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ABSTRACT

In response to the shortage of mathematics and science teachers in Washington, this state's legislature developed a program to provide loans for students preparing to teach secondary-level mathematics or science in Washington public schools. The rationale was that these loans would encourage students majoring in mathematics or science to prepare for teaching careers. Funds made available through the loan program were distributed to the 15 colleges and universities in the state that have teacher education programs. This study surveyed these institutions to determine the interpretation of guidelines and distribution of funds by subject area, the adequacy of the funding level, and the number of mathematics and science teachers available as a result of the program. Among the results (presented as answers to nine questions) are those indicating that the number of students in mathematics and science teacher preparation programs has increased, more males than females received loans, and only one-third of those who completed preparation under the program were teaching science or mathematics in Washington public schools (it was noted that some individuals were still seeking employment). Recommendations based on these and other results include continuing the program and clarifying program guidelines. (JN)

WASHINGTON STATE TEACHER INCENTIVE LOAN PROGRAM FOR MATHEMATICS AND SCIENCE:

STUDY OF COLLEGE/UNIVERSITY IMPLEMENTATION OCTOBER 1983 - NOVEMBER 1984

REPORT TO WASHINGTON STATE LEGISLATURE

by

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INTRODUCTION

During the 1970's the number of people preparing to teach mathematics and science decreased significantly. The technological fields were hiring an increasing number of college graduates from the areas of mathematics and science (Levin, 1982; Worthy, 1982) while teachers of science and mathematics were leaving the classroom for other employment (Olstad and Beal, 1981; Shrag and Hair, 1984; Good and Hinkel, 1983). This combination of fewer teachers being prepared to teach mathematics and science with a significant increase in the number of teachers leaving the teaching profession helped to precipitate a national shortage of science and mathematics teachers (Taylor, 1984; Yoetist and Nickel, 1983; Howe and Gerlovich, 1982).

In response to the need to encourage more people to become mathematics and science teachers, the state legislature in 1983 developed the TEACHER INCENTIVE LOAN PROGRAM FOR MATHEMATICS AND SCIENCE. The funds made available through the loan program were distributed to the fifteen colleges and universities in the state that have teacher preparation programs.

In order to determine the effect of this loan program on the number of students preparing to teach mathematics or science, and to determine if there are similar programs in other states, three studies were commenced at the University of Washington in cooperation with the Council on Postsecondary Education (CPE). This report describes the first of the three studies and answers the following questions:

1. How were the state guidelines interpreted by each institution to determine who was eligible for a loan?
2. How was the loan money distributed between mathematics and science?
3. What was the amount of the average loan for the academic year?
4. What percentage of those who applied were eligible and received a loan?
5. How was the loan money distributed among male and female applicants?
6. Who selected students to be recommended for an incentive loan?
7. How was the incentive loan program advertised?
8. From the information that is available at this time, are the loan recipients entering the teaching profession?
9. Are more qualified mathematics and science teachers available for teaching positions?

Subsequent studies will deal with questions related to what other states are doing to encourage more students to become mathematics or science teachers and with questions concerning whether loan recipients enter the teaching profession in Washington state.

PROCEDURES

A questionnaire was prepared and mailed to each of the 15 public or private colleges and universities in the state of Washington (see Appendix I). These colleges and universities are: Central Washington University, Eastern Washington University, Evergreen State College, Gonzaga University, Pacific Lutheran University, Seattle Pacific University, Seattle University, Washington State University, Western Washington University, Whitman College, Whitworth College, University of Puget Sound, and the University of Washington. Two colleges did not recommend any students for loans, St. Martins College and Walla Walla College, and, therefore, are not included in this report. Additional information was obtained from the Council on Postsecondary Education.

FINDINGS

QUESTION 1: How were the state guidelines interpreted by each institution to determine who was eligible for a loan?

Each institution was asked to respond to a series of statements regarding their policy for determining who was eligible to be recommended for an incentive loan. There was a great variation in the interpretation of these guidelines. Table I summarizes the responses to these statements.

TABLE I
Guidelines Used to Determine Eligibility for Teacher Incentive Loan for Mathematics and Science in Washington State (1983-1984)

Guidelines for Receiving Loan	Institutions With Guidelines YES	NO	Institutions With NO POLICY	Percent Having Guidelines Responding YES
Never Certificated				
with major	13	0	1	100 percent
with minor	4	6	3	40 percent
Currently Certificated				
no major in math or science	11	0	2	100 percent
change science major to math major	4	8	3	40 percent
change math major to science major	5	5	3	50 percent
change one science major to another science major	4	6	3	40 percent
change math minor to math major	7	3	3	70 percent
change science minor to science major	6	4	3	60 percent
add major in science or math	4	7	2	40 percent
Certificate Lapsed				
renew mathematics or science major	5	5	3	50 percent
renew and add science or mathematics major	9	1	3	90 percent

Most of the institutions agreed on three of the guidelines. Students who were never certificated and working on a major in mathematics or science and students who are currently certificated but do not have a major in either mathematics or science were guidelines used by all institutions. Those who had certificates that had lapsed and were adding majors in mathematics or science was used by nine of the thirteen schools. Approximately two-thirds of the schools granted loans to people with minors changing to majors..

Certificated teachers changing a previous minor to a major in mathematics were recommended for loans by seven of the thirteen schools, while six of the thirteen schools recommended loans to certificated teachers changing minors to majors in science.

Half or less than half of the colleges and universities allowed students who had never been certificated to teach to receive loans if they had only a minor in either mathematics or science; or allowed certificated teachers to change to a major in mathematics or science; or add a major to a prior major but in a different area of mathematics or science or allowed a person with a lapsed certificate to renew a major in mathematics or science.

Question 2: How was the loan money distributed between mathematics and science?

Forty-seven percent of the loans were in mathematics; the rest were in science: 31 percent in biology, 6 percent in chemistry, 4 percent in physics, and 12 percent in other science areas such as geology, natural science, general science, and

earth science. Table II summarizes the distribution of loan money between mathematics and science students for October 1983 to November 1984.

TABLE II
Distribution of Loan Recipients by Subject Area
for October 1983 - November 1984

SUBJECT AREA	PERCENTAGE RECEIVING LOANS
Mathematics	47 percent
Biology	31 percent
Chemistry	6 percent
Physics	4 percent
Other Areas of Science (geology, earth science, natural science, and general science)	12 percent

The distribution of loan money by subject area is comparable to the distribution by subject area to the number of people recommended for certification for the period from October 1983 to November 1984. One hundred eighty-two were recommended in mathematics and science: 32 percent were in mathematics, 35 percent in biology, 8 percent in chemistry, 5 percent in physics, and 20 percent in other sciences. (This information is summarized in Table III.) During this period, of all students recommended for certification, 5.1 percent were in mathematics, 5.5 percent were in biology, 1.4 percent were in chemistry, 0.1 percent were in physics, and 3.2 percent were in other sciences.

TABLE III
Total Number Recommended for Certification
Compared with
Total Number Recommended for Certification
In Mathematics and Science
for October 1983 - November 1984

Total Recommended For Certification For All Subjects	Total Recommended For Certification For Mathematics and Science
1139	182

SUBJECT AREA	NUMBER (n)	PERCENTAGE OF ALL (n=1142)	PERCENTAGE OF MATHEMATICS AND SCIENCE (n=182)
Mathematics	58	5.1 percent	32 percent
Biology	63	5.5 percent	35 percent
Chemistry	16	1.4 percent	8 percent
Physics	9	0.1 percent	5 percent
Other	36	3.2 percent	20 percent

Question 3: What was the average loan received for the academic year?

For the academic year of 1983-84, 93 loans were granted with an average loan amount of $1583. (CPE)

Question 4: What percent of those who applied were eligible and received a loan?

The total number of students from the 13 institutions who applied for loans was 316. Eighty-two percent of those were eligible for loans and 67 percent received loans. Of the 258 students eligible for loans, 83 percent received loans.

Question 5: How was the loan money distributed among male and female applicants?

Fifty-nine percent of the loans were granted to males and 41 percent to females. Eighteen percent of the total loans went to females in mathematics, and 23 percent of the total loans went to females in science.

Question 6: Who selected students to be recommended for an incentive loan?

A committee was responsible for recommending students for loans at six of the institutions while four schools indicated that the chairperson of the department of education or the dean of the college of education was responsible. The financial aid office was responsible at two of the schools, and one school did not indicate who selected students for loan recommendations. In all cases, consideration for a loan was dependent on need status as determined by financial aid forms.

Question 7: How was the incentive loan program advertised?

The most common methods of advertising the availability of loans were through announcements in classes and by printed posters. Only two of the 13 schools provided printed brochures for students inquiring about a loan program.

Question 8: From the information available at this time, are the loan recipients entering the teaching profession?

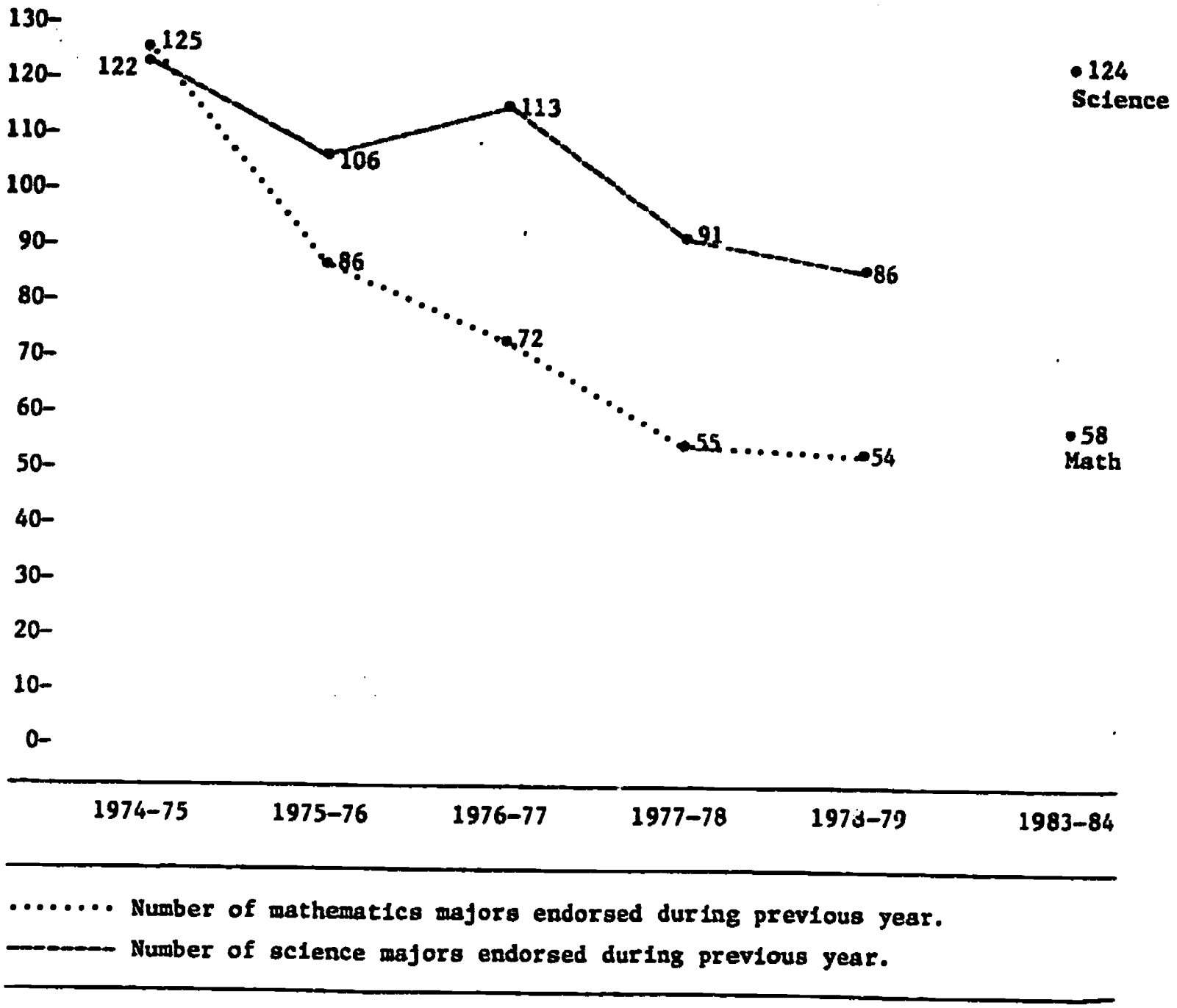
Of the 32 loan recipients who have completed teacher preparation in science and mathematics and are currently certified to teach, 10 are teaching mathematics or science in Washington

state and two are teaching out of the state. The remainder are in the 9-month grace period between completing certification requirements and finding placement to qualify for loan forgiveness. More accurate information to this question will be provided from a subsequent study being conducted by these investigators.

Question 9: Are more qualified mathematics and science teachers available for teaching positions?

Figure I shows what happens when the 1984 supply data is added to the data from Olstad and Beal's 1981 study of supply and demand for secondary science and mathematics teachers in Washington state (Olstad and Beal, 1981.) The number of mathematics majors endorsed in 1983-84 (58) has risen slightly from the level of 1978-79 (54). The number of science majors endorsed in 1983-84 (124) is considerably above the level for 1978-79 (86).

FIGURE I
Profile of Supply of
Science and Mathematics Teachers
In Washington State
1974-1979 and 1983-1984



SUMMARIZING CONCLUSIONS

1. There is a wide variation among the institutions of higher learning in the interpretation and application of the guidelines outlined by the state for the TEACHER INCENTIVE LOAN PROGRAM FOR MATHEMATICS AND SCIENCE.

2. The distribution of loans by subject area is similar to the distributon by subject area of certificate recommendations for the same time period, October 1983 - November 1984.

3. The average amount of loan was $1583.

4. Eighty-one percent of those who applied and were eligible received loans. However, the gross variation of interpretation of guidelines makes it impossible to tell if the level of funding for the loan program was sufficient.

5. The most common method for selecting students was through a committee. At some institutions the head of the education department or college selected students while at a few schools the financial aid office determined eligibility. At all colleges and universities the financial aid office determined financial eligibility based on financial aid forms.

6. More loans were received by males than females.

7. Due to the limited time involved since the start of the loan program and due to the disparity in the interpretation of the guidelines, it is difficult to determine the difference the loans have made in the production and placement of qualified teachers in mathematics and science. The study does indicate a rise in the number of teachers completing preparation in science and a leveling off in the decline in the number of teachers completing preparation in mathematics.

8. The most important question is whether loan recipients eventually teach mathematics or science in the state of Washington. At this time only one-third of those who have completed preparation under the loan program have teaching positions in mathematics or science in Washington state public schools. However, these data should be interpreted with care since some of those who have completed preparation are still in the 9-month grace period while seeking a teaching position.

9. The TEACHER INCENTIVE LOAN PROGRAM FOR MATHEMATICS AND SCIENCE has been supportive of the preparation of science and mathematics teachers. It has possibly encouraged some students in science and mathematics to pursue teacher preparation. The incentive loan program may be a start toward reducing the shortage of mathematics and science teachers, but its effect will be felt only when these qualified people find teaching positions.

RECOMMENDATIONS

1. Given that the numbers of students in mathematics and science teacher preparation have increased, we recommend to continue the incentive loan program for the next biennium.

2. Given the high discrepancy in the interpretation of the state guidelines to determine eligibility for the loans, we recommend that these guidelines be clarified and that this clarificaton emphasize the preparation of new teachers in science and mathematics. The upgrading of teachers, currently certificated, teaching mathematics or science who do not meet the minimum qualifications as set forth in the SPI report "Teacher Assignment Study in Relation to Subject-Matter Preparation" (Shrag and Hair, 1984) is a separate concern that needs to be addressed by additional legislation.

3. This study indicates that there are qualified people completing preparation as science and mathematics teachers. We recommend that the legislature enable school districts to hire qualified teachers when mathematics and science positions are open rather than distribute the teaching assignments among the teachers currently on continuing contracts but not prepared to teach these subjects.

APPENDIX I

University of Washington College of Education
in Cooperation with the
Council on Postsecondary Education

TEACHER INCENTIVE LOAN PROGRAM
for
MATHEMATICS and SCIENCE
SURVEY

The College of Education at the University of Washington, in cooperation with the Council on Postsecondary Education, is conducting a survey of the institutions involved in this program. The purpose of the survey is to measure the degree of success of the Teacher Incentive Loan Program for Teachers of Mathmatics and Science, which is administered by CPE. Please help with the study by completing this form.

Name of institution responding: _____

Name of person completing form: _____

Date: _____

1.0 Information regarding selection of students to receive loans:

1.1 Is the financial aid officer at your institution solely responsible for selecting students for loans? Yes____ No____

1.2 If no, who at your institution besides the financial aid officer is responsible for selecting students to be recommended for loans?

_____

1.3 In which of the these categories do you recommend students for loans:

	YES	NO	NO POLICY
1.31 Applicants never certificated:			
1.311 With major in mathematics or science:	___	___	___
1.312 With only a minor in mathematics or science:	___	___	___
1.32 Applicants currently certificated:			
1.321 Not in mathematics or science and becoming certificated in mathematics or science:	___	___	___
1.322 Changing from any science to mathematics:	___	___	___
1.323 Changing from mathematics to science:	___	___	___
1.324 Changing from one science to another science:(e.g.biology to physics)	___	___	___
1.325 Changing from minor in mathematics to a major in mathematics:	___	___	___
1.326 Changing from minor in science to a major in that science:	___	___	___
1.327 Taking additional credits to add to an already existing major in mathematics or science:	___	___	___
1.33 Applicants with a lapsed certificate:			
1.331 Reinstating in mathematics or science:	___	___	___
1.332 Adding mathematics or science:	___	___	___

1.4 Has your institution developed guidelines which interpret or augment the state guidelines. Yes___ No___
(If printed. please enclose a copy when returning this form.)

1.5 How was the Teacher Incentive Loan Program for Mathematics and Science advertised at your institution?
(Briefly answer on the back of this page.)
(Enclose any handouts for students.)

2.0 Information regarding applicants for funds at your institution:

	10/1/83-11/15/84
2.1 Number who applied:	
2.2 Total number eligible based on FAF need for funding:	_____
2.3 Number recommended for a loan:	_____
2.4 Of the students who applied and did not receive a loan, how many did not pursue certification?	_____
Information not available.	—

3.0 Information broken down by areas:

3.1 Breakdown by subject area of emphasis of students involved in this loan program:

Primary Emphasis Area Used In Loan Application:	10/1/83 - 11/15/84 Number Applied	Number Recommended for a loan
3.11 Mathematics	_____	_____
3.12 Biology	_____	_____
3.13 Chemistry	_____	_____
3.14 Physics	_____	_____
3.15 Other Science, i.e.,Natural,General,etc.	_____	_____

3.2 Total number of students recommended for provisional or initial certification in ALL FIELDS of secondary education: (PE, English, Math, Music,etc.) 10/1/83-11/15/84 _____

3.3 Number of students recommended for provisional or initial certification in science and mathematics, broken down by major area :

Major Area:	10/1/83 - 11/15/84
3.31 Mathematics	_____
3.32 Biology	_____
3.33 Chemistry	_____
3.34 Physics	_____
3.35 Other Sciences, i.e.,Natural,General,etc.	_____

If you have any questions please contact us at (206)543-1847. Write any additional information or ideas which you feel would be helpful on the back of this page. Thank you again for your help.

PLEASE RETURN BY DECEMBER 1,1984.

APPENDIX II

Number of Students Who Applied, Were Eligible and Received Loans by Institution

INSTITUTION	# APPLIED	# ELIGIBLE	# REC'D.	PERCENTAGE RECEIVED THAT APPLIED
Central Washington U.	101	71	39	39 percent
Eastern Washington U.	46	36	36	78 percent
Evergreen State Coll.	7	5	5	71 percent
Gonzaga University	4	4	4	100 percent
Pacific Lutheran U.	15	15	15	100 percent
Seattle Pacific U.	11	11	11	100 percent
Seattle University	10	7	7	70 percent
U. of Puget Sound	12	9	6	50 percent
U. of Washington	47	30	26	55 percent
Washington State U.	30	16	16	54 percent
Whitman College	3	3	3	100 percent
Whitworth College	15	8	8	53 percent
Western Wash. U.	48	43	37	77 percent
TOTAL	316	258	213	

APPLIED: Any student who applied

ELIGIBLE: Students who met criteria of both: 1) program
2) financial need

REC'D.: Students who received loans between October 1983 and November 1984

APPENDIX IV

Number of Students Recommended For Certificates By Area and By Institution October 1, 1983 - November 15, 1984

INSTITUTION	MATH	BIOL	CHEM	PHYS	OTHER SCIENCE	TOTAL	ALL AREAS	PERCENT OF TOTAL IN MATH/SCIENCE
Central Washington U.	4	11	1	0	7	23	305	7 percent
Eastern Washington U.	9	5	1	0	4	19	121	16 percent
Evergreen State College	0	0	0	0	1	1	9	11 percent
Gonzaga University	3	2	0	0	0	5	24	21 percent
Pacific Lutheran U.	6	4	1	1	3	15	67	22 percent
Seattle Pacific U.	3	10	6	0	0	19	64	30 percent
Seattle University	2	11	1	0	0	14	42	33 percent
U. of Puget Sound	2	0	0	0	5	7	25	28 percent
U. of Washington	7	11	4	2	5	29	97	25 percent
Washington State U.	8	1	0	4	2	15	140	11 percent
Whitman College	0	0	0	1	0	1	3	33 percent
Whitworth College	3	5	2	0	0	10	25	40 percent
Western Washington U.	11	3	0	1	9	24	217	11 percent
TOTALS	58	63	16	9	35	182	1139	

APPENDIX III

Number of Students Who Applied and Received Loans By Area and Institution

	MATH A	MATH R	BIOLOGY A	BIOLOGY R	CHEM A	CHEM R	PHYSICS A	PHYSICS R	OTHER A	OTHER R	TOTAL RECEIVED MATH/SCIENCE
Central Washington U.	37	19	22	12	4	1	4	2	14	5	39
Eastern Washington U.	23	19	12	9	1	1	4	4	6	3	36
Evergreen State Coll.	3	1	2	2	1	1	–	–	1	1	5
Gonzaga University	3	3	1	1	–	–	–	–	–	–	4
Pacific Lutheran U.	10	10	3	3	2	2	–	–	–	–	15
Seattle Pacific U.	6	4	6	6	–	–	–	–	1	1	11
Seattle University	4	2	6	5	0	0	0	0	0	0	7
U. of Puget Sound	2	2	7	2	1	1	–	–	2	1	6
U. of Washington	22	12	10	7	5	3	3	1	7	3	26
Washington State U.	n/a	5	n/a	4	n/a	2	n/a	0	n/a	5	16
Whitman College	3	3	0	0	0	0	0	0	0	0	3
Whitworth College	15	8	–	–	–	–	–	–	–	–	8
Western Washington U.	15	12	19	15	3	2	1	1	10	7	37
TOTAL	143	100	88	66	17	13	12	8	40	25	213
Percent Receiving Loans in Each Area	47%		31%		6%		4%		12%		

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