel, and to learn more about ways in which computers could help them be more effective educators.

Some respondents pointed to specific programs as being particularly successful. For example, both the Manhattan TAC supervisor and C.S.D. 2 computer coordinator were pleased that the telecommunications training offered had some immediate results: in one C.S.D. 2 school, students were using telecommunications to link up with their counterparts in Moscow. The Brooklyn TAC supervisor and computer coordinator in C.S.D 14 cited the interaction generated between computer teachers and language arts teachers through the team teaching training they had received, and their new understanding of the relationship between word processing and creative writing.

Other comments about the success of the programs referred to the increased confidence and enthusiasm on the part of computer novices about using computers in their subject areas.

Five of the ten TAC and district respondents commented on two major problems related to the program's implementation: participants were unable to make use of what they had learned because the training began too late in the school year; and the number of sessions offered was not adequate to meet the needs of subject area teachers.

Among the specific suggestions offered for making the program more effective were the following: institute longer range planning ("a three- or five- year plan"); make more computers available for home loan; and create a computer lab for school staff.

While this evaluation generally focused on a sample of five districts--one in each borough--in order to better understand what dynamics were involved in establishing a successful partnership among the TACs, districts, and schools to support computer education, TAC supervisors were asked what distinguished those districts that accepted the TAC invitation to participate in the C.L.T Program from those who did not take advantage of this offer. Overall, respondents believed that leadership on the part of the district superintendent and the level of support provided by the district computer coordinator were major determinants of a districts' commitment to the use of computers in the classroom. The importance of support from school administrators and supervisors is reflected in the remark by one TAC respondent that the district superintendent asked him to

"prod" an assistant principal into taking part in the C.L.T. Program.

One TAC respondent noted not only the importance of district leaders understanding the value of computers, but the responsibility of the TACs in helping them to appreciate both the role of computers in education and how the TACs can assist them. In elaborating on the importance of commitment from both district and school administrators, some TAC respondents recognized that securing such support would, in some cases, take time.

District personnel were asked about the assistance they had received from their local TACs in formulating and implementing the computer training plans developed. All respondents expressed satisfaction with the leadership and support provided by the TACs. Some typical comments:

- "Success of the program is due to the professionalism of the TAC people. They were great."
- "The TAC has done a fine job. We don't have a full-time coordinator, so they have been helpful."
- "The TAC has supported our needs. They've always been there for us."
- "The TAC has provided tremendous assistance through the home loan program and in-service courses."
- "The TAC should continue to provide support."

Trainees' assessment of program. In order to assess trainees' reactions to the C.L.T. Program, and to provide an indication of the extent to which they made use of the training, OREA developed a participant reaction form that was distributed at the training's conclusion in spring, 1989.

A total of 71 individuals returned the questionnaire, representing a response rate of 51 percent.* Most respondents (83 percent) held intermediate or junior high school positions; the great majority (85 percent) were classroom teachers.

Most trainees were computer novices. The majority (62 percent) answered that they were "not at all" or "minimally" comfortable with the use of computers; most (60 percent) had never used computers for educational purposes prior to the training.

The means by which teachers had been recruited for the program varied. The majority (62 percent) had volunteered. The proportion of volunteers differed among the five districts, however. In both C.S.D 2 and C.S.D. 14, volunteers constituted a majority of respondents (68 percent and 73 percent, respectively). In C.S.D.s 10, 26, and 31, however, volunteers constituted less than half of the respondents (40 percent in each district). Volunteers were asked their reasons for participating. Almost half (41 percent) cited the computer's value as a teaching tool; the rest expressed a more general desire to get an introduction to computers or to improve their computer skills. Those who had been chosen by a school administrator or supervisor were asked what criteria had governed their selection. Almost half of this group (48 percent) replied

*It should be noted that in one district, although 26 teachers participated in the program, only the names of those (n=6) who were expected to assume leadership roles during 1989-90 were provided to OREA by the TAC; thus, in this district only a selected group of trainees received questionnaires.

that they had been chosen because of the subject area they teach. Others were chosen because of their inexperience with computers (most training plans were directed at novices), or their interest in learning how to use technology for educational purposes.

Participants generally received only a modest amount of instruction, with the majority (59 percent) attending between five and eight hours of training. About a fifth (21 percent) received even less (between two and four hours), while another fifth (20 percent) received more (between twelve and twenty hours). Participants from C.D.S. 14 generally received less training than others; about two-thirds of that district's respondents (71 percent) attended sessions for four hours or less.

Trainees were asked about the appropriateness of the C.L.T. Program training in light of their prior experience with computers. Nearly all of the respondents said that it was "very" or "moderately" appropriate (75 percent and 21 percent respectively).

Among those who regarded the training as "very" or "moderately" appropriate, almost half (44 percent) explained that the program met their need for a basic introduction to computers. Remarked one trainee, "The program... focused on introducing terms, methods [and] equipment to beginners." Several found the introductory nature of the program to be particularly helpful in relieving their anxieties about computer use. "I had practically no familiarity with computers," explained another, "and feared

attempting to use them. That fear was greatly lessened." Other respondents (22 percent of those in this category) commented on the assistance it provided in helping them to apply their rudimentary knowledge of computers to classroom instruction. Nevertheless, several of those who said that they found the program "moderately" useful expressed reservations, complaining that the training was too elementary to be very helpful.

Participants were asked whether they had made use of the staff development provided by the C.L.T. program. Their answers made it evident that the training's brevity and initiation late in the school year (most sessions began in May 1989) left little time to put its teachings into practice. A majority of the respondents (53 percent) had as yet made no use of the training. Over half of this group (57 percent) attributed this to the fact that little time remained in the school year. A smaller proportion of the non-users (30 percent) gave as a reason their lack of access to computers. However, the fact that most trainees (94 percent) intended to make use of the training during the following school year points to the value of this staff development experience.

Almost half of the respondents (47 percent), on the other hand, had made some use of the staff development. Over a third of those who had used the training (37 percent) reported that they had either employed software in the classroom or evaluated software for future use. One trainee noted: "I was able to evaluate the software available for early childhood in an attempt

to integrate it with the present early childhood curriculum." Another third (32 percent) of this group were, as a result of the training, having students use computers. "After the seminar, the students were using the computers to publish their work; before the seminar I wouldn't turn them on," wrote one.

Trainees were asked if they had received assistance from their community school district in support of computer education activities. A large majority of all trainees (78 percent) had received some district assistance. The form of aid most frequently cited (noted by over a third, or 38 percent) was release time. Almost a fifth (24 percent) explained that the district had provided hardware or software. In addition, a smaller proportion (19 percent) noted the training provided by district computer coordinators.

Trainees were also asked whether they had received any support from their schools. Again, a large majority (83 percent) answered affirmatively. As in the case of district support, the most commonly cited type of assistance (noted by 44 percent of this group) was release time. That the school supplied computers was noted by more than a third (39 percent). Almost as many (37 percent) cited the assistance of school computer coordinators in providing direction in how to use computers in the classroom.

In order to gauge the C.L.T. Program's success in bringing the computer into the classroom, trainees were asked how useful the program was in helping them integrate computers into their teaching. Most (88 percent) found it to be either "moderately"

or "very" useful Respondents noted a range of ways in which the program facilitated computer use. The most common, noted by almost a fifth of all trainees (18 percent), was the introduction to the use of instructional software in the classroom. Observed one, for example, "I had no idea [previously] how these programs could be used other than as an individually-oriented program with little...class discussion. We were shown how to project images on a screen allowing the class to partake in certain programs." Some teachers (14 percent) cited their increased confidence in using computers in the classroom; others (about 10 percent) explained that they had gained an increased understanding of how to guide students in computer use (e.g., for writing), or found the introduction to word processing to be valuable for instructional purposes.

Among those who described the program as "moderately" useful were some whose enthusiasm was qualified. Seven respondents explained that they would have found it more useful if they had access to a computer at school. Six respondents found it either too short ("the workshop was a good beginning, but additional workshops would be needed for added information and reinforcement") or too rudimentary ("the instruction was at a level below that at which junior high students would operate; there was not instruction on how to teach the kids the basics").

Suggestions for improving the program tended to stress two themes. Almost a third (30 percent) suggested that it focus more sharply on showing teachers how to use the computer in the

classroom (e.g., introducing software, demonstrating classroom techniques). Recommended by more than a quarter of the trainees (27 percent) was an increase in the amount of training.

Trainees were also asked what additional kinds of assistance in computer education the borough TAC might provide. Answers fell into two categories. About a third of the trainees (36 percent) wanted the TAC to provide more hardware and software. A smaller number (14 percent) suggested that the TAC provide more training in the form of workshops or demonstration lessons.

Computer Repair Program

During the 1988-89 school year, 121 (out of 138) high schools received services from the program's repair centers; a total of 5,036 high school computers were repaired. An additional 1,185 repairs were made through the various plans available to selected community school districts.

With regard to the student career component, a total of 73 student technicians from six high schools received hands-on work experience at the repair centers. (The student career program was implemented at all repair sites this year except Staten Island, which did not become operational until March 1989. All students completed the program successfully.)

Perceptions of lead technicians. In March and April 1989, OREA staff conducted interviews with the lead technicians (L.T.s) in each of the four borough-based repair centers that had been in operation since the beginning of the school year. Questions

focused on their role, assessment of the program, and suggestions for improving it.

All of the lead technicians nad previously worked for companies doing computer repairs; two had been associated with firms that worked as vendors for the Board of Education. Their experience in this field ranged from four to ten years. All had been working as the lead technician at their centers since September 1988.

In describing their major responsibilities, the L.T.s cited the following: supervising the on-site and school-based work of the other technicians; ordering parts; dealing with vendors and schools; and overseeing all aspects of the student component.

Overall, the L.T.s believed that the program provided schools with high quality service that was both less expensive and faster than that available from private vendors. As a consequence, they believed, students and teachers had access to working computers for a greater proportion of the school year than they would otherwise have had. One L.T. noted that his center was "averaging about 30 repairs per week per technician, a better record than IBM's."

When asked about problems they encountered in making computer repairs, the L.T. mentioned the following:

- breakdowns and parking problems with the vans used to make repairs at school sites. One center had its van stolen;
- the large number of schools to be serviced;
- obtaining accurate and updated information from schools about the number and type of computers, location of equipment, and computer problems; and

- lack of cooperation in unlocking schools' security devices.

Suggestions for improving the repair centers' operations were offered by two L.T.s who cited the need for more technicians and vans to accommodate the number of schools to be served.

Other interview questions focused more directly on the student component. In describing the course content, all of the L.T.s indicated that they followed the outline developed by the Manhattan L.T. Each week of this eight-week course of study is organized around a particular competency, beginning with the basics of computer service and progressing to more complex operations.

Students are expected to maintain good attendance and a professional attitude--to view their training as a "job, not a class," and to exhibit regard for safety in their work habits. (Two L.T.s indicated that they had to "fire" a student because of improper conduct.) Evaluation of students included reviews of attendance, written exams, and performance-based tests, although not all centers used all of these indicators.

As part of their evaluation of this component, lead technicians were asked to assess the qualifications of the students selected to participate in the program--specifically, their knowledge of computers, computer repair skills, work attitudes, and enthusiasm for the program. Overall, L.T.s rated incoming students as fair to good on these indicators. One L.T. commented, however, that students' preparedness for the program

could be improved if they were given more experience in digital electronics.

Lead technicians observed a marked improvement in students at the end of the eight-week program: they rated "graduating" students as being knowledgeable about computers, and skilled in diagnosing and repairing problems. Also rated excellent were students' work attitudes and enthusiasm for the program.

Since the lead technicians were not teachers but were expected to provide learning experiences for students, the next several questions addressed issues related to their teaching role. First, they were asked how well prepared they felt to work with students. (One had a B.A. degree, another had some college background, and the other two had no formal academic training.) One L.T. said he felt very prepared, explaining that he had conducted some training sessions for a previous employer; the other L.T.s said that they were apprehensive at first, but ultimately found the experience rewarding. Overall, the L.T.s did not believe their lack of teaching credentials to be a problem since they saw themselves as essentially responsible for "work supervision" rather than "teaching."

Nevertheless, they did cite some problems in implementing the student component: difficulties in supervising a large group of students; insufficient instructional/work experience time; inadequate space; lack of preparation time; too many other responsibilities besides supervising students; inadequate supply

of tools and test equipment; and the slow and cumbersome system for paying students.

Despite these problems, the L.T.s believed that the program was worthwhile. Among the most successful aspects, in their opinion, were: "the coming together of interested students and downed (sic) computers"; "being able to give valuable experiences to interested students...helping them to decide about a career"; and "the hands-on approach to training."

Given the career focus of this program, L.T.s were asked about the likelihood of program graduates finding entry-level jobs in the computer repair field. Their responses reflected a cautious optimism. As one L.T. put it, "They need more than they can get here, but this is a beginning." While some of the L.T.s indicated that they helped students in developing resumes, none provided specific assistance in securing jobs in the field.

Among the specific recommendations made by the L.T.s for improving the student component were the following:

- "Assign fewer students to training sessions so that they can get maximum supervision. Six students should be maximum."
- "Increase the length of training sessions...we are working with three different types of computers, and need more time. Extend program from eight to 16 weeks."
- "Use teaching tools like videotapes, guest speakers, and field trips to do repairs on site."
- "We could use more test equipment."
- "Our space is inadequate...we could use another room. We should also separate the shop from the training room."
- "Stimulate vendor support for students by making connections with IBM or other vendors to begin student career path."

Perceptions of student technicians. In March and April 1989, OREA staff conducted interviews with a total of 12 student technicians (S.T.s) at the Bronx, Brooklyn, and Manhattan computer repair centers* (four at each site who were present on the day of OREA's scheduled visit to the centers). Four students were in grade 11 and seven were in grade 12. (One had already graduated.) They ranged in age from 16 to 19 years.

Students typically learned about the program in an electronics or computer class, or from a teacher or friend. All reported having some contact with the teacher coordinator (who was responsible for selecting them) during the weeks that they attended the program. This usually consisted of informal talks at their home school about their progress in the program and any problems they were having. Half of the students interviewed reported having a computer at home.

Students' expectations of the program included learning a skill, getting hands-on work experience, and learning what to expect in the real world of work. When asked what they liked best about the program, they cited the absence of pressure, the hands-on training, and teaching that had some practical application. Aspects they liked least included the erratic payroll system, and not having enough time to learn all the basics..."I still feel there's more to learn." Only one S.T. mentioned a conflict between the program and his regular school

*Because of scheduling problems at the Queens center, no training sessions were being conducted there at the time of the OREA interviews.

schedule, since the program sometimes conflicted with after-school basketball games.

Students generally believed that the computer and electronics courses they had taken were good preparation for the program, stating, "They helped me to learn the components," or "They were very helpful." (Most students had at least two to four courses in electronics and computers.) When asked if they would have liked some other preparation, one student expressed the need for more experience with computers.

With regard to their plans after high school, nine students indicated that they hoped to attend either a community or four-year college, two students planned to attend a technical school, and one student said that he would try to get a job. Asked if their participation in the computer repair training program had influenced their decisions about college or career, nine students said that it had for the following reasons:

- "This work is fun...and it also pays very well."
- "I love working with my hands."
- "I already knew a little about this field, but now I know I want to go into it."
- "This is a good-paying field, but I need some kind of degree to do this work."

One student, the only female S.T., indicated that she had earned a scholarship to a nursing program, but was still glad to have had the experience in computer repair.

Most students (n=9) said that this program was good preparation for a career in computer repair, especially because

it gave hands-on experience, and helped students understand what to expect and to be serious about work. Among the most important things students said they had learned were:

- "working with others";
- "listening to details";
- "safety and the one-hand rule";
- "facing up to problems";
- "learning how the computer works";
- "learning more than in a regular classroom"; and
- "learning IBM"

When asked what they would change or modify about the program, five S.T.s mentioned that they would improve the payroll system, and four said that they would extend the number of hours and days of the program. Half indicated that they would not change anything. All said that they would recommend it to interested students.

Assessment by computer coordinators/assistant principals. In May and June 1989, a total of 25 telephone interviews were conducted with computer coordinators, and in a few cases, with assistant principals, at high schools in Brooklyn (n=8), the Bronx (n=6), Manhattan (n=5), and Queens (n=6), whose computers were serviced by the computer repair centers in their borough during the 1988-89 school year.* (Since 107 high schools

*Staten Island high schools were not included in this evaluation because responsibility for the repair of their computers was assumed by the Brooklyn center until March 1989 when the Staten Island center became operational. To expect individuals to distinguish between services rendered at different times of the

received services from the centers in these boroughs, the individuals interviewed constitute a 23 percent sample.)

All of the schools surveyed had one-quarter to one-half of their computers down and in need of repair during this period. The most common types of problems were with disk drives, monitors, and keyboards.

While all interviewees in the Bronx, Manhattan, and Queens schools rated repairs as satisfactory or very good, half of those interviewed in Brooklyn rated repairs as poor or not acceptable. In addition, the turnaround time reported in Bronx, Manhattan, and Queens schools was usually two weeks or less, while in Brooklyn, it was more likely to be four weeks or more. Computer coordinators from schools that experienced long delays in getting repairs done expressed concern about the instructional consequences of the unavailability of working computers for all students.

Computer coordinators in the Bronx, Manhattan, and Queens judged the Board of Education computer repair program to be better than their previous arrangement with regard to both service and quality of repairs; Brooklyn coordinators, on the other hand, were more likely to say that their former repair arrangement was more satisfactory.

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school year did not seem realistic. In the other boroughs, a random sample of high schools that had had at least ten computers repaired between September and November, 1988 (the most up-to-date information available at the time) were selected for interviews.

When asked about suggestions to improve computer repairs, a majority of coordinators (n=13) pointed out that under the current arrangement, printers were not covered, and that this was a problem. Other recommendations included stocking adequate parts (n=5), establishing some system of preventive care (n=4), and shortening repair time (n=3). Brooklyn schools tended to suggest that the center hire more staff.

With respect to these findings, it should be noted that for most of the 1988-89 school year, the Brooklyn center was servicing computers in both Brooklyn and Staten Island, and was responsible for one-quarter to one-third more computers than the other repair centers. Also to be noted is the ongoing problem of obtaining parts for IBM microcomputers, which certainly affected the quality of service and repairs, but which is beyond the control of the local centers.

IV. CONCLUSIONS AND RECOMMENDATIONS

During 1988-89, the Staff Development Program in Mathematics, Science, and Computer Science made use of a variety of approaches to provide curriculum and staff development support to New York City school personnel, including workshops directed by the central Board, training sessions conducted by local districts, and scheduled programs and technical assistance given by regional resource centers. In addition to training in curriculum content, staff development activities focused on innovative teaching strategies and use of new instructional materials. Some computer science activities were also directed at providing computer repair services for schools and career training opportunities for students interested in this field.

MATHEMATICS

In grade six mathematics, a major staff development initiative for the year, a turnkey approach was adopted. Participating districts selected individuals with staff development experience to serve as members of district Mathematics Leadership Teams (M.L.T.s). The M.L.T.s participated in training sessions conducted by the Mathematics Unit in August 1988, and were then responsible for implementing the grade six program in their districts during the 1988-89 school year.

Overall, math coordinators, M.L.T. members, and trainees gave positive assessments of the program. All groups tended to

agree that the training succeeded in teaching core concepts and strategies, and most trainees reported that they had been able to integrate the concepts and strategies covered during the sessions into their teaching.

As in past years, however, turnkey training proved to be a problematic strategy. Many M.L.T. members and some math coordinators argued that the sessions conducted by the Mathematics Unit placed undue emphasis on devising a district staff development plan and devoted insufficient attention to the new curriculum. In some cases, individuals selected as M.L.T. members were unable to attend the summer training; in other instances, those who did attend could not fulfill their turnkey responsibilities, sometimes because they could not get release time. As a result, in some districts the teams did not function at all, and the science coordinator alone assumed responsibility for implementing the program.

The three Mathematics Resource Centers (M.R.C.s) also functioned throughout the year, providing staff development workshops, drop-in services, off-site presentations, and other mathematics-related activities for teachers, other school and district staff members, and students. M.R.C. supervisors believed they had been successful in providing support to teachers, but expressed the need for more staff and better security. They were also concerned about the continued operation of the centers in view of proposed funding cutbacks and administrative changes.

SCIENCE

The major emphasis in science staff development was on the new grade four curriculum. Districts had the option of having selected staff attend the program provided by the centrally operated Science Training Assistance Centers (STACs), or conducting their own training program.

The STAC workshops received strongly positive reactions from participants, who generally found them successful in communicating innovative strategies for teaching science. In addition, testimony from coordinators and trainees indicated that the sessions were of great value in giving teachers greater confidence in their ability to provide science instruction. One result of the STAC training, according to many trainees, was a substantial increase in the amount of science taught in the fourth grade. As in the case of mathematics training, however, there was little follow-up assistance to trainees in their schools.

Community school districts that chose to conduct their own grade four science training programs employed a wide variety of strategies, reflecting considerable differences in their conceptual approaches and utilization of resources. Local programs also differed in the amount of training provided and their efforts to involve school supervisors in staff development activities. Unlike the STAC trainees, who typically reported receiving the requisite 15 hours of training, participants in local programs, on average, claimed to have attended fewer

hours. Nevertheless, local trainees also assessed the training favorably, and a majority reported devoting more time to science this year. Requests for further assistance included more supplies and follow-up assistance in putting what was presented into practice.

COMPUTER SCIENCE

In conjunction with their borough TACs, most districts developed customized Computer Leadership Training programs (C.L.T.s) designed to help schools (primarily intermediate and junior high schools) integrate computers into their instructional strategies.

In the sample of five districts studied by OREA, there were substantial variations, not only with regard to the computer education priorities, but in the respective roles and responsibilities assumed by the TACs, districts, and schools in implementing the various staff development plans. These differences reflected overall differences in the availability and/or utilization of resources and personnel, and arguably, varying levels of commitment to the use of computers in education. In some cases, the C.L.T. program was an extension of ongoing district computer education activities, whereas in others it represented an effort to redefine previous goals or target particular populations.

Another important difference was the extent to which the TACs and districts had worked together previously. Not surprisingly, those that had long-established working

relationships, and were consequently familiar with each other's philosophy and resources, seemed more successful, overall, in collaborating this year in implementing the C.L.T. program.

Participants, who were for the most part computer novices, said that the training was appropriate to their level of experience and met their need for a basic introduction to computers. However, most could not make use of this staff development experience (typically consisting of only five to eight hours of instruction), primarily because the training had been provided very late in the school year. Some complained about inadequate access to computers in their school. Nearly all trainees, however, intended to make use of what they had learned during the 1989-90 school year. Suggestions for improving the program focused on the need for more training and greater emphasis on showing teachers how to use computers in the classroom.

The Computer Repair Program serviced more than 5,000 computers in 121 high schools during the 1988-89 school year; an additional 1,185 repairs were made in selected community school districts. Approximately 70 high school students received paid hands-on work experience at four of the five borough-based repair centers.

Overall, the lead technicians believed that the program provided high quality, cost-effective service and that students received a valuable training experience. Student technicians were similarly enthusiastic about the program, noting in

particular the hands-on approach and learning what the work world is like.

In discussing service problems encountered, the lead technicians referred to the insufficient number of staff and vans, parking problems, and difficulties in obtaining accurate information from schools. For the most part, the technicians were comfortable in their instructional role, but cited difficulties in supervising a large group of students, the need for more instructional time, the inadequate supply of equipment, and delays in payment to ~· ents--a criticism strongly echoed by the student technicians. In addition to extending the program to provide students with more work experience, assistance should be provided in securing entry-level jobs in computer repair.

RECOMMENDATIONS

Based on the findings reported here, and other information presented in this report, the following recommendations are made:

- In order to help trainees integrate into practice what is presented at staff development sessions, districts and schools need to find ways to increase the level of in-school support. This might include having science cluster teachers serve more as resources to classroom teachers than as providers of instruction, utilizing M.L.T. members to make on-site visits to support teachers, and encouraging teachers to collaborate in planning lessons and sharing materials. In addition, follow-up assistance should emphasize demonstration lessons, classroom observations, and feedback, directed at providing practical help in applying the concepts and strategies presented in training sessions within the context of the classroom. Previous program efforts to involve school supervisors in staff development activities, which have met with some success, should continue.

- Given persistent problems in implementing turnkey models of staff development, program staff need to reconsider the feasibility of this approach. If it is to be used in the future, more rigorous criteria for selecting turnkey trainers need to be established, with roles and responsibilities more clearly delineated and communicated prior to selection, and the necessary release time assured in advance. In addition, commitments to cooperate in making the necessary arrangements for school staff to attend turnkey training activities must be secured from appropriate district and school administrators.

- Program, district, and school staff need to explore strategies for providing release time in ways that minimize the burden it poses for school administrators. One way of doing this might be to pair teachers who would periodically cover each other's class so that each could attend various staff development sessions, and otherwise assist each other.

- In view of districts' diverse training needs and resources, both central and local staff development options should continue to be provided. Resource center programs that provide opportunities for the same group of individuals to meet over an extended period of time during the school day and establish a collegial spirit should be continued and, to the extent possible, expanded. If funding permits, the role of these centers should be extended to include follow-up assistance to schools, and even greater support to locally developed programs.

- To promote attendance at staff development activities, training sessions should be held at more than one location and scheduled on different dates, to the extent possible; to this end, neighboring districts might collaborate in developing and conducting some workshops--e.g., sharing space, staff developers, and resources.

- Efforts to provide trainees with the materials necessary for teaching a new curriculum or instituting innovative instructional strategies should be continued and, to the extent possible, extended. Given limited financial resources, this responsibility should be shared by the program, the districts, and the schools.

- To encourage district and school support for computer education staff development programs, TAC staff need to familiarize superintendents and principals with the diverse ways in which computers can be used to promote the achievement of their educational objectives, as well as with the assistance that is available from the TACs.