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AUTHOR Davis, Ronald M.
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ABSTRACT

As mathematics instruction in two-year colleges enters the late 1980's and 1990's, two major concerns will come to the forefront. The first is retraining faculty to ensure the provision of instruction relevant to the needs of two-year college students. Retaining this relevancy involves two aspects: faculty must acquire new knowledge in order to provide instruction in new areas; and faculty must incorporate new approaches, methods, and emphases into existing courses. The second concern involves retaining and uplifting of the vitality of mathematics faculty. Limited resources, changing demographics, and heavy resources are fast depleting the vitality of faculty in two-year colleges. The changing clientele of two-year colleges includes underprepared students, older returning students, part-timers and students needing nontraditional class times and nontraditional modes of instruction. Providing appropriate instruction to these students will require mathematics faculty attention and concern. The notion of faculty vitality appears to be the key link upon which any new curriculum recommendations will depend. There needs to be a new direction on the part of colleges in terms of workload, remuneration, and the role of the faculty at the college. Other facets of society, such as industry, government, and foundations will also have to support efforts to retain quality instruction and faculty vitality. (Author/LAL)

NEW DIRECTIONS IN TWO-YEAR COLLEGE MATHEMATICS

RELEVANCY AND REVITALIZATION

Retaining Quality and Vitality

in

Two-Year College Mathematics Faculty

Ronald M. Davis

Northern Virginia Community College

Alexandria Campus

Retaining Quality and Vitality in Two-Year College Mathematics Faculty

As mathematics instruction in two-year colleges enters the late 1980s and 1990s, two major concerns will come to the forefront. The first of these is retraining faculty so that it will continue to provide instruction relevant to the needs of students in two-year colleges. Retaining this relevancy involves two aspects: (1) the faculty must acquire new knowledge so that it can provide instruction in new areas and (2) the faculty must incorporate new approaches, new methods, or new emphases into existing courses as the need for change arises.

The second concern involves the retaining and uplifting of the vitality of mathematics faculty. Limited resources, changing demographics, and heavy workloads are fast depleting the vitality of faculty in two-year colleges. Revitalizing involves rejuvenating the psychological state of faculty so that they might perform their instructional duties at the best of their abilities.

The Need for Revitalization

In many ways revitalization is central to our efforts at developing new directions in mathematics at two-year colleges. Without a confident, motivated and committed faculty, efforts at modernizing and refining content will fall well short of what would be desired and of what could be achieved.

In 1981 the Conference Board of Mathematical Sciences reported alarming trends in the teaching environment in two-year colleges.[1] It indicated substantial increases in teaching loads of faculty, noted that larger numbers of faculty were electing to teach overload courses to improve their

financial status, and indicated that the number of full-time faculty were electing to teach overload courses to improve their financial status, and indicated that the number of full-time faculty was decreasing while student enrollments and the number of part-time faculty were increasing. Simply stated, mathematics faculty in two-year colleges was expected to teach more students and exercise more responsibility for the content and instructional quality of the courses taught within the program while not receiving equivalent increases in remuneration. The economic uncertainties and restricted government budgets for education that have existed in the years since that CBMS study do not portend a change in this pattern. It is not surprising that more and more faculty express concern over the even more limited time they have available for expanding their mathematical knowledge and for expanding or modifying their courses. Yet, such efforts by two-year college faculty are essential if they are to retain the instructional quality of their courses.

The economic conditions of recent years have also precluded faculty from relocating to other colleges, primarily because of the substantial expenses of relocating. This means that faculty who in 1979 averaged over 9 years of teaching experience in two-year colleges[2] are today likely to average over 14 years of two-year college teaching experience with much of it at the same two-year college. Many of these instructors will not have had the opportunity of exchanging ideas with new colleagues in new and different teaching settings. Thus, one path of access to revitalization has been restricted substantially.

Not only are the faculty unable to relocate, but they are often working overload schedules and teaching summer courses. Not only does this

heavy teaching load limit opportunity for creativity and additional study, but it almost eliminates time for revitalization. Thus, it is not surprising that faculty according to an article in the Chronicle of Higher Education[3] are becoming victims of burnout and the resulting psychological self-protections. These burdens are having a negative impact on the vitality of faculty and on the quality of their instruction.

Traditional methods of protection from faculty burnout, such as sabbatical leave and professional development programs, unfortunately, are some of the first areas for which funding is reduced or eliminated in times of constrained financing. An additional problem is that the criteria for sabbatical leave is narrowly defined. At a number of two-year colleges, including all those in Virginia, sabbatical leave can be used only for obtaining advanced degrees.

The financial consequences for the faculty member who does embark upon a broadening of knowledge by sabbatical leave or leave without pay can be shattering. While those who remain, continuing as usual, receive a salary increase for the year's additional experience in Virginia, the adventurous faculty member who will return refreshed, revitalized and full of new ideas will receive less than half the yearly increase, if any. At a time when faculty need to be revitalized and renewed, two-year colleges, and not just those in Virginia, retain policies which discourage rather than encourage faculty revitalization.

There is an urgent need for new approaches to revitalization of faculty. Our present efforts are too limited and are often inappropriate at a time when faculty in ever increasing numbers need support and uplifting.

It is interesting to note that in China, a less developed country than ours, this commitment to maintaining the vitality and the relevancy of mathematics faculty is strong. In addition to being assigned to only two classes a day, faculty are expected to participate in their own professional development by expanding and renewing their knowledge. In addition, faculty are expected to spend one-half day per week in formal group meetings for the exclusive purpose of the professional development of the group. Such a commitment of time by educators in this country coupled with administrative encouragement and financial support within the two-year colleges would be at least a first step in faculty revitalization.

The Need For Retaining Instructional Quality

In the 1970s and early 1980s, mathematics content has undergone an extensive reevaluation, especially the first two years of undergraduate study. Much of this effort at reevaluation was hastened by inexpensive hand-held electronic calculators and by microcomputers. These have led to expanded emphasis on discrete mathematics, statistics, real data analysis, and "real life" problems, and expanded interest in the use of computers within instruction. Reevaluation has also been fostered by the alarming numbers of students requiring remediation and by the lack of problem solving skills on the part of high school graduates.

The reevaluations of the mathematics curriculum must include occupational-technical courses as well as transfer courses. Revised instructional approaches have been necessitated by the impact that modern technology has had on altering the mathematical needs of technology, business, and health careers. When one looks at how the modern office has changed in the last

ten years, it becomes clear that a need exists to approach instruction in these careers in an entirely different way. Also the advances within the electronics industry over the last decade have led one electrical construction company president to indicate that his business is shifting from one which utilizes algebra to one that requires a knowledge of the concepts of Fourier transforms and series.

Even the most basic course in mathematics is not immune from re-examination. This was most evident in the recent conference, "Mathematics K-12: What is Still Fundamental and What Is Not."[4]

For two-year college mathematics faculty it is essential to be involved in these reevaluations of content and to be knowledgeable about the topics under consideration. Two-year colleges occupy a pivotal location between high schools and four-year colleges and universities. In that position the mathematical content must build upon what has been taught in high school and at the same time serve as a sound foundation for advanced undergraduate study. To have high school and four-year college faculty change their mathematical content while two-year college mathematics content remains static will mean a loss of quality and credibility as well as a loss of student enrollments.

Some faculty will find themselves well-prepared for incorporating the changes into their mathematics classrooms. Some others will find themselves incapable of adapting. Mathematics departments must be prepared to deal with such situations, even to the point of dismissing the non-adaptable faculty members. The largest group will be those faculty who with careful assistance will be able to adapt their instructional approach to incorporate any new directions. It is this last group that will need the focus of retraining efforts if recommended changes in content or approach are to be successful.

Previously, the appropriate knowledge was disseminated by word-of-mouth, through new textbooks, or by presentations at special meetings. In recent years the textbook has not been as good a vehicle for dissemination of new ideas because, for financial security, editors tend to only publish books which reflect the content of courses that currently exist and are well established. It is gratifying to note that there has been a 29% increase from 1975 to 1980 in the number of individuals who have attended and delivered professional presentations.[5]

These efforts at knowledge dissemination have been satisfactory but hardly sufficient. That is supported by the overwhelming popularity of the newly instituted minicourses at national meetings of the Mathematical Association of America (MAA) and the summer workshops sponsored by some of the regional sections of the MAA. These workshops, most of which have had capacity enrollments, have emphasized such topics as problem solving, exploratory data analysis, microcomputers, computer software, mathematics in industry, and numerous computer programming language workshops.

It is crucial that two-year college mathematics faculty be encouraged to participate in such exchanges of relevant knowledge. Workshops and minicourses are an expedient and inexpensive method through which mathematics faculty can learn about areas of interest within the mathematics community.

Another approach to assisting mathematics faculty to retain relevancy is an on-going effort to decrease the critical shortage of computer science instructors by retraining mathematics instructors. The Institute for Retraining in Computer Science at Clarkson College is sponsored jointly by the MAA and the Association for Computing Machinery (ACM). During a two summer program, the institute prepares mathematics instructors to teach computer science courses at the undergraduate level.

These efforts, however, have not been sufficient in light of the multitude of changes being considered in beginning undergraduate mathematics. The concept of the Retraining Institute should be extended into other areas of mathematics. Of course, such institutes should be provided with adequate funding.

The retaining of instructional quality by two-year college faculty also requires an understanding of the necessary mathematical skills and knowledge required within the occupational areas that career oriented students pursue. The opportunity for mathematics faculty to spend a summer or part of an academic year within appropriate industries should be encouraged, supported, and facilitated.

The successes of the MAA minicourses should be shared with those who find it difficult to attend national MAA meetings. Repeating these minicourses in conjunction with MAA section meetings or at meetings of other professional organizations in other parts of the country would provide faculty with an opportunity to participate at locations much closer to their colleges. Some of the minicourses could even take on the characteristics of a touring road show with presentations made in cities across the country.

Retaining quality in instruction, even in the best of times, is an ongoing, time-consuming activity. With the likely advent of a variety of recommended changes and adjustments in the mathematics content of two-year college courses, the efforts by mathematics faculty to retain quality in their instruction will require all the cooperative efforts that colleges and professional organizations can provide. The present efforts have been beneficial but much more remains to be done.

The Need For Quality Instruction For a Changing Clientele

Two-year colleges are facing the prospect of providing instruction to a changing clientele. This will require mathematics faculty to become concerned with providing relevant instruction to this changing student population.

Ten years ago, while four-year colleges and universities were emphasizing higher education for the well-prepared 18 year old on a full-time basis during the traditional work day, two-year colleges were offering their courses and programs to the underprepared student, the older returning student, the part-time student, and the student needing nontraditional class times and nontraditional modes of instruction. Today, many senior institutions, because of shrinking numbers of traditional students, have also begun to teach these nontraditional students. Although the remediation programs have long been considered the specialty of the two-year college, some of the remediation programs at the senior institutions are considered today to be the most innovative and successful.

During the last decade, two-year colleges also surfaced as the institution which would provide Southeast Asian refugees with an opportunity to succeed in their new country as well as to aid in their assimilation. This role will be of less significance as the flow of such refugees continues to shrink dramatically. However, the two-year colleges will continue to have a role in aiding in the assimilation of increasing numbers of Hispanics from Central and South America.

In the 1970s there was a large pool of adults eager to take enrichment courses offered by two-year colleges. Today, that pool has reduced in size

as more and more adults have exhausted the course offerings available at the beginning undergraduate level or have concluded that pursuing higher education is of little interest to them.

Of further impact on the mathematics programs at two-year colleges is the concern in state legislatures and by governors about the extensive cost of remediation in higher education. In Virginia the governor suggested that remediation was not an appropriate activity for higher education. In California a special task force was established to examine the role of remediation in higher education.

There is a substantial number of high school graduates who have received less than an appropriate high school education in mathematics. With the increasing number of states which are requiring more stringent course work in mathematics from high school graduates[6] two-year college mathematics departments need to be preparing for the future decline in the remediation function as well.

Mathematics faculty must also be concerned about retaining a relevant approach to instruction in light of the changing clientele. Two-year colleges are getting increasing numbers of students from local industries which require retraining on the part of their employees. This retraining is the result of the expansive alterations within the last decade in industrial operating procedures, in the technology that is used, and in the level of mathematical training that is required by employees to perform their altered jobs.

Two-year college mathematics faculty are also going out into industry to assist in retraining of employees. These faculty need to know that

they are there in the industry at the discretion of the employer. The employer and employees expect the instruction to be job-related. It is important to note that employees do not have time for content which they fail to view as relevant to their employment.

This approach to industrial training requires a mathematics instructor who can adapt instruction to meet the particular needs of the industry. It also requires a college administration which will provide appropriate acknowledgment and credit for the efforts of the faculty member providing the industrial retraining. Such efforts by faculty and administration will build strong credibility in the community and will provide the college with a continuing supply of students as industries continue to evolve and require additional retraining of employees.

In Summary

The future direction of mathematics instruction in the two-year college will rest on the success of efforts at retaining quality instruction by faculty as content and student needs change and of efforts to retain the vitality of faculty as they continue to become more experienced.

The notion of vitality of faculty appears to be the key link upon which any new curriculum recommendations will depend. There needs to be a new direction on the part of colleges in terms of workload, remuneration, and the role of faculty at the college. Part of this new direction should include a total reexamination of the true cost of providing a quality two-year college education. At the least, colleges need to have enlightened approaches to sabbatical leave and to fund programs in professional development and retraining. These programs, after all, were originally implemented as preventative maintenance to ensure a continued program of

quality instruction. Mathematics faculty will soon be confronted by substantial changes in mathematics content at the beginning undergraduate level. Already increased emphasis on calculators, computers, educational software, statistics, problem solving approaches and algorithmic instructional modes are making inroads into altering the variety of approaches to math instruction in two-year colleges. Colleges should well consider immediately investing in preparations for these imminent transitions.

The retaining of quality instruction also becomes vital as mathematics content changes are considered and as student needs and clientele change. Retraining opportunities for faculty need to be intensified, broadened and expanded. Workshops and minicourses need to be offered with more frequency and in convenient locations. Only a properly prepared and revitalized mathematics faculty will be sufficiently equipped to meet the changing needs of students and industry.

Efforts at retaining quality instruction and faculty vitality will require the combined support of all facets of society. The educational community, industry, government and foundations must provide opportunities for and adequate funding for involvement in continued and frequent faculty development. Professional organizations must provide activities and assistance for faculty. College administrations must encourage, support, acknowledge and reward faculty who are involved in efforts at retaining instructional quality and vitality.

In the end, relevant, vibrant mathematics instruction rests squarely on the instructor. Faculty, through efforts at faculty growth and development, must commit themselves to retaining and enhancing the quality of their instruction and their vitality as educators. For only with a vibrant, knowledgeable mathematics faculty will the recommendations of this conference become a reality.

NOTES:

1. James T. Fey and others, Undergraduate Mathematical Sciences in Universities, Four-Year Colleges and Two-Year Colleges, 1980-81, Report of the Survey Committee, Conference Board of the Mathematical Sciences, Volume VI (Washington, 1981), pp. 108-111.

2. Robert W. McKelvey and others, An Inquiry into the Graduate Training Needs of Two-Year College Teachers of Mathematics (Missoula, MT: Rocky Mountain Mathematics Consortium, 1979), p. 46.

3. The Chronicle of Higher Education, March 24, 1982, p. 1.

4. Mathematics K-12: What is Still Fundamental and What Is Not (Washington: Conference Board of the Mathematical Sciences, 1983).

5. Fey and Others, p. 110.

6. Focus (Washington, Mathematical Assocaition of America), September-October, 1982.