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ABSTRACT

For the remainder of the century, large numbers of students will transfer from two-year to four-year colleges. In light of this, two- and four-year mathematics faculty need to sharpen their understanding of each other and to plan improved interaction. The problem in communication between two- and four-year mathematics faculty comes from living in different and separate worlds and a tendency to stereotype the other--two-year faculty are seen as being without standards and as pseudo mathematicians; while the four-year faculty are viewed as aloof and ineffective with undergraduate students. Both groups need to recognize that the other has unique and important contributions to make in a dialogue. The two-year faculty members need to visit the four-year campus to teach, work, and experience the environment that their students will encounter. The four-year faculty must recognize the outstanding teaching that generally takes place at two-year colleges. Both have to work together on projects that benefit them mutually and their students. In particular, they need to discuss curriculum and standards, the entry-level preparation of incoming students, and details of mandated common state curricula where these exist. Both groups should begin by treating each other as equals and should interact, particularly at the local level, to develop mutual respect as the foundation for future cooperation. (Author/HB)

SOME REFLECTIONS ON THE INTERACTION OF MATHEMATICS PROGRAMS AT TWO AND FOUR YEAR COLLEGES

Stephen B. Rodi

SUMMARY

For the remainder of this century, large numbers of students will transfer from two year to four year colleges. In light of this, two and four year mathematics faculty need to sharpen their current understanding of each other and to plan improved interaction.

For the most part, faculty at two and four year institutions live in separate worlds. Part of the reason is mutual uncomfortableness rooted in mutual stereotyping: the TYCer is suspected of being standardless and/or of being a pseudo mathematician; the university faculty member is viewed as aloof and ineffective with undergraduate students.

Both groups need to come to recognize that the other has unique and important contributions to make in a dialogue. The TYCer needs to visit the four year campus regularly--and teach and work there from time to time--to re-experience the environment his transfer students will encounter. The university faculty need to recognize--and learn from--the outstanding teaching that generally takes place at two year colleges. The groups need to work together on a variety of projects and programs that can benefit each of them and students. In particular, they need to interact in discussions of mutual curriculum and standards, on the entry level preparation of incoming students, and on details of mandated common state curricula where such exist.

Mutual respect is the best foundation for future cooperation. Interaction, particularly at the local level, is the best way to promote such respect. The principal professional mathematics organizations have a special responsibility to promote this interaction, where necessary changing their policies and encouraging change in their members. In short, for a relationship to work, the partners need to see each other as equals.

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Talk Net is a syndicated nationwide phone-in radio show with early evening host Bruce Williams. Williams dispenses wisdom on the best swimming pool liners and on the worst life insurance policies. His fans love him.

On the night I drove to my office to begin sketching out these reflections, one young man called Williams to discuss the merits of staying at the local community college for a year or two before transferring to the four year college. Williams' reply: you certainly will save some dollars that way, a plus in anyone's ledge..

In his own unvarnished way, that night Williams gave us the principal reason two and four year mathematics programs need to be concerned about one another. For the rest of the century, and likely beyond, economics will motivate (and frequently force) large numbers of students to start out at the community college and end up at the four year school.

Increased Transfers

I know that the 1980-1981 CBMS survey committee report [1, Figure 4.2] showed that college transfer enrollments as a percentage of fulltime enrollments at community colleges had dropped below occupational/technical enrollments for the first time. But I sense

that phenomenon may be reversing again. Or, even if these percentages do not reverse, the gross numbers of students at two year schools who transfer to four year schools certainly will grow steadily.

I know this is the case at my school where each semester we have as many as 750 students in calculus and differential equations and fewer than 200 in arithmetic. I sense it is a growing phenomenon in my state where, for example, increasing numbers of community colleges are concerned about topics like the common core engineering curriculum for freshmen and sophomores at publicly supported colleges. (By the way, "common core" does not mean all colleges must offer the same courses. More on that below.) When a state like Florida has a 357,993 headcount in community colleges (December, 1982, figures), a transfer rate of but 20% feeds 70,000 students into a university system whose headcount at that time was only 135,072. Finally, at the most recent meeting of the American Association of Community and Junior Colleges (AACJC), as reported in the April, 14, 1984, Chronicle of Higher Education (p. 22), the dean of instruction at Virginia's Piedmont Community College predicted that the increasing cost of higher education would lead to larger enrollments of middle-class, traditional, college-age students in two year college transfer programs.

Mutual Perception

It is hard to know exactly what perceptions two and four year mathematics faculty currently have of one another. But, if they are going to be sharing so many students, they ought to try to find out.

On the one hand, in the 1980-1981 CBMS survey [, p. 111] more than half the administrators in two year college mathematics programs reported no problems with coordination with four year colleges. But,

on the other hand, in this same report (p. 92), these same departments reported a low level of consultation with four-year programs: less than once a year for 42%, only yearly for another 35%, and more than once a year for only 23%.

My own suspicion is that these last figures tell the real story: life for the most part in separate worlds. I suspect there are two causes for the infrequent interaction. One is the natural human inertia and organizational problems in getting one's own department together without even considering coordination with the school across town. But a second reason is a fundamental uncomfortableness between mathematic faculties at two and four year schools, an uncomfortableness that has existed for most of the past two decades and only now may be diminishing slightly as these faculty interact more on national committees and at each other's national meetings.

Roots of These Views

As in many such cases, some partly factual, partly stereotypic attitudes may lie at the root of the uncomfortableness. The university faculty member isn't quite sure the two year faculty member <u>really</u> is a mathematician and for that reason is reluctant <u>fully</u> to welcome the TYCer into the informal camaraderie of the mathematical fraternity and into the older, mainline mathematical organizations. Two year faculty members, for their part, perceive too much casual disregard for undergraduate instruction at large four year schools where massive lecture sections and the faculty's pursuit of publication isolate the student and result in failures that should not occur.

I don't think we should pretend these mutual perceptions are not there. They are. And they are too often grounded in fact. But, in

an era when cooperation will become more critical, we need--as a first step toward improved interactions--to work at modifying these perceptions. An important starting point in this process is for each group to recognize that it has something to learn from the other.

Learning From Each Other

Too frequently two year college faculty are not good enough mathematicians. Their mathematical education has not been broad enough. They need to be willing to expand it, particularly in a decade that will bring more probability, statistics, discrete mathematics, and programming to their courses, even at introductory levels. And their view of what they do as teachers--particularly with transfer students--can be too narrow. "Feeling good" about factoring is not an adequate goal. Too many TYC faculty are influenced inappropriately by training programs based in colleges of education which confuse ideas with feelings and seem to make the touchstone of the successful two year college a student exiting with a warm glow about a "good experience."

In short, these TYC faculty, like some of their colleagues in secondary schools, need to raise their personal and departmental standards, particularly as regards transfer students. Such action will have a positive effect on the confidence and respect accorded by their four year colleagues.

Colleagues at four year schools can be helpful in this process. For example, an imaginative program at The University of Texas at Austin invites mathematics faculty from across the state to spend a "semi-sabbatical" in Austin teaching at U.T., participating in

seminars, and refurbishing research skills. As it stands, that program is skewed at bit toward other four year faculty. But it is a good, solid model of a program that also could be oriented for visiting two year faculty, even if only in the summer. The TYCer needs to get close from time to time to the environment the transfer students will end up in and needs to have some intellectual challenge similar to that his transfer students will face.

TYC: Skills To Share In Teaching

But four year faculty have to recognize that two year faculty have special skills to offer, too, in this dialogue of recognizing each others' strong points. It may well be that much of the best teaching in the U.S. today at any level takes place in the two year colleges. Four year faculty ought to be more aware of this and more eager to tap this resource.

All sorts of possibilities exist. Graduate students could spend an intern semester teaching with two year faculty. An experienced, effective two year faculty member could be invited to the four year school to teach undergraduate courses as models for graduate students and others. The four year department might invite in their two year colleagues on curriculum or classroom organization or teaching style and effectiveness or textbook selection for undergraduate courses.

Wouldn't it be lovely (apologies to Henry Higgins) if graduate programs could take at least as much interest in the teaching skills of their students as in their research skills? After all, not only will their graduates be entrusted with the education of many generations of young people--no small societal responsibility --but faculty salaries are paid by parents and other taxpayers who expect

and deserve good instruction for their dollar--no small obligation in justice for the payee.

The needs of both four and two year college faculty for renewal and expansion of viewpoint and skills is one of the principal recommendations in the CBMS report "New Goals for Mathematical Sciences Education" [2, p.20,21], the results of a conference held November 13-15, 1983. The suggestion here is that in some areas these two groups should look to each other for renewal.

Other Interactions

Let me now give some specific suggestions for interaction and cooperation. where the beneficiaries are students and society. When a state like Michigan (The Chronicle of Higher Education, April 18, 1984, p. 14) calls for colleges to pool resources, neighboring faculty at two and four year schools should be comfortable enough with each other to consult and see how coordination might help each. When the Rockefeller Foundation reports (same Chronicle, same page) that lack of high school mathematics is a major hinderance to women and minorities in science, local community colleges and four year schools should be active, natural allies in attacking the problem.

I participate in two programs of the last kind, neither perfect, but both steps in the right direction. One is called TAME, Texas Alliance for Minorities in Engineering, largely funded by industry. In my area, it is not unusual for a graduating minority high school senior to spend the summer on scholarship at our community college in mathematics and physics classes before moving on to the university.

The second program developed five years ago when, for a variety

of reasons, the mathematics department at The University of Texas at Austin decided to stop offering college algebra except in the summer term. Nonetheless, they expected a certain number of their incoming freshmen not to score high enough on their placement examinations for the usual first level course (frequently, Business Calculus I).

The mathematics chairperson at The University of Texas approached us at the community college. What developed was a Monday/Wednesday night college algebra class supervised and taught by us for credit at our college but offered in the U.T. mathematics building for mostly U.T. students. The course enrolls 400 total in fall and spring, with as many as 500 requests for the 200 seats available each fall.

In some ways, the most instructive part of this last example is the high spirit of cooperation that has developed among us, the U.T. mathematics department, the undergraduate advisors in the U.T. College of Business, the staff at the U.T. Measurement and Evaluation Center, and the summer orientation staff in the Dean of Students office at U.T. By getting to know one another over the phone and in person, each side has been able to make small adjustments that makes the program work for students. On our part we have established a special mail-in registration inquiry that U.T. advisors can give their prospective freshmen. We have tailored the course to 15 weeks (rather than 16) to avoid conflict with their examination period. On the other hand, various colleges at U.T. have been cooperative in giving exemptions to the usual requirements of fulltime registration, if the student is enrolled with us for this special program at an advisor's suggestion. And the U.T. mathematics department through its chairperson has been

most helpful in greasing the wheels of approval at various decision levels within his institution.

Is Calculus A Freshman Course?

My personal experience with our college algebra classes on a university campus always makes me think of a particular area where I feel four year schools have something to learn from two year colleges. One result of the post-Sputnik, new math era was an attempt to put more preparatory mathematics in high schools so that students entering the university would be ready as freshmen to take calculus. This was in direct contrast to the practice of the 1940's, 1950's, and early 1960's--when most of us went to school--wherein the normal expectation was that a freshman college student would take a full year of mathematics (college algebra, trigonometry, a thorough analytical geometry course including rotations, and maybe even a little spherical trigonometry) before beginning calculus.

In my mind, the curriculum revision of the past 20 years has clearly failed. Our high schools are graduating seniors distinctly less well prepared in mathematics. Nonetheless, there remains at most universities an assumption that calculus is a freshman course, that students who do not begin calculus in the first semester of their freshman year are "out of sequence" or "doing catch up work."

The pressures for calculus as a freshman course frequently comes from outside the mathematics department (e.g., engineering and physics) where curricula are constructed on that assumption. But it may be time to question the reasonableness of that assumption--or even the reasonableness of a four year degree plan--for the American educational system. Two year colleges have generally been more realistic about the preparation level of students and can make a special contribution in such a dialogue.

Common Curricula

The specific examples of cooperation mentioned above are valuable mostly at the local level. There is a broader area of cooperation of great importance. This has to do with establishing common statewide or regional curricula.

Robert E. Shepack is the president of El Paso County Community College. In a long article about Hispanic students, he is quoted in The Chronicle of Higher Education, March 21, 1984, as follows on the subject of transferability and program coordination between two and four year schools: "The problem is not a community college problem; it is a university problem. Universities have to develop enveloping curriculums so they can recognize what we do but still get what they want. And they have to be less imposing... They are the ones who refuse to change."

In El Paso's case, forty parallel programs have been developed in cooperation with the university; but, says Shepack, "only a few places in the country have well-thought-out programs that follow through a matriculation."

Shepack is commenting on what I think should become the single most important point of articulation between two and four year colleges for the rest of this century. Four year schools have to be willing to incorporate two year schools in the degree planning process so that the community college can organize its own curriculum to make the student's path straight and efficient. This interactive process requires confidence on the part of the university that transfer students indeed will receive a comparable education at the two year feeder school and requires flexibility where necessary at the two year level to make adjustments to earn this confidence from their university colleagues.

On one level, these sorts of common curricula can be imposed by the state whose legislatures have a powerful interest in not duplicating educational appropriations. Florida has an articulation agreement mandated by the legislature and supervised by a Deputy Commissioner of Education. Texas has developed about 18 "core curricula" which assure intra-state transferability whenever public colleges offer the same course on the core list. In the 1980-1981 CBMS survey [1, p. 92], thirty-eight percent of the two year colleges reporting indicated official state-wide coordination of two year mathematics offerings with those of four year institutions.

It might be very instructive as part of the next CBMS survey, or as a follow-up from this conference, to get a great deal more detailed information on how the various states are handling this coordination and (where successful plans have been developed) to publicize what techniques were used. I have in mind something as thorough as the 50-state survey recently undertaken by the Education Commission of the States on state response to the national crisis in precollege mathematics and science [3].

Are Four Year Schools The Obstacle?

Frankly, however, I agree with Shepack that the biggest obstacle to the formation of coordinated curricula remains with the four year schools. No amount of state mandating will be truly effective as long as four year schools are reluctant to participate or are suspicious that their participation will in some way dilute their product. Too few large university mathematics faculties are like the University of Illinois at Champaign which took the initiative years ago to get involved with two year colleges and in the process helped establish one of the strongest statewide two year college mathematics associations in the U.S.

Promoting Mutual Respect

But Illinois--and some others, like Michigan--are showing us the right path: interaction at the local level. National groups like the American Mathematical Association of Two Year Colleges (AMATYC) and the Mathematical Association of America (MAA) have to promote both nationally and statewide as much collegiality as possible. MAA particularly, which through the years and even now sends ambivalent signals about its eagerness to promote mathematics at the two year college, should use its prestige and resources to promote this regional cooperation by appropriate policy decisions and receptivity at the highest levels.

Knowledge through association will erase misconception and become the foundation of confidence and cooperation. The closer to home the elbow rubbing, the better.

Much of what I have written in these reflections has to do with attitudinal changes on both sides that should facilitate cooperation. The March 28, 1984, Chronicle of Higher Education ran a provocative article about similar collaboration between college faculty and secondary school teachers. It was titled "Equal Status for Schoolteachers, Professors Called Key to Successful Collaboration." Mutatis mutandis, the article provides a good source of reflection on the relation between two and four year mathematics faculties. Let me close with some excerpts:

(1) "unless you enter a relationship believing you are working with persons who are equal to you, a project has no probability of success";

(2) "professors are not trained as teachers; they regard instruction as an obligation"; "when it comes to instruction, schoolteachers may actually be somewhat superior to faculty members...perhaps they could work with new faculty members and teach them some skills";

(3) "a school-college collaborative must develop a common understanding about what it is about";

(4) "there is a need to avoid the condescension that has marked the attitude of many college faculty members working with their counterparts at the secondary-school level";

(5) "establish an analogue of the county medical society for those teaching in each discipline...doctors meet monthly in county medical societies and take the primary responsibility together for the quality of practice of medicine in their area and for keeping each other up to date in the field... societies of ... mathematics teachers should also meet monthly and take responsibility for the quality of teaching in their disciplines in their locale and keep each other up to date."

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