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ABSTRACT

Intended to identify current and near future needs within the two-year mathematics community and inform the greater mathematics community of their special needs and problems, this publication presents the American Mathematical Association of Two-Year Colleges' (AMATYC's) guidelines for mathematics departments at two year colleges. Following introductory sections, the paper is divided in two parts. Part 1 focuses on the current status of the two-year college mathematics community. The section outlines pressing issues, such as increasing student diversity, the impact of technology, the growth of part-time faculty, and articulation facilitation; present needs such as student access to tutorial centers, faculty computer literacy, and well-equipped math labs; and actions required, such as increased faculty development, curriculum development, and support from professional organizations. Part 2 proposes model guidelines for two-year college mathematics departments, addressing five central issues: faculty preparation, responsibility, and workload; departmental organization and administration; curriculum; support services; and student guidance and enrichment. Recommendations include orientation and training programs for new faculty, access to computer resources for both students and faculty, use of open-ended problems and critical thinking, and extracurricular activities that complement student mathematical interests.

The American Mathematical Association of Two-Year Colleges

Guidelines for Mathematics Departments at Two-Year Colleges

June, 1993

GUIDELINES FOR MATHEMATICS DEPARTMENTS AT TWO-YEAR COLLEGES

AMATYC began the task of developing guidelines for mathematics programs in 1988. What started as a joint effort with the Mathematical Association of America (MAA), became the task of the Two-Year College Mathematics Department Subcommittee of the AMATYC Academic Committee on Education in 1990. At that time it become apparent that the procedure for developing and gaining approval for one set of guidelines for both the two- and four-year college communities was preventing the task from being accomplished in a timely fashion. These guidelines are consistent with the MAA Guidelines for Programs and Departments in Undergraduate Mathematical Sciences but address some issues of relevance only to two-year institutions.

Quality mathematics programs are necessary for two-year colleges if these institutions are to continue to serve our constituencies by providing relevant and worthwhile mathematics education which will prepare students for transfer to four-year institutions and for work in an increasingly complex, technology-based world. These guidelines are designed to be used by two-year college mathematics faculty and administrators to assist in program evaluation, strategic planning, and continual quality improvement.

The guidelines consist of two major sections: Current Status of the Two-Year College Community, which outlines the major issues and most pressing needs of the two-year college mathematics community, and, Model Guidelines. The document should serve to increase the awareness of faculty, administrators and the community of the challenges facing two-year college mathematics educators and the importance of allocating both financial and human resources to help faculty meet those challenges.

AMATYC is deeply indebted to Phil DeMarois of Harper College, chair of the subcommittee on Two-Year College Mathematics Departments, and his subcommittee. Their efforts and energy made possible the following guidelines.

Marilyn Mays
President of AMATYC, 1993-95
North Lake College

The American Mathematical Association of Two-Year Colleges

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Statement of Purpose

In Spring, 1990, the Two-Year College Mathematics Department Subcommittee of the Education Committee was formed by the American Mathematical Association of Two-Year Colleges (AMATYC) with the following charge: Develop a position paper which establishes standards for two-year college mathematics departments.

Objectives

1. Identify the pressing issues within the two-year college mathematics community.
2. Identify the current and near-future needs within the two-year college mathematics community.
3. Inform the greater mathematics community of the special needs and problems faced by the two-year college mathematics community.
4. Inform the greater mathematics community of the actions necessary to address the special needs and problems faced by the two-year college mathematics community.
5. Establish model guidelines for two-year college mathematics departments.

Overview

Part I: Current Status of the Two-Year College Community

The first part of the report focuses on the current status of the two-year college mathematics community. First, the pressing issues facing two-year college mathematics departments are identified. Next, the needs of two-year college mathematics departments are listed. Finally, actions required to meet the present and future needs are stated. The next major section includes model guidelines for two-year college mathematics departments.

Part II: Model Guidelines

In this part of the report, model guidelines are proposed for two-year college mathematics departments. The guidelines address five central issues: faculty preparation and workload, departmental organization and administration, curriculum, support services, and student guidance and enrichment.

Definitions

1. *Mathematics* is used repeatedly to describe course work in pure or applied mathematics. The phrase mathematical sciences may be substituted for colleges that teach statistics or computer science within the mathematics department.
2. *Hours* refers to semester hours.
3. *Faculty* refers to both full-time and part-time two-year college faculty.
4. *College level mathematics* refers to courses at the level of College Algebra or above.
5. *Minority* refers to any underrepresented minority.
6. *School* refers to an institution teaching any segment of grades K through 12.

These guidelines were developed by the Education Committee of the American Mathematical Association of Two-Year Colleges, Subcommittee on Two-Year College Mathematics Departments, Phil DeMarios, Chair.

Part I: Current Status

A. Pressing issues

1. Student population
   a. Increasing diversity:

      What offerings and support services will best serve the educational goals of a student body that is increasingly diverse in cultural and ethnic make-up, age, and academic experience?

   b. Growing numbers of students with inadequate preparation in basic skills:

      How can we identify and counsel students whose pre-collegiate preparation is deficient? What courses will best serve these students, and how can faculty be prepared to instruct such courses?

   c. Need for student access to assessment and advising:

      How can all students be assured of adequate counseling and educational planning in a timely fashion?

   d. Need for student motivation:

      How can faculty best motivate students whose academic goals are unclear, whose study skills are inadequate, and whose perceptions of the value of education are, at best, short-term?

2. Curriculum
   a. Impact of technology:

      As budgets become tighter, what aspects of technology (e.g., computers, calculators, manipulatives, video) can best be used in attaining our educational goals? How should technology be incorporated into the educational environment?

   b. Impact of the standards developed and published by the National Council of Teachers of Mathematics (NCTM) in Curriculum and Evaluation Standards and Professional Standards for Teaching Mathematics and other curriculum reform documents:

      How should the recommendations be implemented in the two-year college setting? How can various strands be incorporated into our traditional course structure?

   c. Calculus reform:

      What reform should two-year colleges consider for calculus courses and how can they best prepare their students for transfer to four-year institutions that are undergoing calculus reform?

   d. Increasing demand for pre-college mathematics courses:

      What is the best way to prepare students for college level courses? How can we provide this preparation and, at the same time, maintain strong transfer programs? What should be the minimum entry level for students taking pre-college mathematics courses?

   e. Increasing difficulty meeting the demands of client disciplines:

      What is the appropriate balance between pure and applied mathematical concepts in courses that serve other disciplines? How should we respond to the growing number of mathematics courses taught outside of mathematics departments?

3. Faculty
   a. Standards for preparation:

      What is the appropriate preparation for two-year college faculty in terms of both content and pedagogy? Should two-year institutions hire remediation specialists as part of their regular faculties, as paraprofessionals, or not at all?

   b. Part-time faculty:

      Surveys indicate a sixty percent growth in part-time faculty during the same time period in which full-time faculty has increased only fifteen percent. How do we insure that part-time faculty meet the same standards as full-time instructors?

   c. Recruiting women and minorities:

      What can two-year colleges do to attract women and minority candidates to their faculties?

   d. Retraining for technology and curriculum reform:

      What is the best way to keep faculty members current (curriculum reform, educational methods, advancing technology, etc.) in their profession?

      How can faculty members best be encouraged and assisted in improving and updating their teaching skills?

4. Outreach
   a. Relations with administration:

      How can two-year college mathematics departments improve their political skills in negotiating with their administrations for support?

   b. Articulation with four-year schools:

      How can two-year colleges develop better relations with the four-year institutions they support? How can articulation procedures best be facilitated?

   c. Relations with high schools:

      Should two-year colleges recruit at local high schools? What contacts between two-year colleges and high schools would best strengthen programs at both institutions?

   d. Relations with business and industry:

How can two-year colleges enlist the help of business and industry to strengthen the colleges' programs?

e. Public relations:

What can two-year colleges do to improve the public's perceptions of mathematics and to heighten public awareness of the crisis in mathematics education?

B. Present needs

1. Student support
   a. Access to advising, assessment, and career planning:

      All students should have access to assessment testing and to counseling on test results.

      Students should also have access to information on careers and requirements of transfer programs to four-year institutions.

   b. Access to computer and tutorial centers:

      All students should have some recourse for assistance outside of class.

      Peer tutoring and computer-aided learning should be available.

   c. Encouragement of women and minorities:

      Colleges should provide active support for women and minorities in the mathematical sciences.

   d. Special needs:

      Reasonable accommodations for students with learning difficulties, varied learning styles, language difficulties, and socialization difficulties need to be determined and implemented to improve success rates.

2. Professional concerns and faculty development.
   a. Standards for preparation and hiring:

      Colleges should reexamine their hiring criteria, against the AMATYC guidelines for the Academic Preparation of Mathematics Faculty at Two-Year Colleges in order to better fit the changing role of the two-year college faculty.

   b. Recruiting:

      Colleges should strive for gender- and minority-balanced faculty.

   c. Retraining and continuing education:

      Colleges should provide encouragement, opportunity, and support for their faculties in order to keep up with the changing demands of the profession.

   d. Computer literacy and access:

      Colleges should have a computer literacy requirement for faculty and should provide computer access to all faculty.

3. Curriculum reform.
   a. Integration of technology:

      Faculty should decide how best to utilize emerging technology, determine the degree to which computer literacy should be required of students, and develop curriculum to accommodate these goals.

   b. Implementation of NCTM standards and other curriculum reform recommendations:

      Faculty should determine how to incorporate the various recommendations into the two-year college curriculum.

   c. Addressing the needs of underprepared students:

      Faculty should take up the challenge of preparing, in an expeditious manner, all students with inadequate backgrounds for college level mathematics courses They should consider all instructional alternatives in meeting students' needs including the use of manipulatives, group and cooperative learning, projects, and discovery techniques.

4. Facilities and support.
   a. Computer technology:

      Both faculty and students should have access to computers, campus-wide learning networks, and appropriate software.

   b. Mathematics labs:

      A well-organized mathematics lab can provide tutorial help, computer-aided learning, and a setting for discovery learning for students at all levels. Opportunities range from closely supervised work with manipulatives for developmental students to independent projects for more advanced classes. Small-group study rooms should be in close proximity to the main tutoring areas.

   c. Manipulatives:

      As two-year colleges become responsible for teaching more basic mathematics, faculty should learn from colleagues in pre-collegiate education and should employ manipulatives to teach basic quantitative notions and foster the transition to abstract thought.

   d. Support staff:

      Mathematics departments require support staff in the form of student tutors and mathematics lab facilitators.

C. Actions required.

1. Faculty
   a. Professional development:

      Faculty members should be aware of advances

in educational methods, including alternatives to the lecture method. They should be familiar with the discoveries of cognitive psychology as applied to mathematics education and understand the issues facing mathematics education at two-year colleges.

b. Teaching issues:

Faculty members should familiarize themselves with findings in the psychology of learning and thinking and with recent research in student learning problems.

c. Professional activities:

Faculty should be encouraged to participate in professional activities at both the local and the national level. They should support and implement emerging educational guidelines developed by the professional societies.

d. Communication:

Faculty should develop regular communication with their colleagues, both within their own departments and throughout the entire community, to share ideas concerning all phases of mathematics teaching.

Departments

a. Implementing guidelines:

Departments should develop strategic plans for incorporating national guidelines, including the NCTM standards, into their programs.

b. Programs to reach all students:

Departments should review and revise curriculum to meet the needs of a changing student population. Departments should investigate effective programs for increasing the success rates of underrepresented groups.

c. Faculty development:

Departments should provide opportunities for faculty members to experiment with alternative teaching methods, and to interact with each other in order to share ideas. They should organize local workshops on teaching and learning which focus on issues facing the mathematics education community. These workshops should include teachers from other areas within the college, from public schools, and from other colleges and universities, and should focus on issues facing the mathematics education community.

d. Equipment and technology to support programs:

Departments should seek funding from both internal and external sources to provide appropriate educational technology.

e. Support services:

Departments should take responsibility for securing the necessary support services for their programs, including adequate assessment and advising for students, aid and support for disadvantaged students, and staffing and equipment for computer and tutorial labs.

f. Student support:

Departments should assist students who have difficulties that negatively impact their academic performance (e.g., learning disabilities, problems in socialization or language, unusual learning styles). Departments should attempt to find reasonable accommodations and standardize these for the department. Work groups and seminars should be established to disseminate the information within the department.

g. Communication:

Departments should build networks with faculty in their institutions, including those in "client" disciplines, and with others who have an interest in the mathematics curriculum. Departments should initiate collaborative projects with mathematics instructors at the local schools and four-year institutions their colleges feed.

3. Professional societies.

a. Research:

Professional organizations should support studies to investigate successful instructional models, including methods targeted at underrepresented groups. They should create a database for cataloging and evaluating educational software and other teaching aids. They should conduct an in-depth study of resources for departments.

b. Recommendations:

Professional organizations should launch a visionary curriculum project aimed at the early decades of the next century. They should develop national guidelines for two-year college programs dealing with curriculum, teaching, and evaluation.

c. Support:

Professional organizations should make available directories of consultants in two-year college mathematics education and encourage dialogue between resource persons and local departments.

d. Communication:

Professional organizations should disseminate approved guidelines and standards to all members of the profession. They should expand programs to educate the public on popular misconceptions about mathematics and mathematics education. They should encourage dialogue between pre-college, two-year college, and university faculties.

Part II: Model Guidelines

A. Faculty Preparation and Responsibility

1. Faculty who teach mathematics courses should have a minimum of a master's degree including at least eighteen hours of graduate-level mathematics, and should, in all other aspects, meet the preparation requirements stated in the AMATYC Guidelines for the Academic Preparation of Mathematics Faculty at Two-Year Colleges. Part-time faculty should be held to the same standards of preparation as full-time faculty. Departments should assess teaching potential and communicative competence when selecting new faculty.

2. Orientation and training programs should familiarize new faculty with departmental expectations and student needs. New teachers should be carefully evaluated in the classroom before being granted permanent status. Each beginning instructor, full- or part-time, should be assigned a mentor who is a full-time mathematics department member. The mentor should be available to assist beginning faculty in resolving problems and in meeting responsibilities. Departments should have programs which encourage faculty members to mutually support each other in improving instruction and to incorporate new instructional technology and the results of research in education into the educational program. Departments should provide opportunities for all teachers, especially those recently hired, to improve their teaching skills.

3. All full-time faculty members should exhibit broadly defined sustained scholarship in mathematics such as participating annually in professional development activities, attending professional meetings, completing short courses, or attending graduate mathematical sciences courses. Departments or institutions should provide faculty development programs such as sabbaticals. Faculty should receive adequate financial support for professional development activities.

4. All full-time faculty should be formally involved in their professions, as demonstrated through active membership and participation in appropriate professional organizations.

5. For faculty who are evaluated primarily on their teaching and for whom research and publication are not required for promotion and tenure, teaching assignments should not exceed fifteen contact hours per week. Appropriate reductions should be made for laboratory or instructional supervision, extensive administrative or professional service, or extensive course, courseware, program, or computational technology development.

6. Faculty should participate in department and institutional service activities.

B. Departmental organization and administration.

1. Department role
   a. Mathematics faculty should take an active role in institutional governance and planning outside their departments. They should have a voice in framing institutional policy, in the allocation and use of resources, and in curricular issues. They should maintain regular communication with faculty in related and client disciplines.
   b. Mathematics departments play a special support role for other disciplines. Meeting the reasonable needs of other departments is a major responsibility. Formalized mechanisms should be in place to insure that other departments can communicate their students' mathematical needs to the mathematics department.

2. Staffing
   a. Mathematics departments should be adequately staffed to allow for a maximum class size of thirty students. Opportunity for frequent interaction between students and instructors should be provided, both in the classroom and in office consultations.
   b. Mathematics courses should be taught by full-time faculty members of the mathematics department, whenever possible. The minimum qualifications for part-time faculty should be the same as for full-time mathematics faculty. As a general rule, in terms of both course sections and student credit hours, at least seventy percent of the total enrollment in day and night mathematics classes should be taught by full-time mathematics department faculty.
   c. Mathematics departments should have policies and procedures for establishing balance for faculty and staff with respect to gender and ethnicity.
   d. Mathematics problem-solving laboratories and tutorial centers should be staffed, scheduled, and located so that services and equipment are accessible to all students who need them.

3. Facilities and environment
   a. All full-time faculty should have offices. All part-time faculty should have access to office space which allows them to confer confidentially with students outside of class.
   b. Classrooms should be equipped with such traditional teaching aids as adequate chalkboard space, projector equipment, and screens. For classroom use of computer instructional

material, computer and calculator display equipment should be available in classrooms that are primarily used for mathematics instruction.

c. Access to computer resources for both teachers and students should be consistent with the joint policy statement Providing Resources for Computing in Undergraduate Mathematics approved by the Committee on the Undergraduate Program in Mathematics (CUPM) and the Committee on Computers in Mathematics Education (CCIME), committees of the Mathematical Association of America (MAA).

d. Dedicated space near faculty offices should be provided for use by students for informal and casual learning.

4. Planning.

a. Departments should have established planning and evaluation processes for their mathematical sciences programs. The major components should include:

- A clearly defined statement of mission.
- A delineation of program goals.
- A description of evaluation procedures.
- The means by which evaluation results are used to improve program effectiveness.

b. Mathematics faculty should plan for the support, maintenance, and updating of computers and other instructional aids. The growing need for technology forces mathematics faculty into new roles which involve competing for institutional resources, grant monies, and other resources.

5. Course content.

A current syllabus for each course should be on file and available. Course prerequisites should be clearly stated and enforced.

6. Placement.

Departments should support established procedures for the placement of students in mathematics courses. These policies should be well-understood and disseminated across the institution. The effectiveness of the procedures should be assessed periodically by mathematics faculty, admissions personnel, advisors, and testing personnel.

7. Teaching evaluations.

Departments should have established procedures for evaluating the teaching of all instructors. These procedures should include consideration of students' perceptions and peer evaluation of teachers. Evaluation of teaching should have promotion and tenure implications.

8. Periodic review

a. Mathematics departments should undergo periodic review where both internal and external mechanisms are used to evaluate the success of the departments' programs and to plan for necessary changes. The views of students, alumni, client departments, program faculty, and external reviewers should be included in the evaluation and planning process.

b. Departments are encouraged to use this document as a guideline for periodic review.

c. Periodic departmental reviews should carefully address program effectiveness as well as program quality. Student outcomes are pivotally important measures of program effectiveness.

9. Department organization.

Departments should be chaired by members of the department who have been granted reassigned time commensurate with the administrative demands of the position. Department chairs should teach at least one course each semester/quarter. If the administrative demands are too great, the department chair should select assistant chairs from the department faculty who will be assigned specific departmental tasks. The assistant chairs should be granted reassigned time commensurate with their administrative responsibilities.

C. Curriculum.

1. The breadth of the curriculum should reflect the mission of the department and of the college. The curriculum should include topics of contemporary interest in the mathematical sciences. The spectrum of beginning courses should be broad enough to offer appropriate choices and placement to all students who wish to study mathematics at the college. General education mathematics courses should meet the quantitative literacy recommendations of CUPM when published.

2. If courses below the college level are available, they should be so designated and should not count toward the mathematics requirements of any degree.

3. Two-year colleges should cooperate in facilitating student transfers. Mathematics faculty at two-year colleges and at four-year colleges and universities should work together to insure the compatibility of appropriate courses. University course equivalencies to two-year colleges should be published. Without sacrificing innovation, two-year college mathematics departments should insure that their courses are consistent in content and focus with equivalent university courses. Any courses known not to be transferable should be clearly identified in the community college catalog.

4. Departments should have a stated policy on the frequency that courses are offered. Basic courses, such as calculus, and support courses, such as statistics, should be offered at least once each year.

5. If an associate degree in mathematics is offered, the mathematics courses required for that degree should enable the recipient to transfer to a baccalaureate degree-granting institution with junior level standing as a mathematics major.

6. Departments should carefully examine new ways of presenting materials, with particular attention given to the use of technology. Course work should encourage appropriate use of computers, graphing calculators, and current technology in teaching, learning, and applying mathematics. In courses where nationally accepted software packages are available, students should be introduced to at least one of these software tools. Departments should facilitate the use of alternative teaching techniques that appear to have merit.

7. The curriculum should provide the connectedness that is inherent in mathematics. Connectedness gives mathematics its power, establishes its truth, and reveals its beauty.

8. Departments should take necessary steps to insure homogeneity between different sections of a given course without infringing on faculty members' academic freedom.

9. Departments should encourage faculty who wish to incorporate a laboratory component into their courses where appropriate.

10. Open-ended problems and critical thinking should be of high instructional priority.

D. Support services.

1. Library

   Periodicals should reflect the needs of the institution's mathematics program. Holdings should include materials to provide mathematics enrichment as well as to support mathematics courses. Holdings should minimally consist of the recommended mathematics materials for a two-year college library as defined by the Library Subcommittee of the Education Committee of AMATYC. Materials required to support students' projects should be available in-house or through interlibrary loan. Holdings and subscriptions should be reviewed periodically to determine if the mathematical sciences are adequately supported. The institution's libraries should be staffed, scheduled, and located so that their holdings and services are available to all students.

2. Institutions should provide tutorial services for students who need such assistance. Tutors should either hold credentials in mathematics or, in the case of peer tutoring, have mathematics faculty recommendations. Tutoring facilities should be staffed, scheduled, and located so that their services are available to all students.

3. Placement testing and prerequisite checking.

   a. Placement testing should be provided for all students prior to their first enrollment in a mathematics course. Statistical evidence related to placement should be compiled and reviewed annually to evaluate the effectiveness of the placement process.

   b. Students should be admitted into mathematics classes only if they meet the prerequisites. Exceptions should be made only by the instructor for the course or the department chair.

4. Computer laboratories should be made available and adequately staffed. The laboratories should be staffed, scheduled, and located so that they are available to all students.

E. Student guidance and enrichment.

1. Every student majoring in a mathematical sciences program should have as an advisor a member of the program faculty. Advisors should hold regular conferences with each of their advisees.

2. Departments should provide students with information about careers in the mathematical sciences and should make students aware of further educational opportunities, particularly in the mathematical sciences.

3. Students who are deterred from success in the mathematical sciences, for whatever reason, represent a great loss to the mathematical community and to society at large. Departments should make every effort to remove obstacles to success from the paths of all students. These obstacles may include learning difficulties, physical difficulties, socialization difficulties, language difficulties, and cultural difficulties. Faculty should be committed to the support and encouragement of students.

4. Departments should provide policies and practices that aid in the transfer of students to four-year colleges and universities and in their persistence to baccalaureate degrees.

5. Department faculty should lead students in extracurricular activities that complement or extend their mathematical interests, such as the AMATYC Student Mathematics League.

6. Students, especially those at risk, need support structures. Departments should provide for these structures (e.g., student mentoring, study labs, and tutors). ▮

FOR ADDITIONAL INFORMATION CONCERNING THESE GUIDELINES CONTACT:

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