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ABSTRACT

The Mathematics Learning Center provides materials and assistance to students in courses from Arithmetic through Calculus and Differential Equations. One component of the program is the Directed Independent Study (DIS) program which provides an alternative to classroom instruction in Arithmetic, Introduction to Algebra, College Algebra, and Trigonometry. After a testing procedure to determine course of study and preferable learning mode, students are guided by a computer through a program consisting of 12 performance-based units of instruction. Success rate for DIS students during the 1974-75 academic year was about 40%; it rose to 50% for the 1975-76 academic year and continued rising until 1977-78 when a Tutorial Study Lab was added and the success rate dropped. The number of students involved in the program rose from seven to 44 by 1977-78. Another increase was found in the number of student visits or contacts, computed daily, weekly, and monthly. Students showed a clear preference for individual tutoring, however, attempts have been made to limit tutoring and increase usage of less popular modes of instruction. Though there was a slightly higher percentage of minorities attending the Center than in the total student population, the profile of DIS students is fairly well representative of the student body. (MB)

THE MATHEMATICS LEARNING CENTER

AT THE

NEW WORLD CENTER CAMPUS

OF

MIAMI-DADE COMMUNITY COLLEGE

Evaluation and Status Report

by

William P. Palow, Ed.D.

Spring 1978

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Introduction

The Mathematics Learning Center at the New World Center Campus exists to perform the following functions:

A. To provide assistance to any student enrolled in one of our mathematics courses;

B. To provide an alternative system to instruction in the classroom; and

C. To provide a place where anyone interested in mathematics may meet to study and discuss the topic with either other students or staff including instructors.

The facility is intended to appeal to the full range of students by providing help and materials in courses from Arithmetic through Calculus and Differential Equations.

The Center formally began operation at the beginning of the Winter Term of the 1973-74 academic year. The original staff consisted of two student assistants and an instructor with 24 points (40%) of release time to set up, administrate, and help tutor in the lab. The authorized staff has since grown to six student assistants, three paraprofessionals, and an instructor designated as Math Lab Director with 24 points of release time to administrate.

The Center is open on a thirteen hour a day basis, Monday through Friday, with hours from 8:00 AM to 9:00 PM. On Saturday students may seek help from 9:00 AM to 4:00 PM. In total, assistance is available some 72 hours per week.

The growth and patterns of usage for the Mathematics Learning Center (Math Lab) will be discussed in the following pages. Since we are a community college, the Center may be used by any student at any campus of Miami-

Dade and also by the general public. Often we receive phone calls from people with mathematical problems, or from concerned parents seeking aid for their children. In the past, we have even been sought out by students from the local universities.

A relatively recent and important event (June 1976) has been an award by the National Science Foundation of $273,400 to cost share a three year project to devise and implement a system of computer managed instruction in the Center. The above amount plus $118,281 from the college has provided a total of $391,681 to develop four courses, i.e. Arithmetic, Introduction to Algebra, College Algebra, and Trigonometry to be taught in the Center through an individualized, multi-media approach.

Directed Independent Study Students

The purpose of our D.I.S. program is to provide an alternative means of instruction to that of the classroom. We presently offer this option in the following courses: Basic Mathematics (Arithmetic), Introduction to Algebra, College Algebra, and Trigonometry. Students are selected for this program solely on the basis of willingness to work. Previous academic success is not a consideration.

Until recently, the D.I.S. students either walked in on their own or were referred by their instructors. Now, these students are augmented by volunteers recruited from the classroom at the beginning of the semester. The first step for each D.I.S. student is to take two paper and pencil inventories. One is a mathematics test geared to the particular course he wants to study. The second is a learning style inventory, the Canfield - Lafferty, to determine how this person likes to learn. The results of these two tests are combined to determine not only his course of study, but which

of the modes of instruction available in that course he is to use. Four modes are available in each of the four courses offered through our grant project. These include audio-tutorial materials (graded for reading level), programmed materials, tape/slide materials and a combination of work-texts with video or audio tapes. When necessary, i.e. when a student fails to meet criterion on a test, other materials such as the SRA Skills Kits and the Auto-tutor are used to provide additional practice.

The D.I.S. students are guided by a computer through a program consisting of twelve units of instruction per course. At the end of each unit a check-up test is administered. If the student scores eight out of ten, he proceeds to the next unit. If he does not score the above criterion, he is asked to review and do additional work with the Skills Kits or Auto-tutor. Once work is completed with the Skills Kits or Auto-tutor the student is allowed a second try at an equivalent test. Criterion on this second test is nine out of ten. If the student is successful, he proceeds to the next unit. If he does not measure up to criterion, he is assigned to a tutor who supervises his learning until criterion is met. This entire program is managed by the College's RSVP computer program.

D.I.S. students are required to attend the Mathematics Learning Center on a regularly scheduled basis. Those recruited from regular mathematics classes are asked to attend during their original class time. Walk-in students set up their own schedules, but must attend at least three hours a week. It is not unusual for students to spend more than three hours a week at the Center. Attendance for D.I.S. students is checked both by means of a punch clock card and by recording it in a grade book. At present, duplicate student records are being kept; one set is stored in the computer and one set is located in the grade book.

So far, we have had good results at both ends of the spectrum of students. Better students have been able to finish two courses in one semester. Slower students have been able to successfully complete courses which they might otherwise have not passed. Our policy until the Winter of 1978 was to assign a grade of "I" to those students who did not complete. The result was that the number of students who returned to complete their programs of instruction was very low. Now, we are experimenting to determine if the assignment of an "F" at the end of the term to those who do not complete will yield a better return. When the student does complete, an appropriate grade is assigned.

Our success rate* for D.I.S. students during the 1974-75 academic year was about 40%. This represents an acceptable, but not outstanding figure. On the other hand our success rate for the 1975-76 academic year was around 50%. Such a figure represents a 25% improvement and we believe it to be a respectable result for this type of work. This increase in success rate was especially remarkable since grading standards were raised for the later period. The Fall of the 1976-77 academic year saw a leveling off of the success rate with but slight improvement to 54%. This was followed by a 55% success rate in the Winter of 1976-77 and an improvement to 60% during the Spring/Summer of 1976-77.

In the Fall of 1977-78, we began testing our grant project system and materials. In order to give additional support to classroom and D.I.S. students, we also tried offering small group practice and problem solving sessions under the umbrella of MAT 179, Tutorial Study Lab. As is often the case

*Success rate is computed by dividing the total number of grades assigned, including W's and I's into the number of A,B,C, or D grades assigned. It includes all students completing courses, no matter how long they take.

when one tries something new, our success rate for this period fell to 13% for D.I.S. students (37% if the MAT 179 students are included). This dramatic drop in success rate was probably due to trying to stretch our resources too far. Therefore, we have discontinued the MAT 179 sessions and have concentrated on the D.I.S. students in the project. Winter 1977-78 saw a slight improvement in success rate to 16%. However, this figure will be larger, since some students are presently finishing their work from that term. We are trying to analyze our data and determine a way to improve our results. For example, one cause for the small success rate might be motivation. That is, all D.I.S. students before the grant project was implemented sought us out and were hence well motivated. Whereas the volunteers from the classroom might not have been as well motivated. Part of our project evaluation will be designed to try to answer this question.

Table 1 shows the grade distribution for Directed Independent Study students during the various academic terms of the 1974-75, 1975-76, 1976-77 and 1977-1978 academic years respectively. Looking at the totals for each term, we can see that the number of these students has grown from an initial seven in the first trimester of operation to a peak of 44 in the Winter term of 1977-78. One of the objectives of our Math Lab project is to increase this number to something between 100 and 120 students per term. This estimate represents the maximum capacity possible in our current facilities.

Please note in Table 1 that beginning with the Fall of 1976 the MAT 201, General Education Mathematics, students from Open College are no longer being reported as D.I.S. students. This procedure was judged appropriate because the Center has no administrative control over these students.

TABLE 1

GRADE DISTRIBUTION FOR INDEPENDENT STUDY STUDENTS

Winter 1974	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	-	-	-	-	-	-	-	--
MAT 120	-	-	-	-	-	-	-	--
MAT 121	-	2	-	-	-	1	-	3
MAT 122	1	-	-	-	-	1	-	2
MAT 201	-	1	-	-	-	1	-	2
TOTAL:	1	3	0	0	0	3	0	7

Fall 1974	Grades							
Course:	A	B	C	D	I	W	NR+	Total
MAT 101	-	-	-	-	1	-	2	3
MAT 120	1	2	-	-	3	-	-	6
MAT 121	-	-	-	-	-	1	-	1
MAT 122	-	-	-	-	-	-	-	--
*MAT 201	-	-	-	-	-	-	1++	1
TOTAL:	1	2	0	0	4	1	3	11

Winter 1975	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	-	2	-	-	3	4	-	9
MAT 120	4	2	-	-	5	4	-	15
MAT 121	3	1	-	-	-	1	-	5
MAT 122	-	-	-	-	-	-	-	--
*MAT 201	-	-	-	-	-	-	-	--
TOTAL:	7	5	0	0	8	9	0	29

Spring 1975	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	-	-	-	-	-	-	-	--
MAT 120	-	2	1	-	1	3	-	7
MAT 121	-	2	-	-	1	6	-	9
MAT 122	-	-	-	-	-	-	-	--
*MAT 201	-	-	-	-	1	-	-	1
TOTAL:	0	4	1	0	3	9	0	17

Fall 1975	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	1	-	-	-	-	-	-	1
MAT 120	1	4	4	-	1	-	1	11
MAT 121	-	-	-	-	2	-	-	2
MAT 122	-	-	-	-	-	-	-	--
*MAT 201	6	2	1	1	4	-	1	15
TOTAL:	8	6	5	1	7	0	2	29

Winter 1976	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	1	-	-	-	-	-	-	1
MAT 120	2	-	-	-	-	-	-	2
MAT 121	4	-	1	-	1	-	2	8
MAT 122	-	-	-	-	-	-	-	--
*MAT 201	5	3	1	-	1	3	14	27
TOTAL:	12	3	2	0	2	3	16	38

+ Individual Study - No Credit - Not Registered

* Open College Students Attending Lab

++ Life Lab Students

TABLE 1 (continued)

GRADE DISTRIBUTION FOR INDEPENDENT STUDY STUDENTS

Spring/Summer 1976	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	2	1	-	-	-	2	-	5
MAT 120	3	2	-	-	-	7	-	12
MAT 121	2	-	-	-	1	6	3	12
MAT 122	-	-	-	-	-	-	-	--
MAT 201	-	-	-	-	1	1	-	2
TOTAL:	7	3	0	0	2	16	3	31

Fall 1976	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	2	0	1	1	2	2	2	10
MAT 120	4	2	-	2	2	-	2	12
MAT 121	2	1	-	-	-	1	2	6
MAT 122	-	-	-	-	-	-	-	--
MAT 201	-	-	-	-	-	-	-	--
TOTAL:	8	3	1	3	4	3	6	28

Winter 1977	Grades							
Course:	A	B	C	D	F		W	Total
MAT 101	-	2	-	-	-	1	-	3
MAT 120	1	1	-	-	3	3	-	8
MAT 121	4	2	2	-	2	1	-	11
MAT 122	-	-	-	-	-	-	-	--
MAT 201	-	-	-	-	-	-	-	--
TOTAL:	5	5	2	0	5	5	0	22

Spring/Summer 1977	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	1	2	3	-	1	1	-	8
MAT 120	6	-	-	-	2	5	-	13
MAT 121	8	2	2	-	-	6	1	19
MAT 122	-	-	-	-	-	-	-	--
MAT 201	-	-	-	-	-	-	-	--
TOTAL:	15	4	5	0	3	12	1	40

Fall 1977	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	3	1	-	-	12	7	10	33
MAT 120	-	-	-	-	-	-	1	1
MAT 121	1	-	-	-	-	3	1	5
MAT 122	-	-	-	-	-	-	-	--
MAT 179	21	9	3	1	12	3	18	67
MAT 201	-	-	-	-	-	-	-	--
TOTAL:	25	10	3	1	24	13	30	106

Winter 1978	Grades							
Course:	A	B	C	D	F	I	W	Total
MAT 101	1	-	-	-	16	-	3	20
MAT 120	2	2	2	-	4	2	7	19
MAT 121	-	-	-	-	2	1	2	5
MAT 122	-	-	-	-	-	-	-	--
MAT 201	-	-	-	-	-	-	-	--
TOTAL:	3	2	2	0	22	3	12	44

+ Individual Study - No Credit - Not Registered

* Open College Students Attending Lab

++ Life Lab Students

Center Usage as Measured by Student Visits

A count of the number of student visits or contacts is the only statistic we were able to record up to the Spring-Summer term of 1976. The student visit is an imperfect measure in that it does not distinguish the student who uses the Lab every day from the one who uses it once a week. That is, up to the Spring-Summer term of 1976, we had no way of counting students as well as visits.

Table 2 tells us that the number of student visits has increased from 154 per term at the inception of the Laboratory to about 5,500 per term for the 1977-78 academic year. A particularly dramatic change occurred with a 300% increase from the Spring-Summer of 1976 to the Fall of 1976. Also, in Table 2, it is interesting to note the figures indicating visits by students seeking help in courses which we did not offer that trimester. (The number of these courses has decreased as our program has grown). These figures are interpreted as indicating usage of the Lab by students from other campuses. The figures listed in the row, "Other", give evidence of visits by people from outside the College.

The average number of student visits per day is perhaps a better way to show the increased usage of the Mathematics Laboratory. Figure 1 gives us a clear indication of the steady growth of the average number of student visits per day over the period from Fall 1974 to Winter 1978. The sudden jump in student usage of the Laboratory from Spring-Summer 1976 to Fall 1976 is outstanding. This spectacular change may be explained by the fact that the Fall of 1976 was the first term in which the Laboratory was featured in an article by the campus student newspaper.

TABLE 2

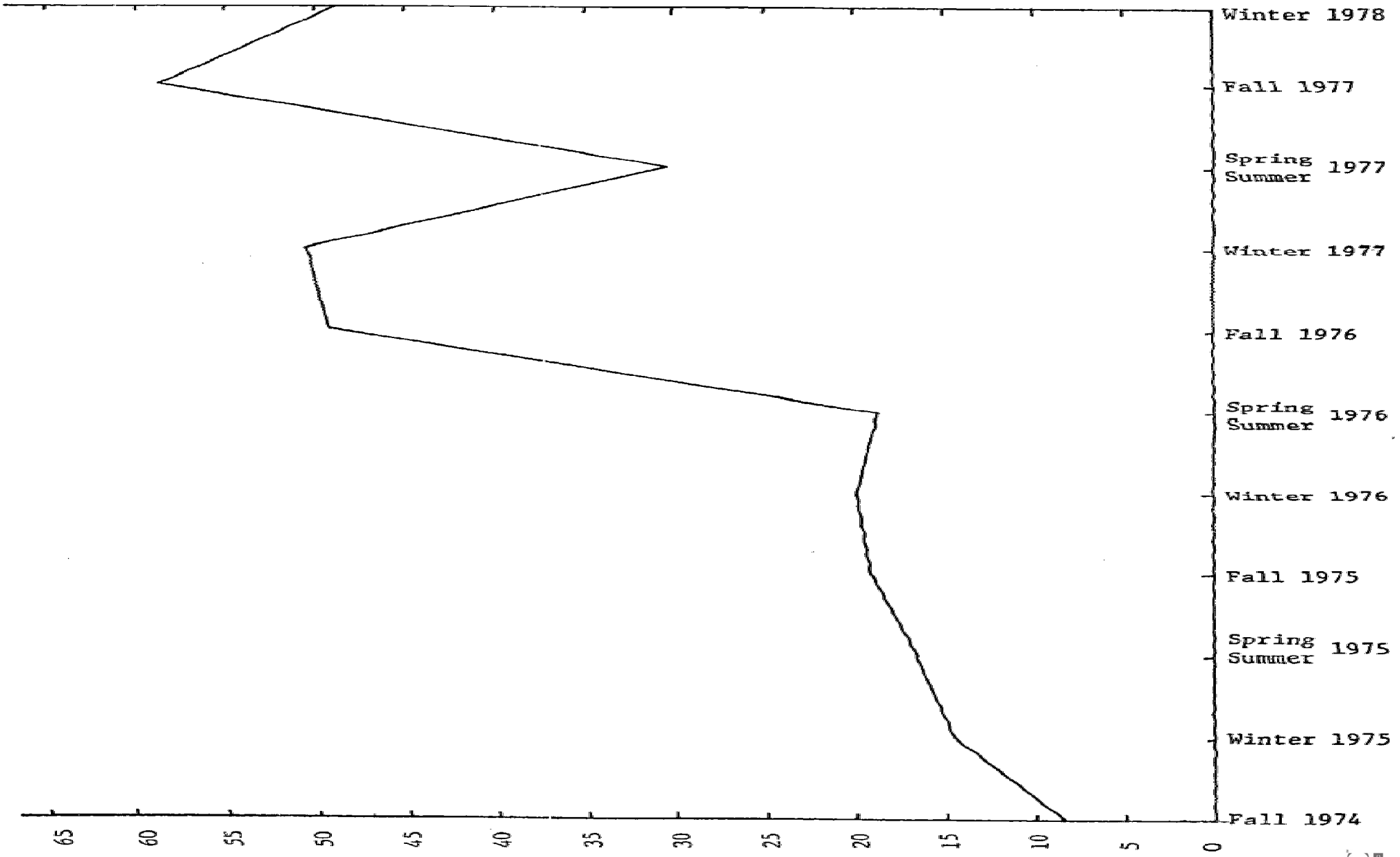
NUMBER OF STUDENT VISITS BY COURSE PER TERM

COURSE:	YEAR and SEMESTER											
	Winter 1974	Fall 1974	Winter 1975	Spring 1975	Fall 1975	Winter 1976	Spring Summer 76	Fall 1976	Winter 1977	Spring Summer 76	Fall 1977	Winter 1978
MAT 101	10	56	162	8	153	161	158	1070	385	115	1287	965
MAT 120	11	121	314	91	394	282	473	1152	727	436	1099	1053
MAT 121	64	95	221	136	366	473	454	1149	1443	640	718	1148
MAT 122	56	--	179	1*	182	171	122	447	1249	441	331	397
MAT 125	--	40	96	5	73	73	30	231	906	607	242	336
MAT 179	--	--	--	--	--	--	--	--	--	--	1294	5
MAT 201	13	51	37	6	186	301	76	219	324	31	82	110
MAT 204	--	--	--	--	--	--	--	--	--	--	110	24
MAT 206	--	--	--	--	--	--	--	--	--	--	--	122
MAT 227	--	--	1	77	26	162	68	45	23	284	485	150
MAT 229	--	--	--	27	3	1*	1*	0*	--	--	--	--
MAT 230	--	--	--	--	105	34	98	341	40	2	97	431
MAT 231	--	--	--	--	1*	72	1*	10*	662	8	--	55
MAT 242	--	--	--	--	1*	1*	35	0*	--	--	--	--
MAT 251	--	--	--	--	0*	0*	0*	22	94	50	139	138
MAT 290	--	--	--	--	--	--	--	--	--	--	87	71
OTHER	--	310	281	57	93	91	90	115	222	176	35	170
Total:	154	673	1291	408	1581	1820	1604	4801	6075	2790	6006	5175

* Course not offered this term at this Campus

FIGURE 1

DAILY AVERAGE NUMBER OF STUDENT VISITS TO MATH LAB



Number of Students per Month

In order to get a more accurate measure of Center usage, we began keeping records of the actual number of people who used the Laboratory on a monthly basis. We were able to start collecting this data in September of 1976 by means of improved procedures for handling information extracted from our time cards. As before, the number of visits per person was computed. The results are graphically illustrated in Figures 2A and 2B respectively.

On inspection of Figure 2A, one immediately realizes that the number of students using the facilities of the Center drops off as the semester progresses. This can easily be understood if one observes that our enrollment in general drops throughout the semester. For example, it is logical that the figures for December should show the smallest number of students using the Laboratory, especially since the drop date is sometime in late October. Also, it should be pointed out that our attrition rate in the Department of Natural Sciences is about 35% to 40%, which compares favorably with the observed drop in number of students per month.

Figure 2B representing the graph of the number of visits per student per month, seems to indicate that those students who make use of the Mathematics Learning Center, do so often. This could be a reflection of scheduled usage by D.I.S. students or a manifestation of students making regular usage of the Lab on their own or both.

Number of Usages of Each Type of Equipment

In order to keep track of the usage of the various pieces of equipment and/or instructional modes in the Laboratory, we have either installed a time clock punch card on each piece of equipment or in the case of the tutors, assigned each person a punch card. Thus, if a student views a video tape,

FIGURE 2A

NUMBER OF STUDENTS PER MONTH

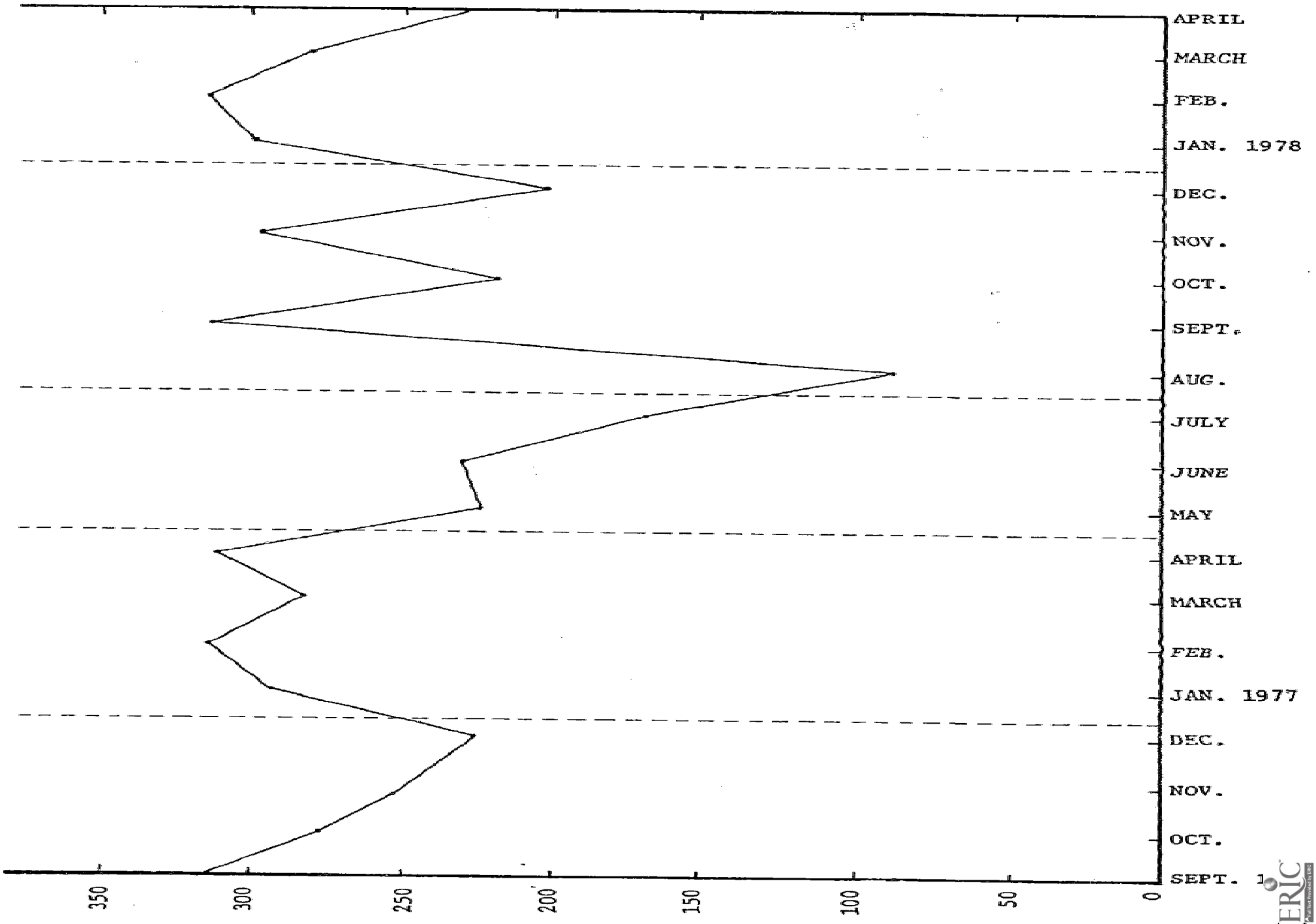
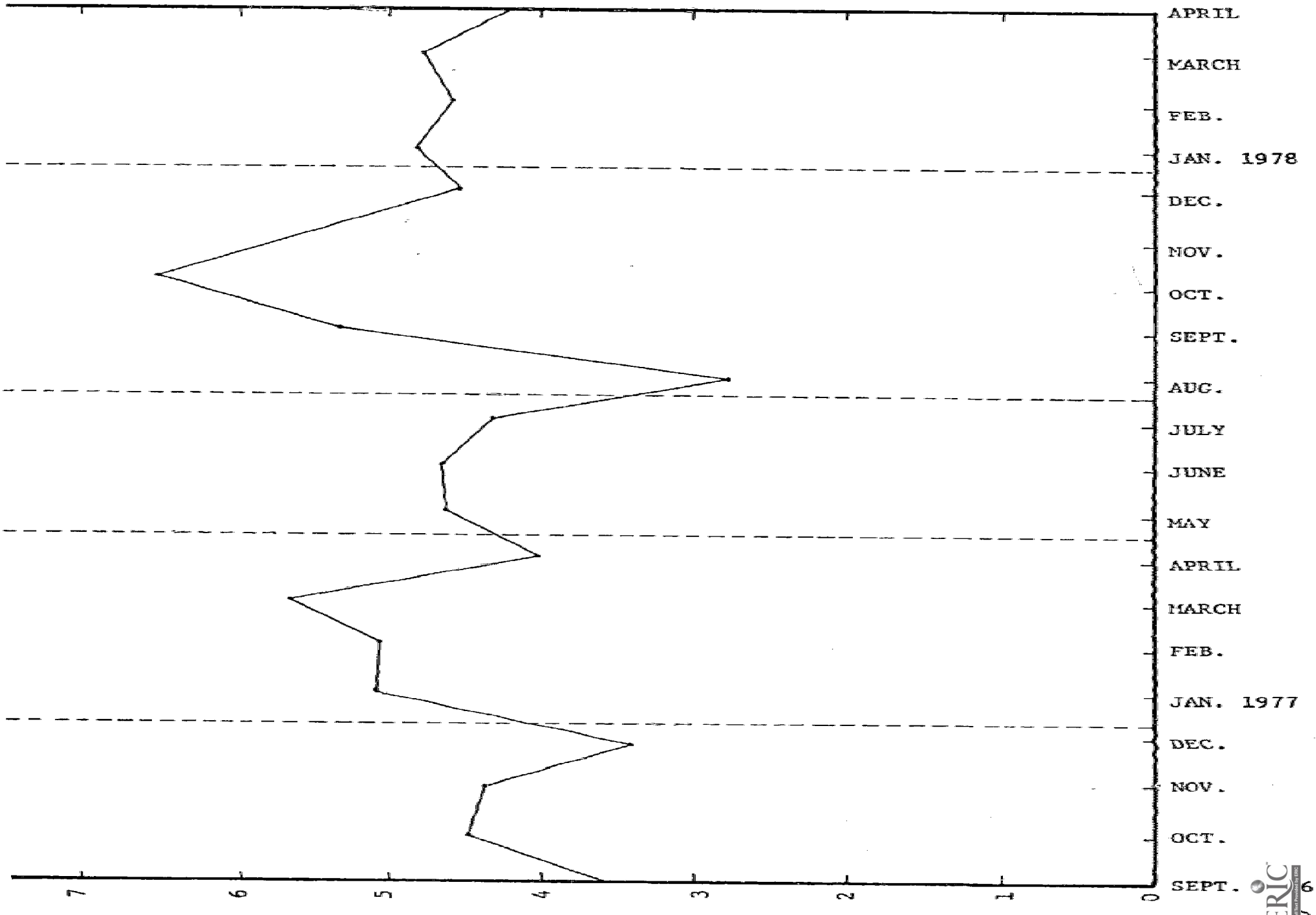


FIGURE 2B

NUMBER OF VISITS PER STUDENT PER MONTH



he punches the card for the video tape system in the time clock; if he receives some assistance from a paraprofessional or student assistant, that person's tutoring card is punched by the time clock. Hence, we are able to keep fairly accurate records of most student usage. The data thus generated gives us a means of determining the mode of instruction preferred by most people and allows us to justify additional equipment when needed. It must be pointed out that unless the system is constantly supervised, there is a good chance of slippage occurring. This does happen occasionally, so the data represented in this section is probably low compared to actuality.

Table 3 shows a clear preference on the part of students for individual tutoring. However, we try to limit tutoring to answering questions when a student "gets stuck" with material in his assigned mode of instruction. Such a procedure helps cut down on the number of personnel needed to man the Center. Another important conclusion which can be drawn from Table 3 is that the Center is succeeding in providing an atmosphere conducive to learning Mathematics. This observation is verified by the number of student visits listed in the row "Math Lounge".

An additional bit of information derived from Table 3 is that less popular modes of instruction are receiving increased usage as part of the grant project implementation. This was one of the objectives of the project and can be seen by looking at the figures associated with programmed materials and auto-tutorial materials.

Ethnic Composition of Students Using the Mathematics Learning Center

The Mathematics Learning Center was established to serve all of our students. The improved data gathering procedure instituted during September of 1976 permits us to comment on the success of the aforementioned goal. The

TABLE 3

NUMBER OF EQUIPMENT USAGES BY TYPE

ACADEMIC YEAR & TERM: / EQUIPMENT TYPE	1974-75		TOTAL	1975-76			TOTAL	1976-77			TOTAL	1977-78		TOTAL	GRAND TOTAL
AUTO-TUTORIAL MANUAL	31	36	67	79	66	37	182	164	186	119	469	585*	312*	897	1615
AUDIO CASSETTE PLAYERS	44	39	83	79	136	22	237	164	186	119	469	585*	312*	897	1686
AUTO-TUTOR	3	--	3	7	49	--	56	16	10	13	39	15	13	28	126
CALCULATOR	31	20	51	62	36	--	98	90	71	35	196	55	57	112	457
MATH LOUNGE	--	--	--	152	--	--	152	1407	924	492	2823	3600	427	4027	7002
REFERENCE BOOKS	?	5	5	11	14	?	25	33	22	19	74	13	3	16	120
TUTORING	25	?	25	624	134	332	1090	2397	559	699	3655	4672	4350	9022	13792
VIDEOTAPES	9	--	9	185	60	33	278	459	204	171	834	800*	800*	1600	2721
GAMES	--	--	--	--	--	--	--	--	--	--	--	3	--	3	3
PROGRAMMED MATERIALS	--	--	--	--	--	--	--	--	--	--	--	120*	261*	381	381
TOTAL:	143	100	243	1199	495	424	2118	4730	2162	1667	8559	10448	6535	16983	27903

* This figure has been estimated due to a breakdown in our accounting system.

data represented in Figure 3 and Table 4 allow us to compare the ethnic composition of the students using the Center with the ethnic composition of the student body of the New World Center Campus beginning with the 1976-77 academic year. See Table 4 below and Figure 3 next page.

TABLE 4

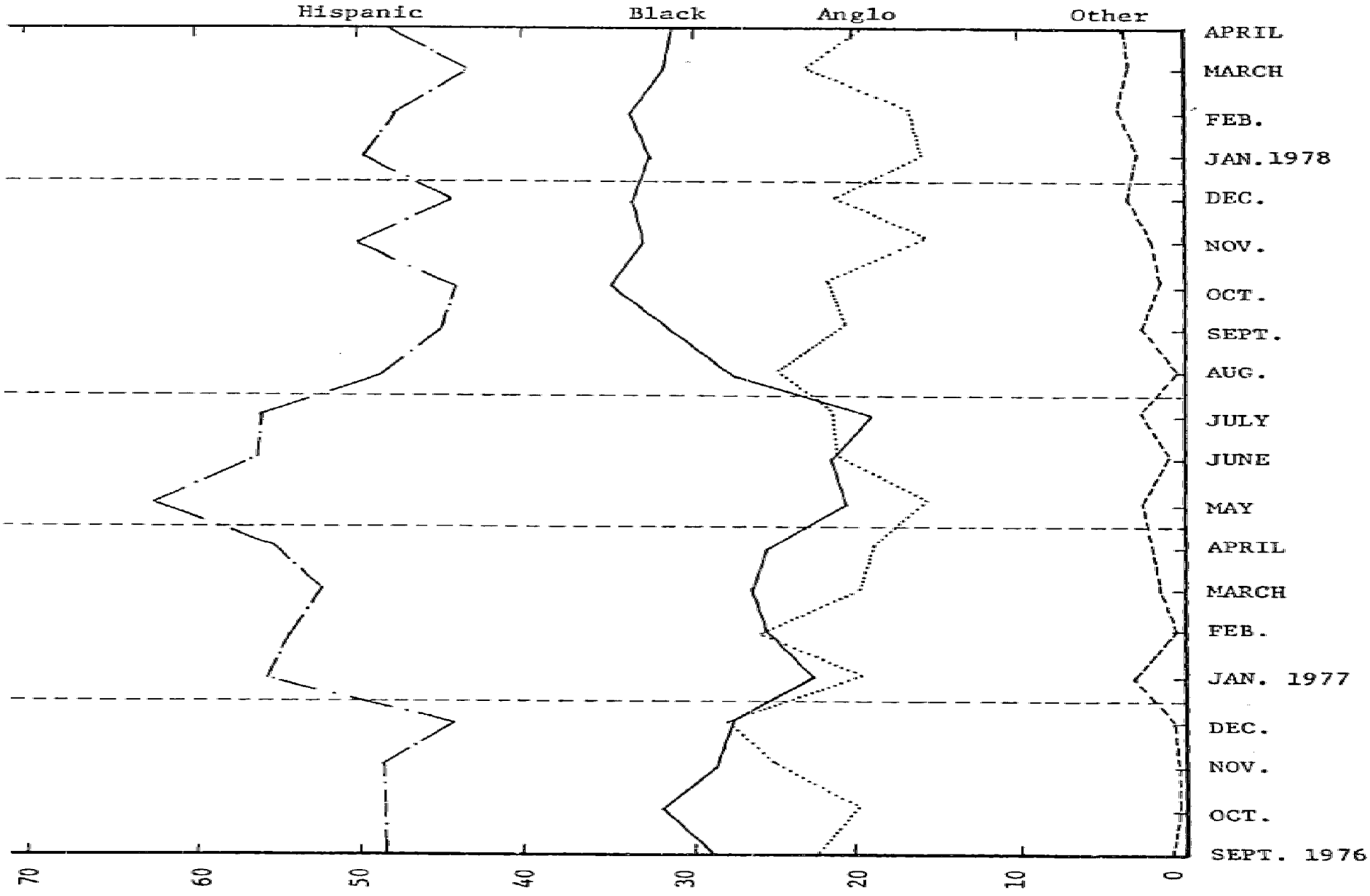
ETHNIC COMPOSITION OF STUDENT BODY BY SEMESTER
FOR NEW WORLD CENTER CAMPUS

	Fall 1976	Winter 1977	Spring 1977	Summer 1977	Fall 1977	Winter 1978
Anglo	30.7%	29.3%	27.8%	21.6%	23.7%	26.3%
Black	25.5%	28.4%	25.4%	33.2%	25.7%	28.8%
Hispanic	43.4%	41.8%	46.4%	44.4%	50.1%	44.0%
Other	.4%	.5%	.4%	.8%	.5%	.9%
Total:	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Comparison of Figure 3 and Table 4 brings to light two aspects worthy of note. The first observation is that the figures for the Campus in Table 4 are derived from registration by academic term and hence, are static while the data in Figure 3 is gathered every month and therefore shows fluctuation within a semester. The second is that there is a slightly higher percentage of each minority attending the Center than is present in the student population. In no case are these differences more than 10%. It is therefore judged that the profile of students using the Mathematics Learning Center is fairly well representative of our student body.

FIGURE 3

ETHNIC COMPOSITION OF MATH LAB USERS BY PERCENT



Conclusion

The Mathematics Learning Center at the New World Center (Downtown) Campus has enjoyed five years of progress and growth. The need for such a support facility is substantiated by the fact that the Center has been able to maintain its spectacular growth by catering to volunteer students only. Fortunately, we have not had to turn anyone away be their problem small or large. This has been due to the tremendous support we have received from both faculty and administration and to the dedication of our Math Lab staff.

The completion of our N.S.F. Math Lab Project will enable us to manage most of our D.I.S. instruction via the College's central processor on South Campus. The greater efficiency of this computerized system will allow us to generate more suitable individualized programs of instruction and will also enable us to help a larger number of students. Perhaps, then we will have reached our goal of providing maximum instructional assistance at a minimum cost.