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ABSTRACT

Factors affecting mathematics enrollment at Broward Community College, South Campus (Florida) were examined. An analysis of demographic data reflects a huge population growth for the South Campus area. Increasing numbers of elderly, young professionals, Hispanics, and other minorities will move here primarily from the northeast and Dade County (Florida). Industrial trends indicate that some small, high-technology industries will move into the South Broward vicinity, although the area will remain primarily residential. However, increased mathematical training will be essential for industrial workers to enable them to keep pace with ever changing technology. Recently enacted state legislation has strengthened both secondary and post-secondary mathematics standards, and mathematics enrollment on the South Campus is increasing as students attempt to satisfy new state requirements. College data indicates particularly large enrollments in lower-level mathematical courses, probably due to past neglect and avoidance of mathematics. Students at all levels recognize the need for greater mathematics skills; women (who comprise over half the total enrollment and are well represented in mathematics courses) find the South Campus an acceptable place to obtain training. Three recommendations offered are to increase the number of full-time mathematics instructors, expand the mathematics program, and create an adequately staffed mathematics laboratory. (Author/JN)

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AN EXAMINATION OF FACTORS AFFECTING MATHEMATICS ENROLLMENT AT BROWARD COMMUNITY COLLEGE, SOUTH CAMPUS

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Societal Factors Affecting Education

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ABSTRACT

The purpose of this study was to examine factors affecting mathematics enrollment at Broward Community College, South Campus. Information on general trends and social factors affecting mathematics was obtained by reviewing the literature. Demographic data and industrial trends were provided by a variety of local community organizations and the political influence on mathematics enrollment was ascertained by analyzing recent legislation addressing mathematics.

An analysis of the demographic data reflects a huge population growth for the South Campus area. Increasing numbers of elderly, young professionals, Hispanics and other minorities will move here primarily from the Northeast and Dade County.

Industrial trends indicate that some small, high-tech industries will move into the South Broward vicinity; however, the area will remain primarily residential. However, increased mathematical training will be essential for industrial workers at all levels to enable them to keep pace with ever changing technology.

State politicians have steadily moved to upgrade mathematics requirements. Recently enacted legislation has strengthened both secondary and post-secondary mathematics standards. Mathematics enrollment on the South Campus is increasing as students attempt to satisfy new state requirements.

College data indicates particularly large enrollments in lower-level math courses. Two possible factors contributing to this finding are past neglect and total avoidance of mathematics.

Generally, students at all levels have recognized the need for greater math skills as indicated by the steady increases both in total numbers of students enrolled in math courses and percentage of student semester hours devoted to mathematics. Women, in particular, have found the South Campus of Broward Community College an acceptable place to obtain training and to expand their math backgrounds. They comprise over half the total enrollment and are well represented throughout the math curriculum.

Recommendations derived from this study were that: (1) the math curriculum be expanded to meet the growing needs of the student population; (2) the number of full-time math instructors be increased to provide proper professional instruction and services; (3) a math lab with adequate support staff be created; and (4) a general review of all programs be conducted to determine future mathematics needs for all students.

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INTRODUCTION

Declining enrollment has caused the educational community, including Broward Community College, South Campus, to take a hard look at its programs and services. Those not considered essential will be cut back or eliminated. Consequently, it is of vital importance to examine the many factors affecting enrollment in each program so that each may be evaluated accordingly. The purpose of this study was to identify those factors affecting mathematics enrollment on the South Campus.

Enrollment figures are often grouped together and conclusions drawn from this grouped data. These figures, however, may be inaccurate for two reasons. First, an individual program may be dramatically increasing at a time when several other programs are decreasing. Secondly, overall drops in enrollment tend to obscure or mask trends toward certain areas or programs of study.

General societal factors affecting mathematics enrollment were obtained by a search of the literature and an examination of political action and support taken by the State of Florida toward math and science. Local community agencies and individuals provided information pertaining to demographics and industrial trends for the South Campus area. Data specific to math enrollment at Broward Community College, South Campus, was obtained from the college registrar.

BACKGROUND & SIGNIFICANCE

Faced with overall declining enrollment, increasing costs and scarcity of funds, educational institutions must strive to become more efficient and effective. Berger (1983:1) points out that "it is apparent that serious problems occur when it takes more and more dollars to educate fewer and fewer students."

Since funding is directly related to enrollment, it is obvious that enrollment estimates need to be as accurate as possible to allow for satisfactory planning. Babcock (1983:89) emphasizes that "in conjunction with such recognition, realistic planning is required." According to Miller and McGill (1984:31), given an accurate enrollment forecast, "colleges can make plans and decisions that would be beneficial both academically and financially."

Many critical decisions are made based on enrollment forecasts. Pocock (1983:32) argues that those institutions whose leadership can react to current information swiftly will fare the best. Corey, Jaksen and Pritchard (1984:18-19) remark that enrollment trends dictate that "the community colleges must respond with new options if they are to survive." Significantly, Greenfield (1979:14) suggests that negative trends may be forestalled or minimized by appropriate action.

> Obviously, cutbacks will be commonplace in higher education if slowed economic growth and changing spending patterns do not lead to vigorous intervening action in the form of new financial approaches and new services and programs for new clientele.

Corey et al. (1984) assert that judicious policy decisions may drastically affect the impact of enrollment projections. Hodgkinson (1983:30) synthesizes these remarks with his realization that those colleges that are aware of and prepared for their future cohorts will flourish in the 1980s.

The Director of Institutional Research at Broward Community College classifies the college enrollment projection process as a "straight-line" method. It is a simple, straight-forward approach which predicts total enrollment. Miller and McGill (1984:3) state that simplicity is a desirable trait for any model. "A model for estimating future enrollments should be simple to minimize the amount of time spent in data collection, yet accurate enough for decision making." The college process has been fairly accurate in predicting total enrollment when the pattern of enrollment was growth. Now that retrenchment and cutbacks are imminent, a closer examination of the results is necessary.

Although the overall enrollment projections for Broward Community College, South Campus, were very close to the actual total, enrollment fluctuations in certain programs and academic areas were not properly reflected by the data. In particular, the percentage of students taking mathematics courses increased from 8.3 percent to 15.8 percent of the total student semester hours from Term I, 1982 to Term I, 1985. Another indicator of the growth in the math department is illustrated by the number of full-time faculty members. During the same time span, the math department increased from one to four full-time instructors and is presently looking to increase this total due to student demand.

According to Odom, Bell, and Olsen (1976:6), "if the community college is sensitive to its task within the community, it will be initiating new programs and eliminating others to fulfill student and community needs." It is difficult to anticipate and thus satisfy the needs of the community using enrollment projections which do not consider variations and trends which could significantly affect public demand. Such projections are misleading and do not allow for efficient allocation of resources and effective planning. The purpose of

this paper was to examine those factors and to discuss trends which may affect future mathematics enrollment at Broward Community College, South Campus.

Some projections of student enrollment are based on demographic studies while other methods rely on prior data or experience. Demographers take present trends, make small adjustments and then use statistics to calculate where those trends will lead. The assumption is, according to critics, that existing trends continue; the problem is that they don't. Other factors including economic, political and social movements must be taken into consideration. Additionally, local factors must be considered in any trend analysis. Baldridge et al. (1978:225) state that

> There must be more care in contrasting local trends in order to make informed judgments about shifts in the client pool, shifts in public attitude and support, and shifts in demand for educational services and products.

There exists a myriad of factors affecting math enrollment at Broward Community College, South Campus. However, it is neither necessary nor conceivable that every variable be identified. Miller and McGill (1984:31) remark that "it is desirable to identify only those variables that have the most impact on the prediction."

The Dean of Student Development and the Mathematics Department at Broward Community College, South Campus, have recognized the need to predict not only the quantity but also the concentration by discipline of students who enroll here. Total enrollment projections as provided by the college do not reflect many present trends and, consequently, are felt to be unreliable. Student needs cannot properly be ascertained nor appropriate emphasis placed with regard to such important matters as staffing, facilities, materials and new programs unless an accurate picture of the student body is provided by enrollment figures. Both students and the college will benefit when enrollment is more closely scrutinized.

PROCEDURES

The procedures followed in completing this study were as follows:

1. A review of the literature concerning factors affecting mathematics enrollment and social factors affecting education was conducted and results compared with actual data on the mathematics enrollment for the South Campus of Broward Community College. The literature was also searched to provide recent demographic data for Florida, in general, and Broward County in particular.
2. An examination of recent state legislation, political and government publications was conducted to ascertain political and financial factors affecting mathematics enrollment.
3. An analysis of local industrial trends and needs as related to mathematics was conducted. Information was provided by the Broward Economic Development Board and the local Chambers of Commerce as well as the city planners for Miramar, Pembroke Pines, Davie/Cooper City and Dania. Additional input was obtained by contacting various business leaders, including commercial and residential realtors and title and insurance agents.

ASSUMPTIONS

1. The data collected was adequate for the purpose.
2. The trends and events discussed would continue as described.

LIMITATIONS

1. The results of the study are limited to the South Campus of Broward Community College.
2. Some conclusions were based on personal observations of contacts.

RESULTS

Social Factors

It is evident from the literature that today's youth are increasingly concerned about economic issues such as inflation and unemployment. Reporting on the attitudes of today's teens, George Gallup (1984:120) concludes that the high cost of living is one of their main concerns. Karl Smith (1984:3) attempts to explain this change

> During the 1970s it became obvious that many persons with liberal arts backgrounds were unable to parlay their education into jobs, or to incorporate their education into jobs at which they were employed.

In short, jobs have become important again.

Fueling this new urge for employment is a trend toward consumerism which, according to Naisbitt (1982:177), will continually increase throughout the decade. "Our society is in love with consumer goods," states Charles Westoff, Director of the Office of Population at Princeton (Guzzardi, 1976:96). Consumer goods are obtained from money which is, of course, generated by good jobs.

Another social factor noted in the literature which greatly affects enrollment is the changing role of women in society. Women are no longer confined to the task of housewife. Society has begun to accept women in a constantly expanding range of roles.

The impact of this change has been felt in both education and the job market. "In 1978, more women than men enrolled in the nation's freshman collegiate class for the first time (Cetron, 1984:14)." Corresponding to this fact was the large number of women who entered the job market for the first time. Interestingly, many of these women came from a group which historically

stayed away from the job market--those married with dependent children at home (Guzzardi, 1979:94). Cetron (1984:13) suggests a growing trend in that many of these women are half of a "career couple." Having children is postponed and the number of children per family decreases. Toffler (1980:213) sees a massive shift from "child-centered" to "adult-centered" families. Moreover, the birth of a child no longer removes the career woman from the job scene.

Employers will increasingly look for bright, talented women to fill positions not only on the basis of equity, but also from the standpoint of societal necessity (Galambos, 1980:15). Educators and employers alike will find that women are an increasing and untapped source for enrollment and employment, especially in the critical shortage areas of mathematics and science. "Excellent, well-trained people are always in short supply, and America's women represent a large, underdeveloped reservoir of such minds in the mathematical sciences" (Anderson, Anderson, and Duren, 1985:53).

Trends in Mathematics Enrollment

The rise in consumerism is greatly responsible for the tremendous increase in vocational-technical programs. Smith (1984:3), however, notes that it is likely that consumerism is also responsible for a large community college math enrollment decline. "Students," remarks Galambos (1980:2), have avoided highly technical fields, particularly math." This avoidance has occurred at all levels of education. Galambos (1980:15) cites inadequate math preparation as perhaps the primary obstacle to the rapid expansion of high technology. This lack of background is further illustrated by the much higher enrollment in lower level mathematics courses (Galambos, 1980:4).

Table 1 illustrates both a significant increase in overall math enrollment at Broward Community College as well as a large proportion of students enrolled in lower-level math courses (below College Mathematics).

Table 1

South Campus Math Enrollment by Level
for Major Terms; 1982-1985

Term	Lower Level	Upper Level	Total
Fall 1982	518	169	687
Spring 1983	592	97	589
Fall 1983	790	194	984
Spring 1984	791	148	939
Fall 1984	1128	170	1298
Spring 1985	979	199	1174
Fall 1985	1218	273	1491

Table 2 indicates that during the past three years, the percentage of semester hours South Campus students spent on math increased from 8.3 percent to 15.8 percent. The rate of increase has slowed, however.

Table 2

Student Semester Hours Spent on Mathematics
and Total Student Semester Hours for
Major Terms; 1982-1985

Term	Semester Hours-Math	Total Semester Hours
Fall 1982	2061	24690
Spring 1983	1767	23040
Fall 1983	2962	29720
Spring 1984	2817	27200
Fall 1984	3894	30929
Spring 1985	3534	26800
Fall 1985	4473	28376

During the same time period, the math department increased from one to four full-time faculty members. Furthermore, minorities continued to enroll in all math courses over and above their representation campus-wide. Females accounted for over slightly half of the total campus population including both full and part-time students.

Demographic Data

Florida, according to John Naisbitt (1982:210), is one of the three "Megastates" which will benefit from increased migration from the North and Northeast. Eighty-nine percent of Florida's present population is from somewhere else (Owens, 1985:1BM). Tom Powers, of Goodken Research, refers to Broward County as the "center of a growth hurricane with much of its new residents originating from the 'old rustbelt' cities like New York, Detroit and Chicago" (Knarr, 1985:2A). Another source of Broward County's population is Dade County. In 1983 Broward County gained over 9,000 new residents at the expense of Dade County (Knarr, 1985:2A).

During the ten-year period from 1970-1980, Broward County as a whole had a 63.5 percent increase in population. Table 3 illustrates that South Broward municipalities have experienced continuing and sometimes phenomenal growth.

Table 3
Percent Change In Population of South Broward County Municipalities; 1970-1980

Municipality in South Broward County	Percent Change of population
Hollywood	9.7
Dania	31.0
Miramar	36.7
Hallandale	53.1
Pembroke Park	62.2
Pembroke Pines	130.9
Davie	256.3
Cooper City	300.0

State public school enrollment reflected general demographic trends in that white-nonHispanic and black populations decreased by 6.29 percent and 1.21 percent respectively during the 1977-1981 time period. Hispanic enrollment increased by 21.11 percent, with the majority of these living in Dade and Broward Counties (Marth and Marth, 1983:386).

Corey et al. (1984:5) note that, despite overall declining enrollment, "there will be an increase, however, in mature females, blacks, and Hispanics." Hodgkinson (1983:28) states that

> The major decline in births after the baby boom was almost completely a Caucasian (and probably middle-class) phenomenon. American public schools are now heavily enrolled with minority students, large numbers of whom will be college-eligible.

Actually, according to Cohen and Westoff (1977:54), the fertility rate has been declining for several decades in all industrialized nations. However, blacks and Hispanics have a higher birth rate per woman than whites.

Another major demographic trend affecting education is the "Graying of America." As the "baby-boomers" mature, the age composition will change significantly with an increase in population of working age and of persons 65 years and older, and a decrease in youth (Cohen and Westoff, 1977:86).

Florida has the highest percentage of its population age 65 and over--17.6 percent--than any other state ("Elderly Growth," 1985). Between 1975 and 1980, the most popular destination for senior citizens residing in other states was Broward County (Owens, 1985:BN13).

A significant development in South Broward is the increasing number of retirement condominiums under construction. Century Village, in Pembroke Pines, is the largest condominium and will house over 14,000 people, mostly retirees.

Political and Financial Factors

In terms of financial influence and power, the State of Florida is a major source of concern to the community college system. 61.9 percent of the revenues obtained by Florida community colleges were derived from the State during fiscal year 1979 (Breneman & Nelson, 1981:14). With no State income tax, lottery or other major revenue sources, the scarce funds available for education are constantly fought for by the K-12, University and Community College systems. Typically, the community colleges are the losers. Financial support from general revenue appropriations for all governmental operations in 1984-1985 were 44.4 percent for K-12, 10.4 percent for universities, and only 5.4 percent for community colleges (Turlington, 1985:28).

The enrollment-driven funding formula used by community colleges to obtain state support is reflecting decreases overall. Although enrollment for Broward Community College is down, the South Campus has shown an increase of more than 6 percent this year. Funding for South Campus is, however, inextricably linked to the other campuses.

Due to the college-wide enrollment drop, during the Winter term of 1985, the college adopted a zero-based budget scheme in order to control expenditures. Items considered by the College as "nonessential" were cut. Furthermore, "frill" courses and those with traditionally low enrollment were cancelled. At South Campus, math courses above Pre-Calculus fell into this category.

Federal, State and local legislators have all called for educational excellence and a general move "back to basics." Terrel Bell, the Secretary of Education, stated in May, 1983, that "the educational foundations of our society are presently being eroded by a rising tide of mediocrity." The National Commission on Excellence in Education has recommended stiffer state and local

graduation requirements, particularly in math, science and computer science (Gallup; 1984:149).

In Florida, The State Board of Education set a goal to make this "a State of Educational Distinction." Educational Commissioner, Ralph Turlington, has led the State in initiating over 100 specific legislative or State Board of Education actions designed to provide accountability, restore credibility and produce excellence in our educational system (Turlington, 1985:3).

The K-12 system has its "Raise-Bill" which, for mathematics, requires three units of high school math for graduation, yet none of these units has to be Algebra.

The State University System is also in the process of gradually raising entrance standards. In particular, completion of three units of high school mathematics, at or above the first-year Algebra level, will be required.

The "Gordon-Rule" addresses all post-secondary institutions. This law, as related to mathematics, requires students seeking an Associate Degree to complete six hours of college-level Algebra or above. House Bill 1689 is a second law which requires students seeking to enter the junior year of study to pass a college-level computational skills test. Both laws affect math enrollment. The increased basic requirement calls for additional sections of existing courses, while the second requires development of new courses to help students prepare for the State test.

The Omnibus Education Act of 1984 provided a classification of courses called "college-prep." Courses below a certain level would not warrant college credit. Funding for these courses, however, may be at a higher level than those not designated college-prep. The State has recently ruled that community colleges be uniquely responsible for all college-preparatory courses. Universities must contract with community colleges to have their college-prep courses

taught. South Campus presently has over 55 percent of its students enrolled in math courses designated college-prep.

Industrial Trends & Needs

American society is in the midst of a great transformation. In Megatrends, Naisbitt (1982:11) labels it a shift from an Industrial society to an Information society. Toffler (1980:158) states that "an information bomb is exploding in our midst." Gallup (1984:63) reports that many opinion leaders today believe that automation, computers and technology will more visibly affect our lives in the future.

Gallup (1984:58) lists this trend as a major factor in the joblessness rate. "Ironically, despite the unemployment problems, a job shortage is developing--particularly in the highly skilled technical positions" (Gallup, 1985:60). Workers entering the job market today are often grossly unprepared for the demands of the information age. Likewise, those already employed are finding that their skills quickly become obsolete. Naisbitt (1982:37) emphasizes that one cannot expect to remain in the same job for life. Cetron (1984:120) predicts that "workers will 'turnover' careers every decade with major revisions every two years."

Employers, according to Toffler (1980:385), will increasingly need men and women who can adjust to changed circumstances. Flexibility may be the most sought after attribute held by tomorrow's workers.

The State of Florida has earned the number one ranking for having the best business climate in the country (Mehallis, 1985:1.06). Low taxes, few unions and inexpensive labor are some of the reasons for this. Broward County is one major area in the State where new industry is expected to blossom. Mehallis (1985:1.06) comments

> During the 1980s, Broward County is expected to become the third major high-tech manufacturing center, rivaling California's 'Silicon Valley' and Massachusetts' 'Route 128.'

The Broward Economic Development Board reports that, in the first two quarters of 1984-1985, 71 companies expanded or relocated in Broward County. Of these, nine are located in the South Broward area and are classified as information services or high-tech companies.

The South Broward cities of Miramar, Pembroke Pines and Davie all have plans for expansion west to the new Interstate 75. Development of these areas, according to the city planners, is to be primarily residential. However, zoning provides several areas for typically "clean", high-tech industries. These would include light industry; industrial, scientific and educational research facilities; and office complexes.

Cetron (1984:44) astutely remarks that little or no benefit can be obtained from all this economic development if education does not provide the right kind of training and background. Educators must provide industry with personnel who "know how to learn, how to find information, how to analyze, synthesize, interpret, and apply information as it is provided" (Powell and Perkins, 1984:37).

Many present jobs obviously require a strong mathematical background. New high-tech positions such as robotics technician, genetic engineer, laser technician, fiber optics technician and energy auditor will also demand a strong mathematical background. "The need for greater awareness and training in science, math and technology is one none of us can ignore" (Cetron, 1984:90). In describing the characteristics of the most employable person of the future, The National Academy of Science recently emphasized "facility with basic mathematics, including Algebra, Geometry, and Trigonometry" (Turlington, 1995:9). Even programs training students in apparently less

technical areas have felt the need for increased mathematical sophistication. Bill Dery (1985), Experiential Learning and Cooperative Education Department Head at Broward Community College, South Campus, has noticed an increased interest from large companies such as General Motors in having the Automotive Technology students beef up their math and computer backgrounds. Sophisticated emission control devices, computer-operated engine components, and ever changing technical manuals must be handled by tomorrow's auto mechanics.

DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

The overriding force affecting math enrollment on the South Campus of Broward Community College in the '80s is the general trend toward a technically oriented, information society. In this new society, an ever increasing number of people will be required to obtain mathematical training, not only to enter but also to retain their jobs.

The large number of women in college and those planning to attend college, as well as those already part of the workforce, will seek out those institutions that offer not only a wide range of math courses but also a flexible time schedule so that they may continue to work and care for their families.

Enrollment trends at Broward Community College, South Campus, have indicated an increasing student perception of the need for more mathematical training and background. Math credits per student are up as well as overall enrollment. The fact that enrollment in lower-level courses is so large indicates mathematical training has been neglected.

The State of Florida has recognized the need for mathematics at all levels of education. Laws and policies have encouraged elementary, secondary and post-secondary educational institutions to strengthen graduation and program requirements by emphasizing the mathematical and related sciences. Funds have been provided by the State to implement many educational programs, including those encouraging math and science training and background for both students and teachers.

In our efforts to emphasize quality, we must be careful not to leave behind those students who typically need greater help in developing the skills or motivation to pursue post-secondary education. "The victim of the

'excellence movement'" (Perkins and Powell, 1984:37) can and should benefit from the community college experience. Higher standards need not come at the expense of access (Spence, 1984:5).

Many of these disadvantaged students will be enrolled in the new "college-prep" program. Due to the large numbers of students enrolled in these courses, particular attention should be paid to retention at this level.

Although it is commonly felt that the "baby-boom" generation's exit from the educational system will cause significant enrollment decline, the South Broward area has less reason for pessimism.

Demographic data indicates South Broward will continue to grow at a phenominal rate. Demographic data should continually be monitored and any significant changes noted.

Despite a large population of senior citizens who exist in the South Broward area, the impact of this group on mathematics enrollment is probably minimal. Survey of Mathematics and History of Mathematics are two courses which might be attractive to this group. Certainly, they should not be ignored in future planning for mathematics.

As South Broward municipalities attempt to lure new "high-tech" industries to the county's western regions, they will point to South Campus as a location for training and retraining of present employees as well as a source for new personnel. Consequently, it would be mutually beneficial for the College and local industry to have a strong mathematics curriculum on the South Campus.

The local community has expressed a desire to attract and hold new, clean high-tech industry. Alfred (1982:44) remarks that business and industry will look increasingly to community colleges for training and high quality programs. Perkins and Powell (1984:37) agree that community colleges are the logical places for business and industry to turn to for both initial skills and

retraining. The success of the community college in satisfying the demands from business and industry will depend a great deal on how our educators perceive the needs of both students and industry. Watche (1982-83:52) sees mathematics as an invaluable tool to be used throughout the community college curriculum in developing successful high-technology programs. Since these industries demand higher levels of mathematical training, all curricular offerings, including general education, must be evaluated on this basis.

The South Campus of Broward Community College can begin the evaluation process by first expanding the math offerings beyond Pre-Calculus. Many students taking Chemistry and Computer Science courses are forced to go elsewhere for the accompanying math training. Secondly, the number of mathematics instructors needs to be increased to reflect the full-time student enrollment. Students are short-changed when day courses are closed, or when they are forced to attend night classes with part-time instructors who have no office hours. Increasing the number of full-time instructors would also help provide flexibility in the scheduling of math courses needed by the large number of working mothers. Third, a mathematics learning lab is a must, especially considering the large number of students who take lower-level math courses and need the special services provided by a strong lab facility. Last, the curriculum content for all academic and vocational areas needs to be reconsidered to determine whether the mathematics requirements of today will satisfy tomorrow's need.

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