The Committee for the Evaluation of Mathematics Study-Programs

Tel-Aviv University Evaluation Report

August 2010

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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[1],** Mathematics Departments, Massachusetts Institute of Technology, USA
- **Prof. Yakar Kannai,** Department of Mathematics, Faculty of Mathematics and Computer Science, Weizmann Institute, Israel

Ms. Noa Nof Steiner - Coordinator 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 Haifa University, Bar Ilan 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 **School of Mathematical Sciences, at Tel-Aviv University.**

The Committee's visit to Tel-Aviv University took place on January 11-12, 2010. The participating Committee members were Prof. Benedict H. Gross, Prof. Ronald Coifman, Prof. Hillel Furstenberg Prof. David Jerison, and Prof. Yakar Kannai. The schedule of the visit, including the list of participants from the institution, is attached as **Appendix 2**.

The Committee thanks the management of Tel-Aviv University and the School of Mathematical Sciences for their self-evaluation report and for their hospitality towards the Committee during its visit at the institution.

Chapter 3: Evaluation of the School of Mathematical Sciences, Tel-Aviv University

* *This Report relates to the situation current at the time of the visit to the institution, and does not take account of any changes that may have occurred subsequently. The Report records the conclusions reached by the Evaluation Committee based on the documentation provided by the institution, information gained through interviews, discussion and observation as well as other information available to the Committee.*

Background

The School of Mathematical Sciences was established in 1958 as the Department of Applied Mathematics in the Faculty of Natural Sciences under the auspices of the Weizmann Institute. The Department later evolved into the Department of Mathematical Sciences in the Faculty of Exact Sciences, and in 1980, it absorbed the Statistics Department and turned into the School of Mathematical Sciences. The School is comprised of the Department of Applied Mathematics, the Department of Pure Mathematics, and the Department of Statistics and Operations Research.

During the 2008-09 academic year, Tel-Aviv University student population was over 31,000, of whom roughly 20,000 were at the undergraduate level and nearly 11,000 at the graduate level. The same academic year 353 undergraduate students, 109 Master's level students, and 43 doctoral students, were enrolled in the School of Mathematical Sciences, and it granted 54 B.Sc. degrees, 21 M.Sc. degrees and 5 Ph.D. degrees.

Faculty

The School of Mathematical Sciences at Tel Aviv University deservedly enjoys a very high international reputation. However, its status is at risk because of the severe stress over several years of budget cuts. The number of faculty in Mathematics has gone from a peak, described to the Committee variously as 66 or 70, to 48 in 2009. The school's morale seems especially low in applied mathematics, with depletions arising from recent and upcoming retirements. Three renowned faculty members in pure mathematics are currently on leave and at risk of leaving permanently for positions in the US.

With four upcoming retirements and only two replacements, the size of the faculty will decrease further to 46. There is no mutual agreement between the School and

upper administration on the target number of faculty after the current retrenchment. The administration has proposed the number 45, which the School's members feel will compromise research and teaching even further.

Because of the difficult financial environment, it has been hard to persuade faculty members to serve as Chairman of the School. The current Chairman is serving only one year, in the last year before his retirement. On the positive side, two subsequent Chairmen are tentatively lined up, so that the succession for the next four years is assured. Although the term of a Chairman is formally four years, Chairmen have actually been serving for only two years.

Faculty retention and recruitment is a chronic problem, which requires persistent attention from both the School and administration. There is also a more acute problem related to teaching. Major cutbacks in support of teaching, especially service teaching, have already compromised the educational environment of the undergraduates and increased the workload of the graduate students.

Teaching and Learning

The School currently offers 18 mathematics service courses (some with large enrollment split into separate lectures), within various Schools, such as Engineering, Physics, and Chemistry. They are taught by 15 adjuncts and by mathematics graduate students. The Committee was unable to learn the total enrollment represented, and recommends a more systematic record of students taking these courses. A few departments, notably Economics, offer some of their own mathematics courses as well.

The Mathematics School acts as a contractor of the service courses in mathematics given at the University. In addition to selecting the lecturers, recitation leaders and graders, it runs a two-day training workshop for graduate students who are prospective teachers, and sends faculty members to observe new teachers and teachers who have generated complaints. The School tailors the content of the service courses according to the discipline served. For example, the Physics Department, after having tried to teach mathematics on its own, reversed course and engaged members of the School to revise its undergraduate mathematics curriculum.

There is a severe problem of diminished funding for the service courses. Even though the School has the responsibility for staffing these courses, the outside departments dictate their schedule and structure. Most departments have decided that the homework exercises only be spot-checked. The Engineering faculty has stopped grading homework entirely. Some lecture classes have been doubled in size from 70 to 140. The size of recitation sections varies from 45 to 70, whereas an ideal number would be somewhere between 20 and 30. The greater class size significantly reduces the attention students receive while increasing the workload of lecturers, teaching assistants and the remaining graders.

The adjuncts are capable and experienced teachers, most of whom also teach at other colleges and universities. They seem content with their working conditions, and, unlike at some other universities, know their employment status and teaching assignments reasonably in advance of the semester.

Much of the burden of the most recent cutbacks has fallen on students in service courses who have less access to their teachers. It has also fallen on teachers, recitation leaders and graders who have more work for the same or lower pay. To make up for lost teaching and grading jobs, the School is expending more fellowship money, but in many cases, individual student teaching loads have gone up. The result of cutbacks on graduate students is that there are fewer of them, and their time to degree is slowed down.

The Committee noted that there is no systematic review of the undergraduate and graduate study programs.

Research

Despite the financial difficulties, the research quality and research environment remain very strong (a large number of the invited speakers at recent ICM and ECM meetings are from Tel Aviv School of Mathematical Sciences). The School has succeeded in recruiting outstanding younger faculty members and the faculty is delivering extremely high quality research training to its students. Graduates with Ph.D.s from Tel Aviv get job offers from top universities in the US and Europe and

M.Sc. and PhD candidates say they have excellent access to their professors and feel they are getting good guidance. The undergraduate program is extremely successful at producing career mathematicians, and the undergraduates are very happy with 2nd and 3rd year courses and access to advice.

On the other hand, the School could slip very soon from its eminent position. The research program of the School will be seriously compromised if it loses three senior faculty in pure mathematics, who are currently on leave and may take job offers in the United States.

The whole discipline of applied mathematics has changed in character over the past twenty years. Historically, applied mathematics concentrated on physical problems, but now it concerns a much larger range of problems, such as signal and image processing, computational biology, extremal combinatorics, and the analysis of large data sets. Moreover, the variety of pure mathematics that enters into applied mathematics has greatly expanded. The Applied Mathematics Department expects four imminent retirements, but only two replacements, both in pure mathematics, not applied. As a result, the Department lacks sufficient faculty to support broad training of postdocs and graduate students without input from other departments. A sustainable model may be an interdisciplinary one, like the new Vision Lab, which has strong connections with pure mathematics, computer science, and other departments.

When visiting the School, the Committee has been asked as to the prospects of merging the Applied and Pure Mathematics Departments. The Committee does not support this initiative, but rather recommends to recruit new faculty members who could bridge the divide between pure and applied mathematics.

Students

Both the mathematics undergraduates and graduate students at Tel-Aviv School of Mathematical Sciences are extremely good. The University attracts many of the best students because of the very high quality of the faculty and the general appeal of Tel Aviv. Moreover, a very select group of several dozen gifted high-school-age

students, as well as very talented students in the military, are permitted to follow the mathematics curriculum at the School.

The undergraduates are happy with their classes in the 2nd and 3rd year. In the first year, the classes are large and students could use more individual attention. There are not enough graders in order for the homework exercises to be graded properly, and the existing graders have huge workloads. The Committee found the attrition rate to be normal.

Some undergraduate students need to work in order to afford tuition, and they find it hard to graduate in 3 years. Those who work as graders for lower level courses find that their workload has increased without any change in pay, which has slowed their progress to getting the degree.

There are at present 60 pure and 49 applied Master's candidates in a two-year program. There are 26 pure and 18 applied PhD candidates in what is approximately a four-year program. While the graduate students are happy with the research environment, their 4300 shekels/month stipend is not enough to live on. Some of them interrupt or delay their studies to earn enough to continue. The increase in recitation and class size puts a further burden on them, and they work as much as 20 hours per week on their recitation teaching. Whether they work outside the University or within it, their time to degree is slowed down. The prospect of delay also discourages some Master's candidates from continuing to the PhD.

Infrastructure

The campus grounds and physical surroundings are very pleasant and well maintained, and office space in the School is adequate for the faculty. Emeritus professors need to share offices, but this is the case in most institutions. Extra office space in the Barracks for Ph.D. students is too far away from the rest of the School. A former dispute with Computer Science concerning office space has subsided, and at present Computer Science and Mathematics are cooperating well in their shared space.

The library has not been able to purchase new books for nearly a decade, and the only source of new books is donations. Electronic access to journals has been maintained, but is expensive and subject to culling each year. The library provides a good physical environment for study and good access to computers.

Summary and Recommendations

The School of Mathematics is a very strong research institution. It also delivers a superb education to undergraduate mathematics majors and graduate students. However, its strength is at great risk of being compromised, primarily because of the drop in faculty size and the accompanying effect on morale. Swollen classes and lack of graders have already compromised the quality of some of the lower level and service teaching.

The School's Chairman is already on a path towards fixing some of the problems, but needs help from inside and outside the School over the next several years, to maintain strength in research and to restore teaching quality.

The Committee's recommendations are as follows:

1. The initiatives of the current Chairman are in the right direction, but need to be sustained and amplified over a long period, not just the one or two years of a single chairman's term. In light of this, the School should develop a cadre of faculty leaders who will ultimately share the burden of chairmanship and other management positions. Indeed, the whole faculty should support the Chairman in identifying hiring directions and opportunities, maintaining and updating undergraduate and graduate offerings and service courses. The Committee recommends that a leadership committee be established in order to carry out these objectives.

2. To ensure that the School weathers the storm and maintains its strength, it must prepare a strategic plan for faculty development. With a clear understanding of short and long-term goals, the School will be better able to conduct its affairs efficiently, explain itself to the upper administration, and develop alliances with the other departments it serves and collaborates with.

3. The target number of faculty members should be discussed with the University administration, as 48 faculty members seem consistent with the attrition in the University as a whole only if one starts from 66 as the number of faculty in the past. The fact that the School stands to lose a net of two more positions seems out of line if the faculty is stabilizing at its current size.

4. The University leadership, on its end, should provide the School with assistance in stabilizing the number of faculty. Sustaining morale requires strong support to maintain the number of faculty members, to respond to outside offers, and to make new appointments at a high level.

5. The Committee recommends that instead of merging the Applied and Pure Mathematics Departments, the School should encourage broad searches for faculty members that could bridge the divide between pure and applied mathematics. The real issue is getting very good mathematicians whether they call themselves pure or applied, and there is more opportunity now to choose faculty whose interests combine pure and applied subjects.

6. In order to regain its control over the service courses and alleviate the difficulties experienced by graders, graduate students and students at service courses, the Committee proposes that the School spearhead a restructuring of service courses, offered within the School, rather than on a contract basis. Instead of the inefficient system of separate mathematics tracks for different disciplines, the School can offer two or three tracks, depending on the course, organized by subject content and difficulty. Sections of the course can be further specialized if necessary. At the same time, the School could recruit high quality teachers and stabilize its offerings further if it acquired the authority to regularize the adjunct faculty positions, for instance with five-year appointments.

   The departments served by these courses would only agree to relinquish control over this aspect of the budget if they were persuaded that the courses would genuinely improve. In exchange for gaining control, the School would have to commit itself to a steady focus on maintaining the curriculum and improving the teaching and assigning good lecturers. Low cost ways to

improve teaching include videotaping and having lectures/recitation leaders visit each other's classes.

Finally, and most importantly, the committee recommends that the School keeps track of the total enrollment for its service courses, and make a strong effort to persuade the University administration to account and compensate properly for mathematics service teaching.

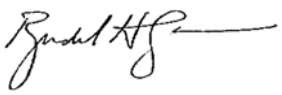
7. The University administration, for its part, should support a consolidation of mathematics service teaching and compensate the School properly for its service courses. More resources and support allocated to the School would permit it to do a better job teaching the service courses. The university as a whole would also benefit from the consolidation in that undergraduates would learn most of their mathematics from a broad point of view suitable for any scientist, engineer, or social scientist, not only the view from within their discipline. Indeed, mathematics is often the medium by which innovations in one discipline are transferred to others. Consolidation may require help from the upper administration in order to coordinate the schedules of many departments and the use of classroom space.

8. In the process of consolidation of the service courses, restoring support for graders would greatly improve their quality, as well as the quality of first year courses for math majors. It would also restore the workload of graduate students to former levels. The current salaries on graduate students should be reconsidered, in light of the cost of living in Tel Aviv. This would improve their morale and the likelihood that they will finish their studies on time.

9. The Committee recommends that the PhD students be moved from the Barracks to offices within the School.

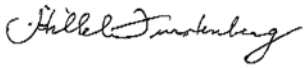
10. The School should undertake a systematic review of its undergraduate and graduate study programs.

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

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Appendix 2- Site Visit Schedule

The Committee for the Evaluation of Mathematics Study Programs - schedule of site visit

All meetings, except for Lunch on the first day will take place at room 210, Schreiber building

Monday, January 11, 2010

Time	Subject	Participants
08:45 – 09:30	Opening Session: The heads of the institution and department	Prof. Dany Leviatan, Rector Prof.Aron Shai, Vice Rector Prof. David Horn, Head of Quality Assessment Prof. Haim J. Wolfson, Dean Prof. Moshe Jarden, Head of School
09:30 – 10:30	Meeting with the academic head of the department	Prof. Moshe Jarden
10:30 – 11:30	Meeting with senior faculty and representatives of relevant committees (teaching/curriculum committee, admissions committee, appointment committee)*	Prof. Jon Aaronson Prof. Josef Bernstein Prof. Michael Biali Prof. Gadi Fibich Prof. David Ginzburg Prof. Dan Haran Prof. Boaz Klartag Prof. David Levin Prof. Steven Schochet Dr. Yoel Shkolnisky Prof. Eli Turkel
11:30 – 12:15	Meeting with administrative staff	Ms. Dorit Barak Ms. Lily Brunstein Ms. Miriam Hercberg Ms. Anat Koren-Dror Ms. Irina Olbinky
12:15-13:15	Lunch at cafeteria, Exact Sciences building	Senior faculty
13:15-13:45	Tour of campus (classes, library, offices of faculty members, computer labs etc.)	
13:45-14:30	Closed-door working meeting of the committee	

Tuesday, January 12, 2010

Time	Subject	Participants
09:30-10:15	Meeting with adjuncts*	Dr.Sergey Kostyukovsky Prof. Boris Kunyavski,
10:15-11:15	Meeting with undergraduate students *	Ms. Inna Entova-Eizenbud Mr. Gil Gitik Mr. Jonathan Hermon Ms. Tal Lahav Mr. Tomer Margalit Mr. Yoav Shany Mr. Nadav Sherman Ms. Natali Tamam
11:15-12:15	Meeting with graduate students and junior academic staff*	Mr. Oren Elisha Mr. Ilia Gorelik Mr. Simmcha Habber Mr. Zemer Kosloff Mr. Alon Nishry Ms. Edva Roditty Mr. Egor Shelukhin Ms. Tamar Ziv
12:15 – 13:15	Lunch and Closed-door working meeting of the committee	Light lunch at the meeting room (Schreiber building, 210)
13:15 – 14:00	Summation meeting with head of the department	Prof. Moshe Jarden
14:00 – 14:45	Summation meeting with heads of the institution and of the department	Prof. Dany Leviatan Rector Prof.Aron Shai Vice Rector Prof. David Horn, Head of Quality Assessment Prof. Haim J. Wolfson, Dean Prof. Moshe Jarden, Head of School

* The heads of the institution and academic unit will not attend these meetings.