DOCUMENT RESUME

ED 295 849 SE 049 238

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TITLE Mathematics and Science Relicensing Project 1986-87. OEA Evaluation Report.
INSTITUTION New York City Board of Education, Brooklyn. Office of Educational Assessment.
PUB DATE Mar 88
NOTE 48p.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *College Science; *Females; Higher Education; *Inservice Teacher Education; *Licensing Examinations (Professions); *Masters Programs; Mathematics Education; Minority Group Teachers; Postsecondary Education; Professional Education; *Program Descriptions; Science Education

ABSTRACT

The Mathematics and Science Relicensing Project provides out-of-license mathematics and science teachers with an opportunity to complete the required coursework needed to qualify for the appropriate licensing examination. In 1986-87, a pilot program offering a Master's Degree in science education was begun. It allows participants to accumulate credits toward licensure while earning a Master's degree in science education. The objectives of this program were to facilitate licensing for those in need, attract female and minority participation and representation among mathematics and science teachers, and encourage program participants to apply for and pass the appropriate licensing examination. This document contains four sections: (1) "Introduction," including background of the program, population served, objectives, and project evaluation; (2) "Program Components"; (3) "Reaction to the Perceptions of Instructional Component"; and (4) "Conclusions and Recommendations." (CW)

MATHEMATICS AND SCIENCE RELICENSING PROJECT 1986-87

EVALUATION SECTION REPORT
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March, 1988

MATHEMATICS AND SCIENCE RELICENSING PROJECT 1986-87

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MATHEMATICS AND SCIENCE
RELICENSING PROJECT

EVALUATION SUMMARY, 1986-87

BACKGROUND

The Mathematics and Science Relicensing Project provides out-of-license mathematics and science teachers with an opportunity to complete the required coursework needed to qualify for the appropriate mathematics or science licensing examination. The Comptroller of the City of New York provided funds to support tuition-free courses and program evaluation activities. In 1986-87, a pilot program offering a Master's degree in science education was begun with 15 participants. The program runs at two sites: Brooklyn College and City College. It allows participants to accumulate credits toward licensure while earning a Master's degree in science education.

POPULATION SERVED

In 1986-87, 550 teachers actively participated in the program -- 286 in math, 264 in science. Course selections covered a range of content areas in mathematics and science. A total of 38 classes in mathematics and 28 classes in science were offered at 12 colleges: Baruch College, Bronx Community College, Brooklyn College, City College, Hofstra University, Kingsborough Community College, LaGuardia Community College, Lehman College, Manhattan College, New York Technical College, Queensborough Community College, and St. John's University.* Forty percent of the participants were licensed in common branches. Junior high school teachers (13 percent) and high school teachers (eight percent) accounted for another fifth of participants. Eleven percent of the participants had a special education license. The remaining one-fourth held a per diem (17 percent) or some other type of license (nine percent).

PROGRAM OBJECTIVES

The objectives for the Mathematics and Science Relicensing Project during 1986-87 were to: (1) provide out-of-license teachers with coursework needed to qualify for a licensing examination in mathematics or science; (2) attract female and minority participation in the program in order to increase their representation among mathematics and science teachers; and (3) encourage program participants to apply for and pass the appropriate licensing examination(s) by providing examination

*The College of Staten Island participated through the 1985-86 school year in the mathematics component of the program. The college declined to participate in the program during the 1986-87 school year.

preparation sessions for teachers who had attained eligibility status.

EVALUATION METHODOLOGY

Evaluation of the program was based on a number of data sources: database files provided participants' characteristics; survey questionnaires and telephone interviews were used in soliciting responses related to participant satisfaction and dropout factors; in-depth interviews, conducted with college coordinators and instructors, explored program implementation and design. Licensing examination preparation classes were observed and participants surveyed to ascertain the usefulness of the sessions. Pass/fail rates of completed program participants who took the mathematics and science licensing examination were compared with those of the general population to assess the impact of the program. In addition, comparisons were made between the mathematics achievement of relicensed participants' pupils and the pupils of mathematics teachers who were teaching out of license in grades seven to nine.

FINDINGS

During 1986-87, the Mathematics and Science Relicensing Program was effective in meeting all its stated objectives. Among the major evaluation findings were the following:

Teachers Served

- The program continued to successfully achieve its minority participation goal. Nearly half (42 percent) of program participants belonged to a minority ethnic group, and 64 percent were women.*

- Seventy-one (13 percent) of the program participants became eligible to take licensing examinations. Participants attending examination preparation sessions described the classes as highly useful. Teachers found working with old licensing examinations, instructors' notes, and practice in problem solving to be the most helpful exercises of the sessions. Twenty-five program participants applied for and took licensing examinations in mathematics and science.

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*Minority ethnic representation and female representation for the general teacher population were 27 percent and 67 percent, respectively, as of October, 1986.

Participants' Perceptions

- Most newly completed program participants indicated that they planned to take mathematics or science licensing examinations and credited the program with being instrumental to pursuing this goal.

- Teachers currently enrolled in the program praised its efforts and recommended that colleagues take advantage of the opportunity. The desire to change teaching assignments and interest in subject area content were cited as primary reasons for enrolling in the program.

- Teachers were generally pleased with the program design, citing increased knowledge, licensing examination preparation, and tuition-free courses as the most beneficial aspects of the program.

- Most teachers were not aware of any participant support services available at their college. Where tutoring or counseling services were identified, very few participants used them.

- Teachers suggested program improvements that would broaden the variety of course selections and assist teachers in sequencing their coursework.

- Program dropouts were likely to cite personal factors as reasons for withdrawing from the program, whereas course dropouts had a tendency to blame course loads and biases in program design as reasons for dropping out.

- Program dropouts, in general, reported the need to upgrade student support services in the areas of tutoring and guidance in course sequencing. Expansion of course offerings and more specific course descriptions were also recommended improvements for the program.

College Coordinators

- College coordinators were pleased with the modified application and registration process implemented by the Division of Curriculum and Instruction. They were relieved of the task of screening out participants and able to process incoming teachers more efficiently.

- Coordinators maintained an effective level of communication with personnel at the central offices of the Board of Education, who were available to assist

them with any questions and/or problems that arose during the program.

- Coordinators designed program curriculums to consist of core content areas supplemented with rotating elective courses. Coordinators believed teachers entered the program adequately prepared to handle the coursework requirements.

College Instructors

- College instructors advocated that program participants follow a prescribed sequence of courses to succeed best in their program.

- Most instructors volunteered tutoring but reported that few participants took advantage of the service.

- Instructors recommended expanding course selections and adding weekend classes to enhance teacher enrollment in the program.

Passing Rates

- The passing rates of relicensing program participants were similar to the general population's rates for both mathematics and science examinations -- 74 to 73 percent and 67 to 65 percent, respectively.

RECOMMENDATIONS

On the basis of these findings and other information presented in this report, the following recommendations are offered:

- Expand the variety of program course selections.

- Re-establish classes in Staten Island to serve teachers in that area.

- Provide better dissemination of information (at the college level) concerning student services in tutoring and counseling specific to relicensing.

- Strengthen support services to teachers in their initial placement and sequencing of program courses.

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I. INTRODUCTION

PROGRAM BACKGROUND

The Mathematics and Science Relicensing Project provides out-of-license mathematics and science teachers the opportunity to complete the required coursework needed to qualify for the appropriate mathematics or science licensing examination. Its objective is to increase the number of licensed mathematics and science teachers by offering college courses in these areas. The goal of the program is to improve instruction in these areas and thereby improve student achievement accordingly. Five years after its inception, the program has provided more than 1,200 teachers with university-credited mathematics and science courses, and over 150 of these teachers have been relicensed.

Coordinated by the Board of Education's Division of Curriculum and Instruction and funded through a grant from the Comptroller of the City of New York, the 1986-87 Mathematics and Science Relicensing Program achieved an active enrollment of 550 teachers -- 286 in math, 264 in science. The project's aims are to qualify teachers for, and encourage them to apply and pass, the appropriate licensing examinations and to have licensed teachers use the experience to enhance instruction of their subject.*

The program represents collaborative efforts among New York City's Board of Education, the City of New York Comptroller's

*Requirement for licensure are: 18 credits for the junior high school mathematics; 24 credits for the high school mathematics; and 36 credits for the science license.

Office, and 12 local area colleges and universities. Participating colleges include Baruch College, Bronx Community College, Brooklyn College, City College, Hofstra University, Kingsborough Community College, LaGuardia Community College, Lehman College, Manhattan College, New York Technical College, Queensborough Community College, and St. John's University. Although an attempt was made to include a Westchester County college, no participants (including Bronx residents) chose to enroll; classes at that college were subsequently cancelled. Participating teachers selected from 38 mathematics and 28 science course offerings.

POPULATION SERVED

All New York City public school teachers who are not licensed in mathematics or science or do not have sufficient credits to meet licensing requirements are eligible for the program. Preference is given to teachers at the junior high school and high school levels who are teaching either mathematics or science out of license. Elementary school teachers are also invited to participate; however, it should be noted that there are no licensing examinations for mathematics or science at the elementary school level. Women and minorities were especially encouraged to take advantage of the program due to their underrepresentation in these fields. Teachers applied to the program by completing application forms available at their schools. Applications, reviewed and approved by the Division of Curriculum and Instruction, were forwarded to the Office of

Educational Assessment (O.E.A.), where database files are maintained on participants to keep track of their progress in the program. During 1986-87, 550 teachers actively participated in the program. Generated enrollment was 286 for the Mathematics component and 264 for the Science component.

PROGRAM OBJECTIVES

Program objectives in 1986-87 for the Mathematics and Science Relicensing Project were as follows:

- Provide out-of-license teachers with coursework needed to qualify for a licensing examination in mathematics or science.
- Attract female and minority participation in the program to increase their representation among mathematics and science teachers.
- Encourage program participants to apply for and pass the appropriate licensing examination(s) by providing exam preparation sessions upon attainment of eligibility status -- 18 credits for the junior high school mathematics license and 24 credits for the high school mathematics license (not offered for science license).

PROJECT EVALUATION

Assessment of the Mathematics and Science Relicensing Project was conducted by the Office of Educational Assessment/ Instruction Support Evaluation Unit (O.E.A/I.S.E.U.). The 1986-87 evaluation plan examined several aspects of program implementation, including: participants' characteristics, participant satisfaction with courses, and factors associated with program and course dropouts. Insights gained from college coordinators and instructors were also used to assess the project's overall strengths and weaknesses. The mathematics and

science licensing examination pass/fail rates of completed program participants, compared with those of the general population, were used to assess the impact of the program. In addition, comparisons were made between the mathematics achievement of relicensed participants students and the students of mathematics teachers who are teaching out of license in grades seven to nine.

Participant satisfaction was measured in four ways:

- First, teachers who had completed the program within the past year were sent an O.E.A.-developed questionnaire, which asked for their perceptions of the adequacy of the courses in preparing them to teach mathematics or science and the relationship between course content and their students' needs.
- Second, a sample of current program participants were interviewed, while a larger number was surveyed about their satisfaction with course content, registration procedures, staff performance, and program services provided.
- Third, program dropouts* (participants who have completed at least one course without completing all credit requirements) and course dropouts* (participants who leave a course by withdrawing officially or unofficially) were identified and sent questionnaires to uncover factors associated with dropping out and determine possible prevention strategies. A total of 85 participants identified as dropouts were sent questionnaires.
- Fourth, teachers who completed program requirements and participated in examination preparatory sessions were asked to give their impressions of the sessions' comprehensiveness and usefulness.

A new application process was instituted during the 1986-87 project year. This modification allowed for central processing

*In 1986-87, 32 percent of participants dropped out of courses, while 12 percent dropped out of the program.

and approval of all applicants into the program to expedite teacher placement and facilitate record keeping. Evaluators from O.E.A. interviewed college coordinators and course instructors to solicit their views on whether this modification improved program implementation. College coordinators were asked to describe student services offered through the program, their interaction with the Central Board, and the structure of their course content design. Interviews with course instructors focused on program implementation, assessment of teachers' capabilities to handle coursework, descriptions of tutoring or counseling services available, and recommendations for improving the program in general.

SCOPE OF THE REPORT

This report presents the results of the evaluation of the 1986-87 Mathematics and Science Relicensing Project. Chapter II outlines project components and implementation, along with a description of the population served. Chapter III documents program staff's and participants' reactions to and perceptions of the instructional component and teachers who received licenses as a result of program participation. Chapter IV offers conclusions and recommendations.

II. PROGRAM COMPONENTS

APPLICATION AND REGISTRATION

The Division of Curriculum and Instruction disseminated information and registration forms for the relicensing program to all elementary, junior high, and high schools in the city. Catalogues were distributed twice during the year, once for the fall and once for the spring semesters. A number of catalogues were mailed to every school, directed to both teachers and supervisors. The information provided included eligibility requirements, locations of participating colleges, and course offerings. In fall, 1986, a modified process of application procedures was initiated, whereby the Division of Curriculum and Instruction centrally approved and placed eligible applicants into the program. Institutions were informed which students had been allowed to enroll in their program and how many credits they would need to qualify for the licensing examination.

In 1986-87, the Mathematics and Science Relicensing Program offered licensing exam preparatory sessions to participants who had met the eligibility requirements needed to apply for the junior high and/or high school mathematics examinations. Of the 89 program participants whose database records indicated that they qualified, 38 registered for the workshop. Sessions were held on February 5, 19, and 26 at Martin Luther King, Jr. High School. The instructor for the course was an experienced mathematics educator from Bronx Science High School. Materials

covered during the sessions reflected mathematics items presented on previous years' examinations, participants' individual questions, and the instructor's impression of what new concepts might be introduced on the mathematics licensing exam in 1987.

PROGRAM PARTICIPANTS

The 1986-87 Relicensing Program was coordinated by the Division of Curriculum and Instruction. In 1986-87, 38 courses in mathematics and 28 courses in science were offered at 12 participating New York City colleges and universities* (see Table 1). Although over 700 teachers were accepted into the program, actual active enrollment for 1986-87 totalled 550.** This number appears to indicate a decrease from the previous year's enrollment of 626 teachers; however, 1985-86 figures incorporated all approved applicants regardless of subsequent withdrawal, whereas 1986-87 data do not.

General Characteristics of Participants

The O.E.A.-maintained database of participant teacher records yielded the following summary of population statistics. Sixty-four percent of the participants were women, and women comprised more than half the program participants in both

*The program courses were open to participants of the Relicensing Program. However, some participants were allowed to enroll in classes which were open to the general college population, in order to fill a licensing agreement

**Of the teachers that initially registered in 1986-87, 178 dropped out, as follows: 69 withdrew from the program; 39 received incompletes; and 31 were shut out because of cancelled classes.

TABLE 1

Number of Mathematics and Science Courses Offered
During the 1986-87 Program Year

Institution	Course	
	Mathematics	Science
Baruch	1	--
Bronx Community	3	2
Brooklyn College	6	9
City College	7	6
Hofstra University	4	--
Kingsborough Community	--	3
LaGuardia Community	1	--
Lehman College	6	--
Manhattan College	--	3
New York Technical College	4	--
Queensborough Community	--	5
St. John's University	6	--
TOTAL	38	28

- There were 38 mathematics courses and 28 science courses offered during 1986-37.

mathematics and science components of the program -- 60 percent and 68 percent, respectively (see Table 2). Accordingly, the relicensing program's objective of attracting female participation was significantly achieved.

Another program objective, minority participation, was also fulfilled; almost half (44 percent) of the participating teachers belonged to a minority ethnic group. Table 3 shows the ethnic distribution of program participants: 56 percent were white; 29 percent, black; 11 percent, Hispanic; two percent, Asian; and two percent, other.

The majority of participants (61 percent) ranged between ages 31 and 45, concentrating in the 36-to-40 age bracket. Participants in the mathematics components reported a total average of six years' teaching experience, with three years' experience in teaching mathematics. Science applicants averaged eight years' teaching experience overall, with a background of three years' science instruction. The majority of participants in both the mathematics and science components of the program had Master's degrees -- 57 percent and 61 percent, respectively.

Table 4 shows the current licenses held by applicants. Fifty-five percent of the participants were licensed at the elementary (42 percent) or junior high level (13 percent). High school and special education licensed teachers accounted for eight and 11 percent of the program's population, respectively. The remaining 26 percent held per diem (17 percent) or some other type (nine percent) of license. As Table 5 points out, half the

TABLE 2

Gender of Mathematics and Science Relicensing Program Participants, 1986-87

Component	Males		Females		Total	
	N	%	N	%	N	%
Mathematics	115	40.2%	171	59.8%	286	52.0%
Science	85	32.2	179	67.8	264	48.0
TOTAL	200	36.3	350	63.6	550	100.0

- Three-fifths (64 percent) of the participants were women.

TABLE 3

Ethnic Distribution of Mathematics and Science Relicensing Participants, 1986-87

	Mathematics		Science		Total	
	N	%	N	%	N	%
White	131	52%	120	61%	251	56%
Black	83	32	47	24	130	29
Hispanic	27	11	19	10	46	11
Asian	9	4	2	1	11	2
Other	3	1	8	4	11	2
TOTAL	253[a]		196[b]		449	

[a]Missing=33.
[b]Missing=68.

- Forty-four percent of program participants belonged to a minority ethnic group.

TABLE 4

Mathematics and Science Relicensing Program Participants' Teaching Licenses, 1986-87

	Mathematics		Science		Total	
	N	%	N	%	N	%
Elementary School	95	34%	127	50%	222	42%
Junior High School	34	12	37	15	71	13
High School	29	10	13	5	42	8
Special Education	32	13	26	10	58	11
Per Diem	58	21	33	13	91	17
Other	29	10	17	7	46	9
TOTAL	277[a]		253[b]		530	

[a]Missing=9.
[b]Missing=11.

- Over two-fifths of the participants (42 percent) held a common branch license with per diem licensed teachers accounting for another one-sixth (17 percent) of the group.

TABLE 5

Mathematics and Science Relicensing Program
Participants' Teaching Areas,[a] 1986-87

Subject	Mathematics N	Mathematics %	Science N	Science %	Total N	Total %
Art	8	2.5%	6	2.1%	14	2.7%
Business/Computer	13	4.2	6	2.1	19	3.2
Elementary Ed.	45	14.6	72	25.8	117	19.9
Foreign Languages	5	2.0	2	0.7	7	1.0
Gym/Physical Ed.	--	0.0	2	0.7	2	0.3
History, Social Studies	9	2.9	10	3.8	19	3.2
English	20	6.4	22	7.8	42	7.1
Mathematics	150	48.7	15	5.6	165	28.1
Black/Women's Studies	--	0.0	1	0.3	1	0.1
Special Ed.	25	8.1	24	8.6	49	8.7
Science	25	8.1	107	38.3	132	22.4
Vocational	6	1.9	6	2.1	12	2.0
Nursing	2	0.6	6	2.1	8	1.3
TOTAL	308		279		587	

[a]Teachers may have taught in more than one subject area.

- Nearly half of the mathematics participants were teaching mathematics at the middle or high school level; nearly 40 percent of the science participants were teaching science.

participants reported they were currently teaching mathematics (28 percent) or science (22 percent). Elementary school teachers also contributed significantly, representing 20 percent of program participants, with the remaining 30 percent teaching secondary school subjects other than mathematics or science. Participants in the mathematics component reported that they entered the program with a mean total of 15 mathematics credits and had earned an average of nine additional credits through the program. Science component participants generally entered with 13 science credits and earned an average of nine more while in the program.

Forty-one percent of the teachers taught in Brooklyn; 22 percent taught in the Bronx; 18 percent in Queens; 15 percent in Manhattan; and one percent in Staten Island. The remaining three percent did not identify any borough assignment. The distribution of borough participation seems to favor teachers who work in the Bronx, Brooklyn, and Queens, where nine of the twelve program-affiliated colleges are located. Table 6 shows that the three colleges with the highest enrollment were: Brooklyn College, with an enrollment of 148 students; City College, with 101 students; and St. John's University, with 61 students.

Students' mean grade point averages among the colleges ranged from 1.5 to 3.6 (see Table 7). The overall G.P.A. was 2.9 for the mathematics component and 3.1 for the science component.

RELICENSED TEACHERS

During 1986-87, three examinations were given that were

TABLE 6

Mathematics and Science Relicensing Program
College Participation, 1986-87

College	Course: Mathematics N	Mathematics %	Science N	Science %	Total N	Total %
Baruch College	9	3%	--	--	9	2%
Brooklyn College	55	19	93	35%	148	27
Bronx Community	14	5	16	6	30	5
City College	45	16	56	21	101	18
Hofstra Univ.	20	7	--	--	20	4
Kingsborough University	--	--	51	19	51	9
LaGuardia College	12	4	--	--	12	2
Lehman College	43	16	--	--	43	8
Manhattan College	--	--	18	8	18	4
NY Technical	27	9	--	--	27	5
Queensborough College	--	--	30	11	30	5
St. John's University	61	21	--	--	61	11
TOTAL	286		264		550	

- Institutions with the highest enrollment number were: Brooklyn College (27 percent); City College (18 percent); and St. John's (11 percent).

TABLE 7

Mathematics and Science Relicensing Program
Grade Point Averages by College Attended, 1986-87

College/University	Mathematics GPA	Science GPA
Baruch	1.5	--
Bronx Community College	3.2	2.8
Brooklyn College	2.4	3.5
City College	3.5	3.1
Hofstra University	2.8	--
Kingsborough College	--	3.2
LaGuardia College	3.6	--
Lehman College	3.0	--
Manhattan College	--	2.4
New York Technical College	3.0	--
Queensborough College	3.0	3.3
St. John's University	2.6	3.3
TOTAL	2.9	3.1

- The G.P.A. of participants in the mathematics component ranged from 1.5 to 3.6. The overall G.P.A. in mathematics was 2.9.
- The G.P.A. of participants in the science component ranged from 2.4 to 3.5. The overall G.P.A. in science was 3.1.

relevant to this program: the junior high school and high school mathematics examinations and the high school examinations in earth science, chemistry, biology, and general science. Data were gathered for those program participants who had completed the program and applied for licensing examinations offered during September, 1986, through August, 1987. The rates of teachers who took and passed relicensing examinations were computed and compared between program participants and the general population. A summary of this information is presented in Table 8, which shows that:

- Seventy-four percent of the 19 program participants who took the mathematics licensing examination passed the test, compared to 73 percent of those from the general population.
- Sixty-seven percent of the six program participants who took the science licensing examination passed the test, compared to 65 percent of those from the general population.

The passing rates of relicensing program participants were slightly higher than the general population's for both mathematics and science examinations. The relicensing program offered preparatory courses for its mathematics participants who qualified for the exam, and this preparation may have contributed to the increase in passing scores among this group over last year's rates.* The reactions of participants who completed program requirements and attended preparatory sessions are presented in the following section.

TABLE 8

Comparison of Passing Rates Among the General Population and Relicensing Program Participants, 1986-87

License	Number General Population Taking Exam	Number General Population Passing Exam	Number Relicensing Population Taking Exam	Number Relicensing Population Passing Exam	Percent Passing Exam General Population	Percent Passing Exam Relicensing Population
Math JHS	40	33	5	4	82.5%	80.0%
Math HS	116	81	14	10	70.0	71.4
Total	156	114	19	14	73.0	73.6
Chemistry & Gen Sci HS	31	23	1	1	74.1	100.0
Earth Sci & Gen Sci HS	12	12	2	2	100.0	100.0
Biology & Gen Sci HS	108	63	3	1	58.3	33.3
Total	151	98	6	4	64.9	66.6

- Almost three-fourths of the relicensing program participants (74 percent) who took mathematics license examinations passed the test, while 73 percent of the general population applicants who took mathematics license examinations passed these tests.
- Two-thirds of relicensing participants (67 percent) who took the high school license examinations in science passed the test. Sixty-five percent of general population applicants who took science license examinations passed the tests.

III. REACTIONS TO AND PERCEPTIONS OF INSTRUCTIONAL COMPONENT

This chapter presents a summary of the responses given during interviews with program coordinators, course instructors, and participating teachers. Results of analyses of surveys sent to program dropouts and participants who completed their coursework are included as well.

COLLEGE COORDINATORS

Six relicensing program coordinators at five of the participating colleges* were interviewed concerning their views on program implementation, assistance from the central Board of Education, program services, and recommendations for improvement. All six coordinators who were interviewed found implementation of the relicensing program a smooth and efficient process. They especially acknowledged the modified participant application forms, which included more detailed information on teachers' background (credits already earned, level of license sought, previous courses taken in the program) and facilitated classroom placement.

Coordinators said they were also relieved of the burdening "screening out" process this year since the Board of Education began enforcing program eligibility requirements. Centralization and coordination of course offerings at participating colleges were viewed as helpful and efficient in the registration process.

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*One of the colleges visited had two program coordinators: one for each component. The colleges visited were suggested by the Division of Curriculum and Instruction.

This was a big change from last year, when the coordinators' major complaint was that they did not know enough about other participating college programs to provide adequate referral services for teachers who could not be served at their particular college. Coordinators also indicated that publicity about the program had been improved over past attempts and that teachers at registration were more aware of program requirements. It was recommended that advertisements regularly appear in the United Federation of Teachers newspaper to promote alertness. Participating colleges still experienced an influx of late applicants who had to be processed quickly before the registration deadline, and it was suggested that program applications be distributed earlier to alleviate this pattern.

Implementation of the program was facilitated by coordinators' contact with Board of Education personnel involved in the project. Coordinators were generally pleased with the assistance they received from the Board of Education. Their comments varied: some said that the help was "not that much," while another coordinator indicated that the Board of Education "brought us in for regular meetings, provided good information, and maintained contact." In general, coordinators agreed that Board of Education personnel were available to assist them with any questions and/or problems that arose during the course of the program. Coordinators expressed an interest in making use of O.E.A. database records of program applicants that are maintained at the Board of Education to ensure accurate record

keeping and assist in tracking students' progress in the program. Each college provided a core curriculum that was supplemented with various elective courses. Mathematics courses were generally modeled on the liberal arts undergraduate curriculum, with advanced courses for applicants nearing completion of the program. Science curricula were more difficult from the onset of the program, frequently requiring laboratory time and written reports.

Coordinators geared their programs to prepare teachers to teach at the junior high school or high school levels. They believed that teachers entering the program were adequately prepared to handle the coursework. Coordinators and program instructors met with participants individually to determine a course sequence. For most applicants, coordinators recommended introductory courses in lieu of remediation to ensure that teachers received a solid background in the subject matter before going on to advanced classes. Teachers were provided tutorial services and information on licensing examinations. Program participants were also given access to regular student services such as use of the library, personal counseling offices, and study workshops. It was believed that teachers' academic performances could be improved by making classrooms smaller and providing instructors with staff development training. The quality of instruction was viewed as the colleges' greatest asset to the program. Coordinators cited their instructors' commitment to the project and their ability to

interact effectively with participating teachers.

Overall, coordinators viewed the relicensing program as a helpful and much needed service for its teachers. They believed the program helped teachers build a solid background in the subject matter, providing them with better teaching tools. They also indicated that the program developed support systems for relicensed teachers (fellow classmates), motivated teachers to obtain the new license, and helped alleviate the "burn out" syndrome that some educators experience. The coordinators believed that the colleges benefitted from the opportunity to enhance educational instruction in the city's schools. It was recommended that the program receive greater funding so that courses in computer programming and other areas could be included. Coordinators stressed that the Board of Education should begin acknowledging and awarding exceptional achievements by program participants as a way of encouraging others to do better. In general, the program was perceived as beneficial to all involved.

COURSE INSTRUCTORS*

Instructors designed their course offerings to follow a sequence covering the basic/introductory courses through more advanced subject matter. In most cases, instructors attempted to coordinate their course contents with junior high school and high school curricula. Program participants, whom in general

*Program coordinators identified instructors in their teaching staff to be interviewed.

instructors perceived as capable of mastering the coursework, had a greater chance of doing well in the program if they followed a prescribed sequence of courses. Instructors offered placement advice to teachers based on their application profiles.

Tutoring and/or academic counseling was provided by instructors. Instructors reported that either they themselves or staff from some other office of the college were available to provide teachers counseling for personal matters as well. To assist teachers in preparing for the licensing examinations, instructors incorporated old examinations into their lesson plans. Teachers were also notified of examination preparation courses offered through the central offices of the Board of Education. One instructor went so far as to offer additional classes on Saturday to review examination materials. Usually, a class announcement would be made to inform participants of the various services available to them in the program. Instructors noted that only a minority of teachers took advantage of such opportunities.

Instructors blamed lack of time, personal problems, unavailability of desired courses, and teachers' feelings of inadequacy as primary factors causing participants to drop out of the program. It was suggested that if teachers were offered a greater variety of courses and weekend classes, the number of dropouts would decrease. In recommending changes to improve overall program design, instructors cited the need for additional funding to expand their programs; the usefulness of conducting

on-site visits of teachers' classrooms as a way of gaining insight into the public school setting; and the practice of awarding teachers graduate credit for advanced courses.

Unlike last year, when most instructors admitted having little or no concept of the relicensing project's goals, current instructors reported that they were well aware of the objectives involved and made great efforts to improve the program's impact on public school education. Instructors viewed the strong educational background teachers received while in the program as the participants' greatest benefit.

PARTICIPATING TEACHERS

A representative sample of 65 relicensing program teachers responded to the participant questionnaire that was sent out in April.* Almost half the respondents (42 percent) reported that they had been in the program for at least one year. Another 26 percent (n=17) said they had been enrolled in the program two years: nine percent (n=6), three years. Only one teacher was starting a fourth year in the program. Seventeen percent (n=11) were new participants who had just begun the program in spring, 1987. Brooklyn teachers made up the majority of the respondents (47 percent), followed by teachers in the Bronx (23 percent), Manhattan (19 percent), and Queens (11 percent). The absence of Staten Island teachers suggests there is a need to re-implement

*One hundred and sixty-one questionnaires were mailed. The 61 questionnaires returned represents a response rate of 40 percent.

the program in that area. Reasons cited for enrolling in the program included the desire to get a new license (33 percent); to change a current teaching assignment (25 percent); to increase knowledge in a subject area (14 percent); and to take advantage of tuition-free courses (eight percent).

Two-fifths of the respondents (41 percent) said they first learned of the program through word of mouth from friends and colleagues. Posted Board of Education flyers (31 percent), recommendations from school administrators (19 percent), teacher newsletter advertisements (five percent), and participating college recruitment materials (three percent) were also credited as sparking initial contact with the project. Teachers said that application and registration procedures ran smoothly and commended program coordinators for their efficiency in handling those procedures. Teachers chose courses in the program based on several factors: their interest and need to enhance classroom instruction (38 percent); the availability of course offerings (26 percent); advisement of program coordinators (14 percent); compatibility with their schedules (11 percent); and other personal reasons (11 percent). Teachers said they were generally pleased with course offerings and recommended better sequencing of classes, making course contents complimentary to teachers' curriculum, adding more introductory courses, and expanding course selections to upgrade program usefulness to further enhance the program's benefits.

If participating colleges offered student services outside

of the classroom, many participants were unaware of it. The majority of teachers admitted ignorance of any type of tutoring (62 percent) or counseling services (84 percent) available at their college. Of the 29 percent (n=19) who said their college did offer tutoring, only two actually used the service, and both found it helpful in their studies. Those who did not take advantage of available tutoring said they didn't need it or didn't have the time to stay extra hours. A few participants (n=19) said that they desired counseling services in areas involving sequencing courses, licensing examination information, career counseling, and personal support and encouragement. Of the 24 percent (n=16) who knew of counseling available at their college (n=16), only two used the service by going to the general counseling office of the college. A teacher commented, "Counseling is available, but recertification is a unique situation, and the college could not counsel appropriately."

Teachers praised program instructors for their knowledge of subject matter, enthusiasm, ability in teaching, and respect of teachers as professionals. Course content, difficulty, and comprehensiveness were also rated satisfactory. Course sequencing was problematic for some participants -- as one teacher elaborated, "Better sequencing of courses is needed. I understand this can be difficult when so many people are starting at different times. I ended up taking a course that prepared me for another course I had already taken." Beneficial aspects of the program focused on its contribution to growth of knowledge in

subject area content, preparation for licensing examinations, and freedom from tuition. Most teachers (65 percent) agreed the experience had affected their teaching of the subject. Teachers said the program broadened their background and gave them the confidence to explore new areas in their teaching.

The overwhelming majority of participants (86 percent) said they would recommend the relicensing program to colleagues who were teaching out of license because it provided a solid background in subject areas, opened career opportunities, facilitated getting a new license, and offered specialized treatment for teachers of New York City public schools. Eighty-nine percent (n=56) of the respondents planned to take a licensing exam upon completion of the program. Only four did not desire a new license, and another four remained undecided on this issue.

Teachers expressed their appreciation of the project in many ways. Although rigorous schedules had to be maintained, they believed it a worthwhile effort. The demands of coursework took the greatest toll on teachers who lacked experience in teaching either mathematics or science. Their frustration was reflected in one teacher's comment: "The relicensing program is an excellent idea, but it is geared for those educators who are already teaching science, leaving the rest of us in a sink or swim situation. I plan to retire from the program because I feel inadequate to take and pass a Board of Examiner's test." However, most perceptions of the program were positive. Overall,

sentiments were like this teacher's accolade: "Thanks for the opportunity to expand my teaching horizons and venture into territories I never would have on my own."

PROGRAM COMPLETION RESPONDENTS

Questionnaires were distributed to 17 participants who completed mathematics coursework (given to all who attended the examination preparatory sessions) and mailed to all 32 science teachers who had been identified as completing their program requirements. Surveys of the mathematics participants solicited views of the program's effectiveness in general, and the preparatory sessions' usefulness in preparing them to take the exam. Science participants were asked for their impressions of the overall program. (Examination preparatory sessions were not given in science.)

Of the 17 mathematics teachers surveyed, 53 percent (n=9) had been in the program for at least two years. Over half the group (58 percent) said that they had acquired at least 13 credits in the program, bringing an average of 11 mathematics credits with them when they entered. The group was composed of nine men and eight women. Only one teacher indicated that he had taken the exam before and failed to pass. Close to 60 percent of the participants were currently teaching mathematics at either high school (n=5) or junior high school (n=5) levels. Most participants (88 percent) were registered for an upcoming exam in high school mathematics (n=6), junior high school mathematics

(n=6), or both (n=2).

Teachers found that working with old licensing examinations (n=13), using the instructor's notes (n=5), and the practice of problem-solving methods (n=1) were the most helpful components of the sessions. Reasons for participating in the preparatory sessions included: the need for a refresher course; curiosity as to what would be in an exam; availability of good reference materials; the need to master certain mathematical concepts; working with other teachers who were preparing for the exam; and learning test-taking skills.

Six of the 11 science teachers who responded to the survey (55 percent) had taken two years to complete the program. Although none of the teachers had received their new science license as of spring, 1987, four indicated that they were either registered for an upcoming science exam, and five or six planned to do so in the future. All but one respondent (who was in special education) had current assignments teaching science -- three at elementary, four at junior high, and three at high school level. Five taught at schools located in the Bronx, two in Brooklyn, three in Queens, and one in Manhattan.

Teachers in both disciplines indicated that the relicensing program had been instrumental to pursuing their goals of becoming licensed in mathematics or science. They viewed the program as a "great refresher," which provided a "forum for exchange" and "enhanced self-confidence." More than half the teachers (61 percent) cited the quality of instructors, and 30 percent cited

applicability of course content, as the most useful aspects of the program.

Instructors were perceived as dedicated, knowledgeable, and understanding. Teachers reported that they were able to relate materials to their classroom curriculum, and one teacher made the statement that program courses had been "very useful in fieldwork, almost immediately." But the program was also criticized for its perceived assumption that teachers came in with strong backgrounds in mathematics or science. One teacher described the problem: "Math credits I earned prior to this program were taken 20 years ago. Who can remember math after all this time? I had to end my participation in the program because of too many credits. However, I can't take the math exam because I do not have enough knowledge to pass it." Overall, 87 percent of participants who had completed the program reported that they would recommend the program to their colleagues and complimented it as an invaluable service to public school teachers. One respondent's comment expressed the general sentiment of the group: "I think it is a fantastic opportunity and much needed program. I hope it continues."

PROGRAM DROPOUTS

Participant withdrawals from the program were categorized in two ways: program dropouts, (defined as teachers who dropped out after completing at least one course but without having earned all necessary credits) and course dropouts (defined as registered

participants who withdrew from courses). A sample of 31 program dropouts and 54 course dropouts were drawn from the database-compiled listing of registered applicants based on incomplete and college dropout lists. Both groups were mailed questionnaires. Of the 17 completed questionnaires returned (all teachers came from the mathematics component of the program), 11 were program dropouts and six were course dropouts.

Program dropouts had completed at least three credits in the program, and over half (n=6) accumulated more than ten. Program dropouts cited personal reasons such as illness for their withdrawal from courses and perceived themselves as being on leave rather than permanently discontinued from the program. Although some respondents (n=4) said that both counseling and tutoring services were available at their colleges, only one teacher actually utilized either service. Only two respondents could definitely say that these services were not available in the program, and the other five respondents were unaware if such opportunities existed. Suggestions made for improving student services included guiding teachers in their selection of course schedules and expanding the variety of course offerings.

In rating various aspects of their course, program dropouts praised course content and classroom instructors. Course content was described as "interesting and diverse," and instructors were viewed as "caring and superior" in their work. Also rated satisfactory were the program's comprehensiveness, course difficulty, and course sequence. General comments about th

program solicited responses of appreciation such as "Thank you for making it available," and recommended improvements centered on making course descriptions more specific so that teachers would not "find themselves taking classes that are of no enhancement in pursuing a license."

Course dropouts cited difficulties in understanding course material (n=3) and lack of time (n=3) as their primary reasons for withdrawing from the program. Some respondents reported that the coursework was not what they had expected, and most did not indicate plans to resume an active status. Although one respondent acknowledged that counseling and three that tutoring services were available at their college, only one teacher actually took advantage of either service.

In some cases, teachers knew that one type of service had been offered but were unsure about the other; usually it was more likely that they would know about the availability of tutorial services as opposed to counseling services. Two teachers said neither counseling nor tutoring services were offered at their college.

Like program dropouts, course dropouts rated the program's course content, comprehensiveness, and classroom instructors as satisfactory. However, program components related to course difficulty and sequence were rated poorly -- teachers said that the "amount of work was too much" and the "pace was too fast." Course dropouts stressed the need to use more tutors, and cut back on the amount of work required from participants.

As mentioned earlier, course dropouts were less likely to indicate an intention to continue with the program. They also had a tendency to fault the structure of the program design. One teacher lamented, "I did not have the background in math that most teachers bring into the program and was completely lost. I have a genuine interest in teaching math, but with the level of coursework required, I don't think it is feasible. I can only hope that someday there will be a program designed for people like me." Easily discouraged, newly enrolled participants need stronger guidance and other support services to encourage them to go through this critical point in the program.

STUDENT ACHIEVEMENT

Comparisons were made between the mathematics achievement of relicensed participants' students* and the students of mathematics teachers who are teaching out of license in grades seven to nine. Analyses of covariance were performed on students' mathematics test scores to determine whether achievement differed significantly among the two groups. Pretest scores obtained in 1986 were used as covariates to control for initial differences in mathematics achievement.

When adjusted for initial differences, relicensing program participants' students in grades seven and eight showed posttest mathematics scores of 671 scale score points while out-of-license teachers' students showed posttest scores of 652 scale scores

*These teachers had completed all the course requirements and were eligible to take a licensing examination in mathematics.

points. The difference between these posttest scores was statistically significant ($p<.002$).

However, when the mathematics scores of ninth-grade students of participating teachers were compared to out-of-license teachers' ninth-grade students math scores, the results showed similar levels of achievement even when adjusting for initial differences.

These results cannot be easily interpreted since, to ensure teacher anonymity, no information on teaching experience in mathematics was collected. Information on teachers' background would allow a more thorough interpretation of these findings.

IV. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

In its fifth year of implementation, the Mathematics and Science Relicensing Project is regarded as an invaluable public service enhancing the quality of instruction in New York City public schools. During the 1986-87 project year, over 500 teachers successfully enrolled in program courses, and 13 percent (n=71) became eligible to take a relicensing exam in June, 1987. The majority of program participants are teachers between the ages of 35 and 40, with an average of six years' teaching experience and academic credentials of at least a Master's degree. Women and minorities were well represented in the population, satisfying important program objectives. Minority members accounted for nearly half the group (44 percent), and women significantly outnumbered men in both the mathematics and science components of the program. A high percentage (59 percent) of participants currently hold elementary school or per diem teaching licenses.

Modifications in the program's structure regarding application and registration processing were well received by college coordinators. The coordinators, who were relieved to be free of the burdening "screening out" process, were able to register participants more efficiently and viewed communications with the Board of Education as instrumental to successful program implementation. Program courses were geared towards preparing teachers to teach at the junior high school or high school

levels, and coursework was supplemented with tutorial services.

Coordinators desired an expansion of their course offerings, along with reductions in class size, to improve teacher performance in the program. The quality of instruction was perceived as the program's greatest asset. Overall, coordinators viewed the relicensing program as a much needed service to the public schools.

Instructors, cognizant of program objectives, sought to provide teachers with strong educational backgrounds in mathematics and science. They perceived program participants as capable of mastering the coursework and attempted to guide teachers in sequencing their class selection. Instructors reported that although tutoring and counseling services were available to teachers, only a few actually took advantage of those services. It was believed that factors causing teachers to drop out could be alleviated by increasing the variety of course offerings and by scheduling weekend classes.

Participating teachers cited the desire to change their current teaching assignment, the pursuit of greater knowledge in subject area, and tuition-free courses as their main reasons for enrolling in the program. Teachers learned of the program primarily through word-of-mouth sources, although the Board of Education's postings and advertisements also contributed to awareness. That Staten Island teachers are underrepresented in the program suggests a need to increase availability of classes in that area. Most teachers had been in the program for at least

one year, and said that they would recommend the experience to colleagues who wanted to expand their career opportunities.

Teachers were generally pleased with course offerings; however, they did suggest that more introductory classes be included and the range of course selections be broadened to enhance program usefulness. A small percentage of program participants reported that tutoring and/or counseling services were available at their college, but hardly anyone utilized such services. As was the case last year, the majority of teachers admitted they did not know if tutoring or counseling services were offered by their college. Student services most desired by teachers involved course sequencing, licensing examination information, and career counseling. Teachers who entered the program with weak backgrounds in science and mathematics were the most vulnerable and found it difficult to sustain the rigors of their coursework.

Participants who left the program after completing a number of credits were likely to cite personal reasons for dropping out. Course dropouts who left before accumulating any credits in the program had a tendency to report difficulty in coursework or lack of time as reasons for withdrawal. Program dropouts perceived themselves as being on leave from the program, while course dropouts showed fewer signs of resuming an active status in the program. It was suggested that more tutors, a greater variety of courses, and less coursework would alleviate factors associated with dropping out.

Teachers who had completed the program said that the experience had been instrumental in pursuing their goals to become licensed in mathematics or science. Most of those surveyed said that they planned to take a licensing exam in mathematics or science. Participants who completed math component course requirements had the opportunity to attend preparatory sessions for the licensing examination, and described these sessions as highly useful. Former relicensing program participants obtained higher passing rates on their licensing examinations than did the general testing population, as compared to similar passing rates in previous years. Seventy-one percent of former program participants surveyed are currently teaching mathematics or science.

RECOMMENDATIONS

In summary, the participants and program staff valued the Mathematics and Science Relicensing Program. Primary suggestions for improving next year's implementation include:

- Expand the variety of program course selections.
- Re-establish classes in Staten Island to serve teachers in that area.
- Provide better dissemination of information (at the local college level) concerning student services in tutoring and counseling specific to relicensing.
- Strengthen support services to teachers in their initial placement and sequencing of program courses.