Expected Outcomes: Broad mathematical knowledge and understanding

Graduates should know and understand the foundations of a broad range of advanced mathematical subjects and be able to read and comprehend textbook literature on these subjects.

Assessment methods

Method: Performance on preliminary doctoral exams

Students will demonstrate their mathematical knowledge and their mathematical reasoning, problem-solving, and writing skills in three written exams ('prelims'), administered by departmental committees and coordinated by the GPO.

Findings:

During the review period, 9 prelims were administered in 9 different subject areas. The total number of exams graded was 50; of those, 42 (84%) were judged 'passing', 8 (16%) were judged 'failing'.

How did you use findings for improvement?

In rare cases of rates exceeding 25%, faculty members in the subject area were asked to identify reasons for theses high failure rates in order to prepare students better for the exams. Under-performing students were closely monitored in order to improve performance.

Additional comments:

The prelim system appears to be working well in identifying students with weak backgrounds and/or lack of motivation.

Method: Evaluation by prelim committees

Members of the prelim committees will be asked to rate the students' depth of knowledge, reasoning skills, and writing skills. Instructors of prelim courses will be asked to rate their students' oral communication skills and mathematical literacy.

Findings:

A total of 78 ratings were filed in the category 'knowledge and understanding'; 80% of the ratings indicated at least satisfactory performance (41% excellent, 39% good, 0% satisfactory). Instructors of prelim courses filed 48 ratings in the category 'textbook literacy'; 79% of the ratings indicated at least satisfactory performance (56% excellent, 19% good, 4% satisfactory).

How did you use findings for improvement?

Informed faculty about the importance of the assessment to reduce the number of NR (not rated) evaluations in order to obtain more meaningful statistical data.

Additional comments:

Faculty members need to be educated about the purpose of this process, in order to further improve ratings return rates.
### Expected Outcomes: Mathematical expertise and scholarship

Graduates should have expert knowledge in at least one area of mathematics and be able to conduct independent research in this area. This requires awareness of the relevant research-level literature and the ability to comprehend and critically analyze such literature.

**Assessment methods**

**Method**: Evaluation by advisory committees

Each student's mathematical expertise and scholarship, mathematical reasoning, problem-solving, and communication skills, and level of career preparedness will be individually assessed by the members of the student's advisory committee.

**Findings**:

A total of 36 individual evaluations were filed. The student's level of expert knowledge and technical skill was rated excellent in 27 (75%), good in 8 (22%), and satisfactory in 1 (3%) of cases. Ability to conduct independent research was rated excellent in 25 (70%), good in 10 (27%) and satisfactory in 1 (3%) of cases. Awareness and comprehension of the relevant literature was rated excellent in 24 (67%), good in 12 (33%) cases.

**How did you use findings for improvement?**

More detailed and more meaningful data were obtained. Advisors will be encouraged to ensure that students are more aware of relevant literature.

**Additional comments**:

Faculty members need to be educated about the purpose of this process, in order to improve ratings return rates.

**Method**: Graduate student seminar presentations

Students close to graduation will be encouraged to present their research in the graduate student seminar; the presentations will be evaluated by the GPO.

**Findings**:

During the review period, nine students gave presentations in the graduate student seminar; in terms of expertise and scholarship, all met or exceeded GPO expectations.

**How did you use findings for improvement?**

This program appears to be beneficial to both, presenters (students close to graduation) and audience (typically first-year students), and should be expanded in the future.

**Additional comments**:

Student feedback was very positive.

### Expected Outcomes: Mathematical reasoning and problem-solving skills

Graduates should be able to apply advanced mathematical techniques and rigorous logical reasoning to derive and prove theorems, design and implement algorithms, or construct and analyze mathematical models.

**Assessment methods**

**Method**: Performance on preliminary doctoral exams
Students will demonstrate their mathematical knowledge and their mathematical reasoning, problem-solving, and writing skills in three written exams (‘prelims’), administered by departmental committees and coordinated by the GPO.

Findings:
During the review period, 9 prelims were administered in 9 different subject areas. The total number of exams graded was 50; of those, of those, 42 (84%) were judged ‘passing’, 8 (16%) were judged ‘failing’.

How did you use findings for improvement?
In rare cases of rates exceeding 25%, faculty members in the subject area were asked to identify reasons for these high failure rates in order to prepare students better for the exams. Under-performing students were closely monitored in order to improve performance.

Additional comments:
The prelim system appears to be working well in identifying students with weak backgrounds or lack of motivation.

Method: Evaluation by prelim committees
Members of the prelim committees will be asked to rate the students’ depth of knowledge, reasoning skills, and writing skills. Instructors of prelim courses will be asked to rate their students’ oral communication skills and mathematical literacy.

Findings:
A total of 78 ratings were filed in the category ‘reasoning and problem-solving skills’; 81% of the ratings indicated at least satisfactory performance (44% excellent, 31% good, 6% satisfactory).

How did you use findings for improvement?
More meaningful statistical data provided evidence for faculty to improve reasoning and problem-solving skills.

Additional comments:
Faculty members need to be educated about the purpose of this process, in order to further improve ratings return rates.

Method: Evaluation by advisory committees
Each student’s mathematical expertise and scholarship, mathematical reasoning, problem-solving, and communication skills, and level of career preparedness will be individually assessed by the members of the student’s advisory committee.

Findings:
A total of 36 individual evaluations were filed. The student’s reasoning and problem-solving skills were rated excellent in 27 (75%), good in 8 (22%) cases, and satisfactory in 1 (3%) case.

How did you use findings for improvement?
More detailed and more meaningful data were obtained. Advisors will be encouraged to maintain students’ skills.

Additional comments:
Expected Outcomes: Mathematical communication skills

Graduates should be able to communicate advanced mathematical concepts and technical material, both orally and in writing.

Assessment methods

Method: Evaluation by prelim committees

Members of the prelim committees will be asked to rate the students’ depth of knowledge, reasoning skills, and writing skills. Instructors of prelim courses will be asked to rate their students’ oral communication skills and mathematical literacy.

Findings:

A total of 78 ratings were filed in the category ‘writing skills’; 84% of the ratings indicated at least satisfactory performance (45% excellent, 30% good, 9% satisfactory). Instructors of prelim courses filed 48 ratings in the category ‘oral communication skills’; 75% of the ratings indicated at least satisfactory performance (44% excellent, 21% good, 10% satisfactory).

How did you use findings for improvement?

Informed faculty about the importance of the assessment to reduce the number of NR (not rated) evaluations in order to obtain more meaningful statistical data.

Additional comments:

Faculty need to be educated about the purpose of this process, in order to further improve ratings return rates.

Method: Evaluation by advisory committees

Each student’s mathematical expertise and scholarship, mathematical reasoning, problem-solving, and communication skills, and level of career preparedness will be individually assessed by the members of the student’s advisory committee.

Findings:

A total of 36 individual evaluations were filed. The student’s writing skills were rated excellent in 27 (75%), good in 9 (25%) cases. Independently, oral communication skills were rated excellent in 30 (83%), good in 6 (17%) cases.

How did you use findings for improvement?

More detailed and more meaningful data were obtained. Advisors will be encouraged to maintain high levels of communication skills.

Additional comments:

Faculty need to be educated about the purpose of this process, in order to improve ratings return rates.

Method: Graduate student seminar presentations

Students close to graduation will be encouraged to present their research in the graduate student seminar; the presentations will be evaluated by the GPO.
Findings:
During the review period, nine students gave presentations in the graduate student seminar; in several cases, the GPO identified issues with delivery and level of the presentation.

How did you use findings for improvement?
The GPO meets with the students after the talks to discuss possible improvements in the delivery and the proper level of these presentations (which are addressed to first-year graduate students).

Additional comments:
Student feedback was very positive.

**Expected Outcomes: Career preparedness**

Graduates should be able to apply their expertise in professional careers that require the teaching of mathematics, the pursuit of mathematical or mathematics-based research, or problem solving by means of mathematical techniques and analytical thinking.

**Assessment methods**

**Method:** Evaluation by advisory committees
Each student's mathematical expertise and scholarship, mathematical reasoning, problem-solving, and communication skills, and level of career preparedness will be individually assessed by the members of the student's advisory committee.

Findings:
A total of 36 individual evaluations were filed. The student's level of career preparedness was rated excellent in 26 (72%), good in 10 (28%) cases.

How did you use findings for improvement?
More detailed and more meaningful data were obtained. Advisors will be encouraged to emphasize career readiness.

Additional comments:
Faculty members need to be educated about the purpose of this process, in order to improve ratings return rates.

**Method:** Program evaluation by graduating students
Graduating students will be encouraged to complete exit surveys to assess their experience in the doctoral program and their level of career preparedness.

Findings:
All four graduating students who completed the exit survey rated the program 4 or 5 on a 5-point scale, both in terms of overall quality and career preparation.

How did you use findings for improvement?
A revised version of the exit survey is under development, with the goal of collecting more meaningful data with less effort.

Additional comments:
Return rates need to be improved!