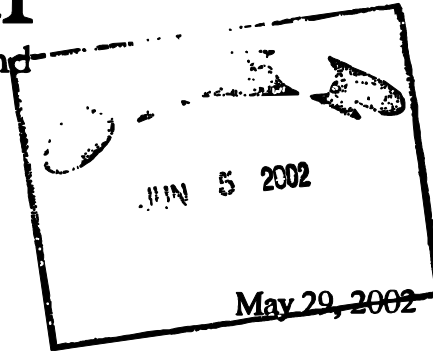




Memorial

University of Newfoundland

Office of the Dean
Faculty of Science



TO: Vice-President (Academic)

FROM: Dean of Science

SUBJECT: Mathematics and Statistics Academic Program Review (APR) Action Plan

Please find attached the Action Plan resulting from the APR of the Department of Mathematics and Statistics. This plan has been the result of extensive consultations between the faculty members of the Department and their Head, and between the Head and the Dean of Science.

The number of recommendations and extensive supporting commentary with each, as well as the considerable volume of written material produced during the development of the action plan, have made it desirable to present the plan in tabular format for ease of reading. One consequence of this format is that there is loss of context which risks making responses appear blunt and even uncooperative. This is not intended to be the case although, as the reader will see, the Department does not always accept the recommendations of the APR report. The number of such instances is, however, small. It should also be noted how many of the recommendations have already been implemented. A number of these concepts had occurred to the Department prior to APR and planning for them was already underway at the time of APR.

With respect to those occasions when the Department disagrees with the recommendations of the APR report, and with respect to one or two other points, it may be useful for me to comment. For example, **Recommendation 2.2** cannot be taken seriously in its current form because the teaching staff to implement this recommendation resides in the Department of Mathematics and Statistics. Taken at face value, implementation would merely result in an administrative transfer of faculty members from one unit in the Faculty of Science to another and would not result in any significant improvement in academic outcomes for students. That notwithstanding, there is a need to rationalize the delivery of Mathematics 1090 to achieve improved student outcomes, greater student satisfaction with the course and economies of scale in its delivery. This rationalization is being pursued independently in my office.

Likewise, **Recommendation 3.1** is impractical. The MLC does not have the staff to carry out this function and it seems unlikely that the Department of Mathematics and Statistics would willingly relinquish control to the MLC over the very quality filter that allows them to select students for entry to their programs.

The Departmental response to **Recommendation 3.10** is best understood in the historical context of the Department. A significant step towards eliminating some of the discord that characterized that Department in years gone by was made by separating certain disputatious factions. This was done, rightly or wrongly, by dividing the Department into divisions of Pure Mathematics and Applied Mathematics. Since many of the proponents in those disputes are nearing retirement, recombination of Pure and Applied Mathematics is an agenda that can be better pursued at a later date since their separation into Pure and Applied divisions is not currently the most significant impediment to the effective functioning of the Department.

Recommendations 6.2, 6.3 and the final item, “**Class Size**”, are interdependent. The number of faculty members needed to deliver the teaching programs and the hiring that must be done to maintain an adequate faculty complement in the face of retirements are matters that are obviously affected by policies on class size. Scholars differ on the impact of class size as a determinant of student outcomes. Models that have been shown to be successful include both small (≤ 35) classes and large (≥ 250) classes. In both cases, however, a significant feature is the provision of ample opportunities for supervised drill, practice of concepts and rapid correction of incorrect procedures. Drill is achieved in the former case in the teacher/faculty-supervised classroom whereas in the latter it is achieved through small group tutorials, laboratories or well-staffed and constantly accessible drop in Help Centres. In the Memorial context, given the large number of impending faculty retirements and anticipated difficulty in hiring replacements, it would seem prudent to explore alternatives to faculty-intensive approaches. Other factors as well, such as the probable future streaming of first year students based on their impending mathematical needs, including identification of a cohort that is currently largely not acknowledged, namely, those who do not require any mathematics, will affect future faculty complement requirements. It is, therefore, clear to me that the faculty complement of 39 proposed by the APR report is almost certainly not an appropriate number. I am at present, however, still uncertain what the proper number might be. A number of processes are, nonetheless, underway within the offices of the Dean of Science, the Registrar and the Vice-President (Academic) that should culminate in a better understanding of what an appropriate faculty complement should be.

In conclusion, support for the notion that experimental offerings, in non-traditional modes, of some high enrollment, currently multi-sectioned service courses, must be attempted to ascertain whether equally effective deliveries of these courses can be achieved at lower costs would be appreciated in any response to the Action Plan that might emanate from the Senate Planning and Budget Committee. If such experimental processes can be implemented, they should help us to reach a rational set of decisions about an appropriate faculty complement in Mathematics and Statistics and about modes of program delivery that are more successful in terms of student outcomes and satisfaction.

C. Robert Lucas
Dean of Science

**DEPARTMENT OF MATHEMATICS AND STATISTICS
MEMORIAL UNIVERSITY OF NEWFOUNDLAND**

**ACADEMIC PROGRAM REVIEW
ACTION PLAN**

Recommendation	Action	Who	Timeline
2.1. The University should consider changing its criteria for admission scholarships to take into consideration that a student is taking an advanced stream of mathematics.	Agree; action required by Senate.	Senate	1 year
2.2. (a) The teaching of all pre-university mathematics courses should be done by the Mathematical Learning Centre. In particular, the teaching of M1090 should be the responsibility of the MLC. The teaching function of the Mathematics and Statistics Department should begin with first-year university level mathematics and statistics courses. (b) Students should begin first-year mathematics courses only after they are sufficiently prepared so that they have at least an 80% chance of succeeding.	Agree; memo dated December 7, 2001 submitted to Dean for action. Agree; placement already in place.	Dean of Science Department	1 year done
3.1. Effective immediately, the Department should no longer be involved in the placement of entering students. This task should be transferred to the Mathematics Learning Centre consistent with Recommendation 2.2.	Agree in principle, see motion from November 28, 2001 department minutes; submitted to Dean for consideration/action.	Dean of Science	1 year
3.2. The Department should seriously consider introducing alternative streams of calculus courses.	Previous negative decision will be considered again as part of program review.	Department	1 year

<p>3.3. The final examinations of calculus courses should have more relevant questions that test the understanding of calculus and its applications.</p>	<p>Already implemented.</p>	<p>Department</p>	<p>done</p>
<p>3.4. The Department should consider the introduction of an alternative stream of courses for prospective Elementary teachers, the Department should actively involve faculty from appropriate MUN units.</p>	<p>Will consider again in a timely way with Faculty of Education.</p>	<p>Department and Faculty of Education</p>	<p>1 year</p>
<p>3.5. When designing alternative streams of calculus courses and an alternative stream of courses for prospective Elementary teachers, the Department should actively involve faculty from appropriate MUN units.</p>	<p>Already implemented as extant practice.</p>	<p>Department</p>	<p>done</p>
<p>3.6. (a) The laboratory components for Mathematics (not Statistics) courses should be discontinued. (b) In place of lab components, the Department should have a greatly expanded Help Centre that is properly funded, properly located, and properly staffed.</p>	<p>Labs are important and will be continued. Expansion of the Help Centre is dependent on outcome of 2.2 and 8.1.</p>	<p>Department Dean of Science</p>	<p>done 1 year</p>
<p>3.7. The laboratory components of Statistics courses need to be updated with better facilities and appropriate software.</p>	<p>Already implemented.</p>	<p>Department</p>	<p>done</p>
<p>3.8. The Department should seriously consider extending the length of final examinations as well as its policy on the use of calculators.</p>	<p>Already implemented in some courses. Faculty will be encouraged to implement longer exams where appropriate. Calculator policy remains flexible.</p>	<p>Department</p>	<p>done</p>

<p>3.9. (a) The role of the Undergraduate Officer should be re-examined.</p> <p>(b) Regular faculty should be fully involved in advising students.</p>	<p>Undergraduate officer is being retained because the position provides me ability to deliver single source advice in a consistent manner.</p> <p>A program to involve faculty in recruitment of majors will be considered.</p>	<p>Department</p> <p>Department</p>	<p>done</p> <p>1 year</p>
<p>3.10. Serious consideration should be given to eliminating distinctions between "pure" and "applied" mathematics in the undergraduate program.</p>	<p>Distinction is being retained.</p>	<p>Department</p>	<p>done</p>
<p>3.11. The university should consider the amalgamation of suitable courses and the sharing of teaching responsibilities where appropriate.</p>	<p>Recommendation involves other units.</p>	<p>Other units and Department</p>	<p>1 year</p>
<p>3.12. The Department should seriously examine the number of courses required for its Majors degree for each year level.</p>	<p>Currently being reviewed.</p>	<p>Department</p>	<p>1 year</p>
<p>3.13. The Department should seriously examine the number of courses it requires for its Honours degree.</p>	<p>Currently being reviewed.</p>	<p>Department</p>	<p>1 year</p>
<p>4.1. The Department should seek to expand its graduate program to about 25 students.</p>	<p>Current policy is that all faculty who want graduate students should have them. We currently have 23 graduate students and this number will grow in response to faculty renewal.</p>	<p>Department</p>	<p>done</p>

4.2. The Department and University should work together to increase funding for graduate students.	Agree; discussions with the deans of Graduate Studies and Science underway.	Department, Dean of Graduate Studies and Dean of Science	continuing
4.3. We recommend that suitable graduate students be given the opportunity to teach one or two courses per year. Graduate students desiring to teach should first be given training in the teaching of university mathematics and those offered teaching assignments should be chosen carefully.	Already implemented.	Department	done
4.4. The Graduate Officer should chair the Graduate Studies Committee.	The Graduate Studies Committee considered the recommendation. It has found the present structure, which divides the work load to be effective and has recommended retaining that structure.	Department	done
6.1. We recommend that the Mathematics and Statistics Department at Memorial follow the accepted standard work model in which faculty are active in research, teach at all levels, supervise students and participate in the collective duties of the department.	The workload model described is already being used within extant staffing limits.	Department	done
6.2. Within the next ten years the Department should have 39 regular tenure track or tenured faculty members who are engaged in research, teaching and service, including at least nine in statistics. They should be hired in a timely fashion.	The head is consulting with Dean about future tenure-track hires.	Department and Dean of Science	1 year

<p>6.3. The Department should develop a hiring plan which takes into account their current strengths and weaknesses.</p>	<p>The department has an existing hiring plan. It will be implemented as soon as the department has permission to hire on a tenure-track basis.</p>	<p>Department and Dean of Science</p>	<p>1 year</p>
<p>6.4. The Department should have a formal mentoring program for junior faculty.</p>	<p>Mentoring of recent hires continues to occur through the head's office. At the point that new tenure-track hiring takes place, a program of additional support will be implemented based on reviewing the experience of hires from the recent past.</p>	<p>Department</p>	<p>done</p>
<p>6.5. The Department should find acceptable ways of measuring teaching effectiveness for all faculty members.</p>	<p>Already implemented by University.</p>	<p>University</p>	<p>done</p>
<p>6.6. We recommend the University consider instituting a system in which outstanding accomplishments are acknowledged in a formal way.</p>		<p>University</p>	<p>1 year</p>
<p>7.1. The Department should explore the development of a workshop program for schools that involves MUN faculty and MUN students.</p>	<p>Already done within existing constraints.</p>	<p>Department</p>	<p>done</p>
<p>7.2. The Department in conjunction with the Faculty of Education should explore the development of an in-service upgrading program for teachers in elementary and junior high schools.</p>	<p>Will consider with the Faculty of Education.</p>	<p>Department and Faculty of Education</p>	<p>1 year</p>

<p>7.3. The Department with the help of the University's support services should consider the conducting of studies on factors affecting preparation of students entering MUN.</p>	<p>Already implemented.</p>	<p>Department and other units.</p>	<p>Done</p>
<p>8.1. We strongly recommend that the Mathematics Department be provided with expanded facilities, particularly larger faculty offices, larger staff space, storage facilities, and a much larger Help Centre space.</p>	<p>Completely agree.</p>	<p>President, Vice-President, and Dean of Science</p>	<p>1 year</p>
<p>Class Size. The report (see Sections 3.5-3.7) recommends the department continue to hold down its class sizes.</p>	<p>Agree.</p>	<p>Department</p>	<p>done</p>



Memorial

University of Newfoundland

Department of Mathematics and Statistics

head@math.mun.ca

To: Dr. R. Lucas, Dean of Science
From: Herbert S. Gaskill, Head of Department
Subject: **Academic Program Review M1090
Recommendation**
Date: December 7, 2001

MEMORANDUM

Recommendation 2.2 of the Academic Program Review Panel states:

The teaching of all pre-university mathematics courses should be done by the Mathematics Learning Centre. In particular, the teaching of M 1090 should be the responsibility of the MLC. The teaching function of the Mathematics and Statistics Department should begin with first-year university level mathematics and statistics courses. Students should begin first-year mathematics courses only after they are sufficiently prepared so that they have at least an 80% chance of succeeding.

Appended to this memo are pages 8-9 of the Panel's report that reveal their thinking on this issue.

The department has considered the recommendation and has come to the conclusion that most of the concerns that underlie the Panel's recommendation, and many of the decisions that need to be taken, are institutional, as I will discuss below.

The Panel recommendation asserts that mathematics instruction within the department should begin with calculus, consistent with most other Canadian universities, in particular, Dalhousie, Acadia, Mt. Allison and UNB. Moreover, none of the four universities mentioned appear to offer any pre-calculus courses for credit, and three of the four have compulsory placement.

Elsewhere in its report, the Panel suggests that the standard of our current entry Calculus course, M1000, is somewhat lower than elsewhere. This appears to be true in respect to the total content covered, but not in respect to the standard of achievement expected on the content covered. However, adding a minimum of two-four weeks of additional content to a syllabus that, in our experience is appropriate for students here, would certainly have the effect of demanding a higher

Dr. R. Lucas, Dean of Science
Re: M1090 Recommendation
December 7, 2001

standard. If the department were to implement this recommendation, either we would have to demand a higher standard of students beginning the course, or, the university would have to accept significantly higher failure rates.

From my perspective as head of the Department of Mathematics and Statistics, the university, perhaps in consequence of the "special obligation" clause in the *University Act*, insists on admitting large numbers of students that desire to complete a degree in a subject area that demands a university-level mathematics component, e.g., Business, Engineering, Kinesiology, various sciences, etc., but who have not been prepared by the Newfoundland school system to take the mathematics courses required. I would draw to your attention the document "Mathematics Equals Opportunity" (www.ed.gov/pubs/math) which identifies the key courses in a school curriculum that are critical to success, both at university and in society in general. The content in these key courses has been severely reduced in the new school curriculum being implemented in Newfoundland and this reduction is likely to make the situation in respect to the skill levels of entering students worse in the future. In support of this assertion, I note that the drop rate in M1000 of students coming from the new curriculum pilot program is double what it was from those coming from the old 3201, and in addition, students from the pilot program report being ill-prepared for M1000.

Finally, I note that the Panel characterizes the department's method of instruction in M1090 (lecture sections of 70) as a "large-class lecture approach" and suggests that alternatives should be found. Alternate pedagogical approaches are impossible at current funding levels and I believe that all my superiors are aware of this reality.

The department is more than willing to cooperate with any strategy the university wants to adopt for dealing with these problems. However, we need some consistent guidance in the form of answers to key questions.

1. Does the university intend to continue for the foreseeable future to admit large numbers of students who intend to pursue degrees that require a university-level math component (calculus), but who have not been prepared to succeed in even a pre-calculus course - such students are identified as having scores of less than 65 on the MPT(MSI)?
2. If the answer to the first question is yes, is the university prepared to commit the resources necessary, in whatever form, to give these students a reasonable chance to succeed?
3. If the answer to the second question is yes, is the university willing to recognize that credit, or lack thereof, is a significant psychological barrier to these students successfully completing remedial courses?

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4. Is the university willing to require completion of a standardized mathematics test as a means of identifying students at risk in a sufficiently timely fashion, say by the end of grade 11, to permit students to begin remediation prior to entering Memorial?
5. Is the university happy with the current standard in MI 000, or would the university want us to raise the standard by adding topics and content as suggested by the Panel?

Answers to these questions would be most helpful to the department if it is to develop a response to the APR that is consistent with university goals. I therefore request, on behalf of the department, that you take whatever steps you deem appropriate to obtain institutional guidance on the issues raised by the five questions.

Dr. Herbert S. Gaskill

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2.2 The Handling of Inadequately Prepared Students--Role of the Mathematics Learning Centre

If the University chooses to admit students who have the formal admission requirements of an overall 70% average and a passing grade in Grade 12 mathematics, but who may not be suitably prepared for university mathematics, then it should provide those students with opportunities to remedy that deficiency in order that the students have a reasonable chance of completing the university program to which they were admitted.

There are a variety of ways in which this could be done. While Newfoundland is unusual in the number of inadequately prepared students, it is not unique in having students who need remedial assistance, and many different approaches have been tried by other universities, some on campus and others off. Presently MUN has a Mathematics Learning Centre, which reports directly to the Dean of Science, determines the placement of students into remedial programs and provides individual attention to students who need the most extensive assistance. Approaches which have been used at other universities include: cooperation with community colleges, adult or continuing education centres and credit or non-credit remedial courses offered through the university. The University should determine the best approach for Newfoundland students.

The problem of a lack of basic mathematical skills is not the fault of the Mathematics and Statistics Department. While the Department should cooperate in the search for a solution to these problems, its teaching function begins with first-year university-level mathematics courses. The University desires to expand its focus on research and graduate studies. Research mathematicians are not the appropriate people to teach pre-university mathematics courses; they are trained to teach university mathematics at the undergraduate and graduate level, and to carry out mathematical research.

A long-term solution must be sought by the University, in cooperation with the educational community of Newfoundland as a whole. In the interim, it is our recommendation that the preparation of MUN students for first-year university level mathematics should be done by the Mathematics Learning Centre. Students should begin courses in the Mathematics and Statistics Department only when they are sufficiently prepared in order to have at least an 80% chance of succeeding in first-year mathematics.

This recommendation means that the pre-university material presently taught by the Mathematics and Statistics Department as M1090 (a pre-calculus course in elementary algebra and trigonometry) should be taught through the Mathematics Learning Centre. This does not imply that the material should be taught with the individualized approach currently used by the MLC, or the university-style, large class-lecture approach currently used by the Department in M1090. Indeed, something between these two extremes may be more suitable in assisting students to make the transition from high school to university mathematics.

Recommendation 2.2. The teaching of all pre-university mathematics courses should be done by the Mathematics Learning Centre. In particular, the teaching of M1090 should be the responsibility of the MLC. The teaching function of the Mathematics and Statistics Department should begin with first-year university level mathematics and statistics courses. Students should begin first-year mathematics courses only after they are sufficiently prepared so that they have at least an 80% chance of succeeding.

Implementing this recommendation may require the MLC to be restructured. Clearly it will need significantly more staff, space and other resources than it currently has. We must stress that these resources should *not* be diverted from the Mathematics and Statistics Department.