

INSTITUTE FOR MATHEMATICAL BEHAVIORAL SCIENCES
SELF STUDY
2009

SECTION 1: ANALYSIS OF PAST REVIEWS (copies available upon request)

1. Briefly characterize the last review of the program, if applicable, conducted by the Academic Senate in 2002-03.

The MBS Program was not reviewed separately as part of the 2002-03 academic senate review.

SECTION 2: ANALYSIS OF CURRENT PROGRAM

1. **Overview of the interdisciplinary program** (*as related to the Social Sciences degrees*)
 - a. Provide a brief history of the program and a description of its organization (e.g., disciplinary specialties, etc.). Include a description of any formal interactions with the departments and schools on campus.

The program began in 1998 to preserve the School's strength and international recognition of mathematical interdisciplinary behavioral science. The idea was that there were types of students whose research interests did not fit into any disciplinary program and that a special program was needed to provide for the recruitment and training of such students. This program was a continuation of the kind of internationally recognized interdisciplinary research taking place within the school of social sciences before departmentalization. In recent years, since Saari became director of the Institute for Mathematical Behavioral Sciences¹ (the formal entity that defines the faculty who

¹ *The Institute for Mathematical Behavioral Sciences (IMBS) in the School of Social Sciences is a specialized research center where the objective is to facilitate interaction and common research goals among scientists whose purpose is to formulate precisely and test theories of human behavior; this is to be interpreted in a wide sense as manifested by the membership which spans the following areas: anthropology, cognitive science, economics, engineering, logic and the philosophy of science, mathematics, political science, and sociology. Additional faculty come from management science and psychobiology.*

A goal of the IMBS is to generate a similar relationship between mathematics and the behavioral and social sciences. With high-power social scientists (several are members of the National Academy) providing insights about the field and working with the mathematicians who are involved, new mathematical approaches to analyze these issues are being developed and new kinds of mathematical questions are being raised.

contribute to the MBS graduate program), the students admitted to the program almost always have B.A. degrees outside of the social sciences and many have masters degrees from areas such as mathematics, engineering, computer science, etc.

Formal interactions:

A number of cross-listed courses with an emphasis in mathematical behavioral sciences is organized by the Institute.

Fellowships for students participating in the Institute's program are provided to select students from other departments within the School and occasionally outside the School, e.g., mathematics and management sciences. Recipients of such fellowships must be working with a faculty member who is part of the mathematical behavioral sciences graduate program.

The program provides a masters degree in mathematical behavioral sciences for graduate students within the School of Social Sciences who are not part of the mathematical behavioral sciences Ph.D. program. In the last 5 years, 15 Masters Degrees have been given out.

- b. Provide in **Table 1** a list of all full-time faculty who are affiliated with the program organized alphabetically by rank (include graduate degree institution and a brief set of research interests).
- c. Are there any part-time and/or visiting faculty affiliated with the program for instruction or research? Are there individuals in the research specialist and professional researcher series deployed in the program?

The Institute has a Project Scientist, Kimberly Jameson, who works with various faculty in the evolutionary modeling of categorization. The funding for this position is provided through extramural grants. Regular visiting faculty include Professor Simon Levin, Ecology and Evolutionary Biology at Princeton who comes each year to engage with graduate students and participate in program seminars and conferences put on by the Institute for Mathematical Behavioral Sciences. Other visiting faculty may include Janos Aczel, Professor Emeritus of Pure Mathematics, Waterloo, and A.A.J. Marley, Professor Emeritus of Psychology, McGill University. Both are available to graduate students and Aczel has given graduate courses for the program.

- d. Describe the program's governance, in particular the procedures for and effectiveness of faculty involvement in curricular development, instructional resource allocation, and service activities to the departments, School and campus

The Executive Committee of the Institute for Mathematical Behavioral Sciences formulates policy for the MBS graduate program and the graduate director of the

program implements the policies and acts as an interface with the School of Social Sciences Dean of graduate studies.

- e. What are the strengths of the program's research program, and how does the overall research program compare with top national research programs in the discipline/field?

We provide a much needed interdisciplinary emphasis in the social sciences. We are recognized as one of the strongest, if not the strongest program for producing interdisciplinary mathematical behavioral research at the Ph.D. level. This program is very efficiently administrated using only resources from other units, e.g., the Office of Graduate Studies, and the Institute for Mathematical Behavioral Sciences. The Graduate Director contributes his time without compensation.

- f. Describe the working relationship between the program and the home departments of the affiliated faculty.

There is no home department for this program. The intellectual relationship is with the Institute for Mathematical Behavioral Sciences, and the administrative relationship is with the Office of Graduate Studies. There is a very close working relationship between the graduate program and the Institute in terms of extra support for students (both M.A. from outside the Ph.D. program and students within the MBS Ph.D. program). The Institute provides a colloquium series that is part of the MBS Graduate Program and has several international conferences each year, of which many students connected with our graduate program attend.

- g. Comment on the adequacy of the program's operating budget, staff support, and space/facilities/equipment. Provide narrative explanation and a brief table of general budget categories and expenditures (no more than a single page) in **Table 2**.

The program receives small amounts of funds for supporting graduate student research. This has proven satisfactory given its size. The program uses existing space and equipment within the School and has no space or equipment assigned to it. This is adequate for the purposes of this program, where faculty in the program have adequate space and equipment for the training of our graduate students.

2. Evaluation of Graduate Program

- a. Admissions
 - i) Provide in **Table 3** an alphabetical list of all current graduate students in the program, showing each student's undergraduate institution, initial quarter of graduate enrollment at UCI, degree sought, and faculty research advisor. If no advisor has been selected or assigned, leave this column blank.

- ii) Describe the program's success in enrolling high quality students in its graduate programs. Describe efforts the program makes to recruit outstanding graduate students (including any efforts supported by the Graduate Division).

Each year the program sends a mass e-mail to all graduate counselors and department chairs of all universities and colleges in the U.S. This e-mail describes the uniqueness of our program and asks that it be forwarded to mathematically-oriented students with eclectic interests. Many students get to know us from searching the web and arriving at our web page.

Our emphasis on accepting only a small number of students who have strong backgrounds and more experience appears to be recognized within the graduate student community because, on a regular basis, we receive messages of interest from students who have earned a masters degree in some topic. As an example, a graduate student in the UCLA math program joined us, and, within three years, he received a position in psychology at the University of Illinois. 2 students joining us with a master's degree now are in Carnegie Mellon (one as a faculty member and one as a postdoc). Also, excellent students in math and econ de facto do their research in the IMBS. First positions for such students includes Carnegie Mellon, University of London, USC, University of Illinois, American University, University of Memphis, U.S. Government, etc.

- iii) Evaluate the program's success in recruiting and retaining graduate students from underrepresented groups. Describe and comment on steps that the program has taken to promote diversity.

The pool of Ph.D. applicants who are from underrepresented groups and who are mathematically sophisticated and interested in the social sciences is very small. Nevertheless, we have one minority and one woman student (in highly mathematical areas, women are underrepresented). We have made offers to members of underrepresented groups but have lost them to other institutions which were higher ranked than Irvine and offered them superior support. To recruit these highly sought after students at a more successful level, we would need more opportunities for providing matching offers of support. This university is apparently not in a position to do so.

b. Training

- i) Provide an overview of the program's graduate program and curriculum. Include a sample course plan.

Because our program is interdisciplinary, each student chooses courses that are specific to his or her field of research so there is no particular "sample course plan". Students work with advisors who are specific to their research interest and the advisors help in selecting a course plan for that student.

- ii) Comment on the program's success in providing adequate financial support for its graduate students including in-state, out-of-state, and international students. Provide data in **Table 4** on the percentage of current students receiving support relative to all the students in the program and data on the percentage of students supported by university grants/fellowships, federal grants/fellowships, other extramural grants/fellowships, teaching assistantships, etc.

So far all of our Ph.D. students since Saari became Director, have received guaranteed full TA support for five years if they are making normal progress. The exception to this occurred this year where one student was admitted with a fellowship from the Air Force. This student has full support from the Air Force and does not need additional support from the university. In addition, since Saari became director, all of the MBS students have received summer support for research projects from the Institute for Mathematical Behavioral Sciences (In addition, many students from other departments within the School and from Mathematics and the Paul Merage School of Business have received summer support from IMBS.).

- iii) Referring to the results of the graduate student survey (*forthcoming from APRB*), how would you characterize student satisfaction with the program? What do students perceive to be the key strengths and weaknesses of the program?

Feedback we received from our students has been overwhelmingly positive about the instruction and the ability to engage in interdisciplinary research. The key weakness of the program from the students' point of view is the lack of mathematical behavioral sciences courses. (Most of the courses they take originate in a department). There are interdisciplinary seminars organized by the Institute that are popular with the students, but the courses that concentrate on disciplinary content are given through departments. Some students have expressed preference for a Ph.D. degree directly in mathematical behavioral sciences, rather than our current degree, which is a social sciences degree, with a concentration in mathematical behavioral sciences.

- iv) Comment on the program's efforts at professional socialization for graduate students. Does the program offer professional issues seminars? What does the program do to train teaching assistants? Does the program provide opportunities for graduate students to present and discuss their research (e.g., brown bags)? Does the program provide guidance and assistance to students applying for fellowships and grants? Does the program take any measures to improve/monitor faculty mentoring quality?

An important feature of our program is that it presents courses and seminars not only for our students to present research and get feedback, but also for other mathematically-oriented students in social sciences and outside of social

sciences (e.g., Merage School of Business, Mathematics, etc.) Our objective is to train all students interested in the mathematical behavioral and social sciences; not just those who are formally enrolled in our Ph.D. program. These courses create an environment where students from different disciplines exchange ideas and methodologies based on a common understanding of mathematics.

We have a course, Methods and Models, which among other things, discusses professional issues and prepares students for making strong presentations for job talks, conferences, Ph.D. orals, etc.

We encourage students to apply for fellowships and grants by providing information of the availability of such fellowships and grants, and by providing feedback to their proposals before they are submitted.

All of our faculty belong to Departments within the School. We do not take any measures beyond what is taken in Departments with regard to “faculty monitoring quality”. However, the Director of IMBS, Donald Saari, and the Graduate Director of the MBS graduate program, Louis Narens, separately monitor the quality of training being provided by a student’s principal advisor to make sure that all of our students are receiving proper training.

c. Placement

- i) Provide a list of all graduate students who participated in the program and graduated from UCI since the last review, including the time they participated in the program, date degree was awarded, department, the dissertation committee chair, the title of the dissertation, and the student’s current employment (**Table 5**).
- ii) Comment on the program’s success in placing its graduates in appropriate professional settings.

Several students have received tenure track positions in academic institutions and also as researchers. Others have chosen positions outside academia in business, such as banking, software companies, pharmaceuticals, etc.

SECTION 3: STRATEGIC PLAN FOR THE FUTURE

1. Provide an overall evaluation of the current strengths and weaknesses of the program and suggest a strategic plan for how the research and teaching programs can be improved without additional resources.

Our program is purposely designed to be a small program. It is currently smaller than desired due primarily to limitations at the School level of the number of TA positions that will be supported. For our current plan, our ideal size would be about double what it is currently. Our plan is to keep this program small until we can get

extramural funding to expand it. Our contacts at funding agencies tell us that it is preferable to have funding for developing or extending a new program rather than for an ongoing full-fledged program. A program like ours, that is relatively new with a proven track record of success along with the success of its associated research unit, (IMBS), and that needs additional resources to reach its full potential is at an ideal point for receiving support from agencies like NSF. Currently, NSF does not have a funding program for this but they anticipate having one sometime in the future.

2. If the program were given additional resources, suggest a strategic plan for how these resources would be used to improve the research and teaching programs.

The program can benefit from having an interdisciplinary laboratory for doing game-theoretic and social-economic experimentation. In addition to space and initial equipment, one would need a programmer/manager for the laboratory. This laboratory could be used for the teaching of experimental economic courses, as well as for courses in other non-psychological areas of the social sciences.

Several mathematical, interdisciplinary positions in the School of Social Sciences arose out of recruitment through the IMBS and placement of the individual within a department. The Institute would be enormously benefited by being able to make appointments within the Institute without the individual being affiliated with a specific department (but, of course, providing courses that are beneficial to a department in the School).

3. Provide a copy of the program's most recent Strategic Plan, if any, that was submitted to the Executive Vice Chancellor and Provost.

A specific Strategic Plan is not available, however, in 2008 the IMBS underwent a Sunset Review, and specific aspects of the graduate program were presented. A copy is available in the IMBS office.

4. What are the emerging trends in the field nationally in terms of research and teaching specialties? How do your strategic plans for future faculty engagement in the program and curriculum revisions fit with those emerging trends?

More important than the emerging trends, the goal of the IMBS is to establish such trends. As an example, two of our members, psychologist Kimberley Jameson and mathematician Natalia Komarova, joined forces to create an approach of using evolutionary game theory to understand psychological categorization, obtaining beautiful results. Already some of our graduate students are exploring the use of evolutionary game theory in investigating long-standing issues in philosophy and social science, e.g., the social evolution of morality, language and altruistic behavior, etc. Two of our members, one a mathematician and the other a psychologist, are exploring to use "decision theory" and some algebraic topology to answer some of

the many mysteries in psychology.. What we encourage is cutting edge, interdisciplinary research, that will quickly migrate to our graduate students.