The Committee for the Evaluation of Mathematics Study-Programs

General Report

August 2010

Contents

Chapter 1 - Background

At its meeting on October 07, 2008 the Council for Higher Education (CHE) decided to evaluate study programs in the fields of mathematics during the academic year 2009-2010.

Following the decision of the CHE, the Minister of Education, who serves ex officio as a Chairperson of the CHE, appointed a Committee consisting of:

- **Prof. Benedict H. Gross,** Mathematics Department, Harvard University, USA - Chair
- **Prof. Ronald Coifman,** Department of Mathematics and the Department of Computer Science, Yale University, USA
- **Prof. Hillel Furstenberg (emeritus),** Department of Mathematics, the Hebrew University, Israel
- **Prof. Gerard van der Geer,** Korteweg-de Vries Institute for Mathematics, University of Amsterdam, the Netherlands
- **Prof. David Jerison,** Mathematics Departments, Massachusetts Institute of Technology, USA[1]
- **Prof. Yakar Kannai,** Department of Mathematics, Faculty of Mathematics and Computer Science, Weizmann Institute, Israel

Ms. Noa Nof Steiner and Ms. Marissa Gross - Coordinators of the Committee on behalf of the Council for Higher Education.

Within the framework of its activity, the Committee was requested to:[2]

1. Examine the self-evaluation reports, submitted by the institutions that provide study programs in mathematics, and to conduct on-site visits at those institutions.
2. Submit to the CHE an individual report on each of the evaluated academic units and study programs, including the Committee's findings and recommendations.
3. Submit to the CHE a general report regarding the examined field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study.

The entire process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (of October 2008).

[1] Prof. David Jerison did not participate in the second round of visits.
[2] The Committee's letter of appointment is attached as **Appendix 1**.

Chapter 2 - Committee Procedures

The Committee members received the self-evaluation reports in November, 2009, and discussed them via email.

The Committee held its first meeting on January 3, 2010**,** during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, as well as Mathematics study programs.

In January 2010, the Committee held its first cycle of evaluation, and visited the Open University, the Hebrew University, Tel-Aviv University and the Technion. In May 2010, the Committee conducted its second evaluation cycle, and visited Bar Ilan University, Haifa University and Ben-Gurion University of the Negev. During the visits, the Committee met with various stakeholders at the institutions, including management, faculty, staff, and students.

This report deals with the Committee's general impression of the field of Mathematics within the Israeli system of higher education.

The Committee wishes to thank the management of the institutions and the mathematics departments for their self-evaluation reports and for their hospitality towards the Committee during its visits.

Chapter 3 - Evaluation of Mathematics Study Programs within the Israeli System of Higher Education

Introduction

Mathematics has always held a distinguished place in the Israeli academy, and the research of Israeli mathematicians continues to be of the highest international quality. The recognition of the high quality of Israeli mathematics is evident from the prizes and grants obtained by Israeli mathematicians and in many other ways; for example we mention that a relatively high number of Israelis were invited as plenary speakers or chairs of sections in the forthcoming International Congress of Mathematicians (India, August 2010), with Israel trailing (in absolute numbers) only USA, France, Germany, and the UK. Nor is this a one time occurrence; a substantial number of Israelis were invited at previous congresses.

But the committee discovered a number of challenges common to all of the institutions that we visited that appear as clouds on the mathematical horizon. We will discuss them here, and refer to the individual reports for matters which were particular to the departments. These issues relate to the curriculum of the undergraduate degree, the size of graduate programs, recruitment of junior faculty and the need to present the general case for mathematics education to the public.

The mathematical research in Israel does not, and cannot be expected to cover all areas of mathematics on the same level. Over the years there were some shifts of emphasis. Opinions may differ on whether certain topics are over-represented while others are under-represented. We do not feel that central planning on the national level is warranted or advantageous (some would hold it to be counter-productive) and regard natural evolution as the preferable strategy. We did indicate several specific areas of relative strength and weakness in several of the individual reports.

1. The undergraduate program

The faculty members at every Israeli University complained that the entering undergraduates were not as well prepared in mathematics as they had been in the past. This often resulted in high failure rates in the first year courses, frequent re-taking of exams, and a high drop out rate. We have no sound basis to determine the true extent of the problem, its causes, and ways to solve it. (We cannot be sure even if the problem is unique to Israel or is part of a more universal trend.) The committee was not charged, nor is it competent, to comment on mathematical education in Israel at the K-12 level. (There are several indications that there is deterioration – Israel's nationwide ranking dropped in several international tests, and even the top achievements as measured by ranking in international Olympiads are dropping markedly; moreover, immigration from the former Soviet Union – once a source of mathematical talent – has all but stopped.) Nor are we able to adjust the timing of military service, which may result in some high school skills being lost, and having an older student body than in other countries. (Military service is not a new thing; consequently it alone cannot be the sole or even the major culprit for a perceived decline.) But we believe that the basic curriculum in mathematics needs to be adjusted to account for the level of the entering students, with the first courses offering more review material and gradually bringing the students up to mathematical speed. This adjustment in the curriculum needs to be made on a nation-wide basis.

Some faculty have suggested moving to a four-year undergraduate program in mathematics, with the first year used to cover the basics not acquired in high school. We considered this, but felt that with competition from the other disciplines (which are running three-year undergraduate programs) and with the late start of many of the students, it is an unrealistic proposal. If some courses have to be dropped from the three-year program, so be it. The main issue for Israel is to train and retain talented undergraduates in mathematics, regardless of their entering level.

Beyond the revision of the first year curriculum, we felt that it was essential to have math homework graded, and that administrators need to find the funds to cover this. On-line

grading technology should be considered, but this will not be able to address the exercises involving proofs.

The number of undergraduates wishing to major in mathematics is much smaller than the number of those who study heavily mathematical subjects (including, but not limited to, Physics, Electrical Engineering, and Computer Science), and negligible compared with students taking service course in many disciplines. (This problem is by no means unique to Israel.)

Various institutions pursue different strategies in order to increase the number of mathematics (proper) students. One such device is recruiting of bright high school students. One should be very careful in challenging young persons in a demanding program.

2. The graduate program

There are a number of strong graduate programs in Israel, but we felt that graduate education would be much improved if the seven individual programs could be coordinated (in addition to the six departments that were evaluated, the Weizmann Institute has a mathematics department which did not undergo evaluation). It might appear that in a small graduate class the students receive more attention from the faculty. But very small programs are not beneficial to graduate education, as students learn a great deal from their peers. Having some circulation of the graduate students among the research institutions would also prevent inbreeding – too many Israeli students go on to get a Masters or doctoral degree at the same University where they receive their undergraduate training. Small programs also result in inefficiencies in graduate teaching, as all graduate students need the same basic training in mathematics.

We recommend that Israel consider the model pioneered by Holland, where graduate students are admitted to a national program (see Appendix 2). They reside in an

individual institution, but take courses and seminars at different Universities. If this recommendation proves too difficult to implement, then nearby institutions (such as Haifa and Technion, or Bar-Ilan, Weizmann, and Tel-Aviv) should attempt to coordinate their graduate programs.

We also recommend that more graduate courses be taught in English. This has become the international language of mathematics, and it would be helpful for the students to acquire a real proficiency in it. It would also permit faculty and postdoctoral fellows from abroad to do more teaching, and help to attract some of them to settle in Israel.

It is recommended that effort is made to alleviate somewhat the economic pressure felt by a few graduate students.

3. Faculty

Many of the institutions that we visited had experienced serious declines in their faculty numbers, to the point where it was seriously endangering their ability to do current research. This situation needs to be addressed quickly, as there are many retirements coming in the years ahead.

Fortunately, there is a great deal of talent in the next generation of Israeli mathematics. To take advantage of it, Universities will have to streamline their appointment procedures for junior faculty. Every post doctoral candidate or tenure-track candidate abroad that an institution in Israel wants to attract in the fall will have several offers in Europe or the States in hand by the mid-spring. They need to have a written offer from Israel at the same time. There is the danger of a serious brain drain of mathematical talent if this issue is not addressed.

We also urge departments to use their junior faculty on search committees. These younger colleagues are in an excellent position to evaluate contemporary research, and represent the future of the department.

4. The general case for mathematics

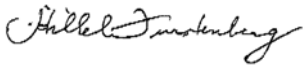
The committee felt that Israeli mathematicians could do a better job making the case for mathematics in Israel to the public at large. Talented undergraduates are being lost to fields like computer science, which ultimately rely on mathematical ideas for progress. Even the undergraduates in mathematics had little idea of what could be done with their skills, other than pursue a graduate math degree. Perhaps this is a task more for the Israel Mathematical Union than for faculty members at individual Universities, but we sensed that there was a lack of information going to the general public.

In fact, mathematics has pervaded our culture in a myriad of ways. Besides the basic service courses that departments provide to students in the sciences, a case can be made for teaching a course in basic combinatorics and probability to all students in Israel, including those studying the humanities. These courses are common in the United States, and would enhance the position of mathematics at Israeli Universities.

Signed by:

Prof. Benedict Gross, Chair

Prof. Ronald Coifman



Prof. Hillel Furstenberg

Prof. Gerard van Geer

Prof. David Jerison

Prof. Yakar Kannai

Appendices

Appendix 1- Copy of Letter of Appointment

December 12, 2009

Prof. Benedict H. Gross
Mathematics Department
Harvard University
USA

שר החינוך
Minister of Education
وزير التربية والتعليم

Dear Professor Gross,

The State of Israel undertook an ambitious project when the Israeli Council for Higher Education (CHE) established a quality assessment and assurance system for Israeli higher education. Its stated goals are: to enhance and ensure the quality of academic studies; to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel; and to ensure the continued integration of the Israeli system of higher education in the international academic arena. Involvement of world-renowned academicians in this process is essential.

This most important initiative reaches out to scientists in the international arena in a national effort to meet the critical challenges that confront the Israeli higher educational system today. The formulation of international evaluation committees represents an opportunity to express our common sense of concern and to assess the current and future status of education in the 21st century and beyond. It also establishes a structure for an ongoing consultative process among scientists around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial endeavor.

It is with great pleasure that I hereby appoint you to serve as the Chair of the Council for Higher Education's Committee for the Evaluation of Mathematics Studies.
The composition of the Committee will be as follows: Prof. Benedict H. Gross – Chair, Prof. Ronald Coifman, Prof. Hillel Furstenberg, Prof. Gerard van der Geer, Prof. David Jerison, Prof. Yakar Kannai.
Ms. Noa Nof-Steiner will coordinate the Committee's activities.

In your capacity as the Chair of the Evaluation Committee, you will be requested to function in accordance with the enclosed appendix.

I wish you much success in your role as the Chair of this most important committee.

Yours sincerely,
Gideon Saar
Gideon Sa'ar
Minister of Education,
Chairperson, the Council for Higher Education

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Ms. Riki Mendelzvaig, Secretary of the Council for Higher Education
Ms. Michal Neumann, Head of the Quality Assessment Unit
Ms. Noa Nof-Steiner, Committee Coordinator

רח' שבטי ישראל 34 ירושלים מיקוד 91911 • טל' 02-5602330 • פקסמיליה 02-5602246
34 Shivtei Israel St' 91911 Jerusalem. Tel. 02-5602330. Fax 02-5602246
شارع شبطي يسرائيل 34 . اورشليم القدس 91911 . هاتف 02-5602330 فاكس 02-5602246
כתובת אתר ממשל זמין: http://gov.il
כתובת אתר המשרד: http://www.education.gov.il

Appendix 2- Description of Program in the Netherlands

The math departments of the different universities in the Netherlands now cooperate in the "Mastermath" program, which provides point courses for the MSc and the PhD programs in mathematics. The website http://www.mastermath.nl/ gives information about the program and its schedule.

This program has been operating for a number of years. The general impression of both the students and the faculty has been very positive. TheMastermath program was developed to address the problem of low enrollment in the graduate courses at the various individual universities. Besides increasing the enrollment in each course, it also has the advantage of bringing graduate students into contact with their peers on a national scale .

A quote from the website

The Departments of Mathematics of the Dutch universities have combined their efforts to enhance their master programmes in mathematics. Part of the cooperation is aimed at organizing joint courses in mathematics. These joint courses offer students the highest quality of instruction and open up opportunities for interaction with students of other institutes of mathematics . In the master programme of each university it is stipulated how many credit points must be earned by taking courses in the Dutch master programme. For students who intend to pursue a PhD programme after completing their master's programme, the joint programme increases the range of options open to them.