College of Sciences & Mathematics

Mathematics & Statistics

Mathematics, MS

**Expected Outcome 1: Career Preparedness**
Graduates should have the mathematical knowledge and problem-solving skills appropriate for a range of professional careers or further graduate studies.

**Assessment Method 1:** Evaluation by Advisory Committees (Direct Evidence)

**Assessment Method Description**

The student’s advisory committee determined during the final exam and during the writing of the Master’s Thesis whether the student’s mathematical knowledge and problem-solving skills are appropriate for a range of professional careers or further graduate studies. The members of the committee summarized their evaluation by judging the student’s performance as one of the following:

**Excellent:** The student’s is ready for a professional career or further graduate studies.

**Good:** The student is ready for a professional career, but needs some additional training for further graduate studies.

**Satisfactory:** The student is ready for a professional career, but not for further graduate studies.

**Unsatisfactory:** The student is not ready for a professional career.

**Findings**
**Findings for Mathematical Knowledge**

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8 (73%)</td>
<td>2 (18%)</td>
<td>1 (11%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Findings for Problem Solving Skills

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent (73%)</th>
<th>Good (18%)</th>
<th>Satisfactory (11%)</th>
<th>Unsatisfactory (0%)</th>
<th>Not Rated (6%)</th>
</tr>
</thead>
</table>

How did you use findings for improvement?

While the revised evaluation forms allowed us to obtain more direct evidence than before, it has become apparent that more fine grain evidence has to be collected to evaluate students’ career readiness. The GPO contacted the Graduate Studies Committee to develop an evaluation form to be used by the faculty during the exam to gain further direct evidence. The reasons for the high number of “satisfactory” ratings for the career readiness in the 2012-13 cycle was investigated by the GSC, and significantly reduced by requiring that students need to take a larger variety of courses to obtain knowledge and problem solving skills necessary for a research career in Mathematics. Advisors are encouraged to emphasize this when students prepare their plan of study.

Additional Comments

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

Assessment Method 2: Program Evaluation by Graduating Students

Assessment Method Description

Graduating students are encouraged to complete exit surveys to assess their experience in the master's program and, in particular, their level of career preparedness and their ability to conduct independent research.

- (5): The students rate their level of appropriate expertise very high.
- (4): The students rate their level of appropriate expertise high.
- (3): The students rate their level of appropriate expertise adequate high
- (2): The students rate their level of appropriate expertise sufficient.
- (1): The students rate their level of appropriate expertise insufficient.
Findings

<table>
<thead>
<tr>
<th>Expertise</th>
<th>5 (50%)</th>
<th>4 (50%)</th>
<th>3 (0%)</th>
<th>2 (0%)</th>
<th>1 (0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Knowledge Needed for Career</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Ability to Work Independently in Career</td>
<td>0 (0%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?

The revised version of the exit survey and the efforts of the GPO resulted in fine grain evidence being available. This evidence was reviewed by the Graduate Studies Committee in order to identify ways to raise levels of expertise to at least good. It was determined that students need to take a larger variety of courses to obtain knowledge and problem solving skills necessary for a research career in Mathematics. Advisors are encouraged to emphasize this when students prepare their plan of study.

Additional Comments

Return rates need to be improved.

Expected Outcome 2: Mathematical Communication Skills

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

Assessment Method 1: Evaluation by Advisory Committees (Direct Evidence)

Assessment Method Description

Each student in this program has to complete a thesis and defend this thesis in an oral exam. These two tasks allows the advisory committee during the defense and during the preparation of the Master’s Thesis to assess the student’s oral and writing communication skills in detail based on the generally accepted standards for publications in the field. The members of the committee summarized their evaluation by judging the student’s performance as one of the following:
Excellent: The student’s communication skills allow him/her to present research at mathematical conferences and publish his/findings in professional.

Good: The student is able to communicate his/her research, but some additional work is required to present orally or in writing in a professional setting.

Satisfactory: Although the student is able to communicate his/her research, significant additional work is required before the student will be able to present orally or in writing in a professional setting.

Unsatisfactory: The student is unable to communicate mathematical concepts orally or in writing.

Findings

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Un satisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing: 11</td>
<td>7 (64%)</td>
<td>2 (18%)</td>
<td>1 (9%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Oral: 11</td>
<td>7 (64%)</td>
<td>3 (27%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?

While the revised evaluation forms allowed us to obtain more direct evidence than before, it has become apparent that more fine grain evidence has to be collected to evaluate students’ communication skills. The GPO contacted the Graduate Studies Committee to develop an evaluation form to be used by the faculty during the exam to gain further direct evidence. The improved collaboration of the advisory committee and the student has ensured that all students’ writing communication skills are at least good. The reasons for the high number of “satisfactory” ratings for the career readiness in the 2012-13 cycle was investigated by the GSC, and significantly reduced by requiring that students need to take a larger variety of courses to obtain knowledge and problem solving skills necessary for a research career in Mathematics. Advisors were encouraged to ask students to give more presentations in seminars.

Additional Comments

Faculty need to be educated about the purpose of this process, in order to improve ratings return rates.
Assessment Method 2: Program Evaluation by Graduating Students (Indirect Evidence)

Assessment Method Description

Graduating students were encouraged to complete exit surveys after their final exam to assess their experience in the master's program and, in particular, their level of communication skills.

(5): The students rate their level of appropriate expertise very high.
(4): The students rate their level of appropriate expertise high.
(3): The students rate their level of appropriate expertise adequate high
(2): The students rate their level of appropriate expertise sufficient.
(1): The students rate their level of appropriate expertise insufficient.

Findings

<table>
<thead>
<tr>
<th>Expertise</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Skills</td>
<td>0 (0%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?

The revised version of the exit survey and the efforts of the GPO resulted in fine grain evidence being available. This evidence was reviewed by the Graduate Studies Committee, and major professors were encouraged to pay more attention to the student’s writing skills during the preparation of the thesis. Apparently, many faculty members assumed that students gained these skills during their undergraduate education. The sample size was too small to draw conclusion whether the new approach has worked.

Additional Comments

Return rates need to be improved!
**Expected Outcome 3: Mathematical Knowledge and Understanding**

Graduates will have an adequate understanding of advanced mathematical subjects relevant to their area of specialization and will be able to comprehend related technical content.

**Assessment Method 1:** Evaluation by Advisory Committees (Direct Evidence)

**Assessment Method Description**

A graduate degree in Mathematics offers a student a large amount of flexibility in choosing classes. Since there are no required classes, any assessment method concerned with direct evidence has to concentrate on the only common elements, namely the Master’s thesis and the final oral exam. The student’s mathematical knowledge and understanding was individually assessed by the members of the student's advisory committee during the preparation of the Master’s thesis and the final oral exam. The members of the committee then summarized their evaluation by judging the student’s performance as one of the following:

- **Excellent:** The student shows complete mastery of his/her chosen subject area.
- **Good:** The student shows a general mastery of his/her chosen subject area but some additional studies of the more difficult topics are necessary.
- **Satisfactory:** The student shows mastery of his/her chosen subject area adequate for completing his/her degree, but significant additional studies are necessary.
- **Unsatisfactory:** The student has failed to gain enough knowledge in the chosen area of specialization to complete a thesis.

**Findings**

**Findings for Knowledge**

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8 (73%)</td>
<td>2 (18%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
<td>1 (6%)</td>
</tr>
</tbody>
</table>

**Findings for Understanding**

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8 (73%)</td>
<td>2 (18%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
<td>1 (6%)</td>
</tr>
</tbody>
</table>
How did you use findings for improvement?
While the revised evaluation forms allowed us to obtain more direct evidence than before, it has become apparent that more fine grain evidence has to be collected to evaluate students’ content knowledge. The GPO contacted the Graduate Studies Committee to develop an evaluation form to be used by the faculty during the exam. The improved collaboration of the advisory committee and the student has ensured that all students’ knowledge and understanding is at least good.

Additional Comments
Faculty needs to be encouraged to participate more actively in this process, in order to improve ratings return rates further

Assessment Method 2: Program Evaluation by Graduating Students
(Indirect Evidence)

Assessment Method Description
Graduating students are encouraged to complete exit surveys to assess their experience in the master’s program and, in particular, their level of mathematical knowledge on a scale from 1 (lowest) to 5 (highest).

(5): The students rate their level of appropriate expertise very high.
(4): The students rate their level of appropriate expertise high.
(3): The students rate their level of appropriate expertise adequate high
(2): The students rate their level of appropriate expertise sufficient.
(1): The students rate their level of appropriate expertise insufficient.

Findings

<table>
<thead>
<tr>
<th>Expertise</th>
<th>5 (0%)</th>
<th>4 (100%)</th>
<th>3 (0%)</th>
<th>2 (0%)</th>
<th>1 (0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breadth of Knowledge</td>
<td>0 (0%)</td>
<td>2 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Depth of Knowledge</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?
The revised version of the exit survey and the efforts of the GPO resulted in fine grain evidence being available. This evidence was reviewed by the Graduate Studies Committee in order to identify ways to raise levels of expertise to at least good, and major professors were encouraged to pay more attention to the student’s breadth and depth of knowledge during the preparation of the plan of studies.
**Additional Comments**

Return rates need to be improved!

**Expected Outcome 3: Mathematical Reasoning and Problem-Solving Skills**

With proper guidance, graduates should be able to apply advanced mathematical techniques and rigorous logical reasoning to prove theorems, implement algorithms, or analyze mathematical models.

**Assessment Method 1: Evaluation by Advisory Committees (Direct Evidence)**

**Assessment Method Description**

Although a graduate degree in Mathematics offers a student a large amount of flexibility in choosing classes, there is a general agreement in Mathematics what constitutes a valid proof of a mathematical theorem, on how to implement algorithms or how to analyze a mathematical model. The student’s ability to perform these tasks was individually assessed by the members of the student's advisory committee during the preparation of the Master’s thesis and the final oral exam. The members of the committee then summarized their evaluation by judging the student’s performance as one of the following:

**Excellent:** The student shows complete mastery of these tasks.

**Good:** The student shows a general mastery of these tasks but needs some guidance when dealing with more difficult situations.

**Satisfactory:** The student shows mastery of these tasks with guidance.

**Unsatisfactory:** The student has failed to gain sufficient mastery of these tasks in order to complete a thesis.

**Findings**

**Findings for Implementation of Algorithms**

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8 (73%)</td>
<td>2 (18%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Findings for Analyzing Models

<table>
<thead>
<tr>
<th>No Evaluations</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Not Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>8 (73%)</td>
<td>2 (18%)</td>
<td>1 (9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?
While the revised evaluation forms allowed us to obtain more direct evidence than before, it has become apparent that more fine grain evidence has to be collected to evaluate students’ reasoning skills. The GPO contacted the Graduate Studies Committee to develop an evaluation form to be used by the faculty during the exam to gain further direct evidence. The improved collaboration of the advisory committee and the student has ensured that all students’ mathematical reasoning and problem solving skills are at least good.

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

Assessment Method 2: Program Evaluation by Graduating Students (Indirect Evidence)

Assessment Method Description
Graduating students were encouraged to complete exit surveys after their final exam to assess their experience in the master's program and, in particular, their level of problem-solving skills.

- (5): The students rate their level of appropriate expertise very high.
- (4): The students rate their level of appropriate expertise high.
- (3): The students rate their level of appropriate expertise adequate high
- (2): The students rate their level of appropriate expertise sufficient.
- (1): The students rate their level of appropriate expertise insufficient.

Findings

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>NR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Experience</td>
<td>2 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Expertise</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Problem. Solving</td>
<td>0 (0%)</td>
<td>2 (100%)</td>
<td>2 (40%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How did you use findings for improvement?

The revised version of the exit survey and the efforts of the GPO resulted in fine grain evidence being available. This evidence was reviewed by the Graduate Studies Committee in order to identify ways to raise levels of expertise to at least good. Major professors were encouraged to pay more attention to the problem solving skills during the preparation of the thesis.

Additional Comments

Return rates need to be improved!

Assessment Method 3: University Level Program Evaluation by Graduating Students (Indirect Evidence)

Assessment Method Description

Graduating students were asked by the University whether or not they would recommend Auburn to someone considering this program.

Findings

<table>
<thead>
<tr>
<th></th>
<th>Definitely Yes</th>
<th>Probably Yes</th>
<th>Maybe</th>
<th>Probably Not</th>
<th>Definitely Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>6 (75%)</td>
<td>1 (12.5%)</td>
<td>1 (12.5%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

How did you use the findings for improvement?

This is the first year this evidence was reviewed by the Graduate Studies Committee. The committee reviews all responses to detect possible reasons for dissatisfaction.

Additional Comments

None
**Expected Outcome 4: Preparation for Teaching**

With proper guidance, graduate students should be able to teach all freshman and some sophomore level courses.

**Assessment Method 1:** All students teaching a course are visited twice a semester by a faculty member to evaluate their teaching.

**Assessment Method Description**
The faculty member evaluates the eleven items listed in the results table using a scale from 1 (Poor) to 5 Excellent.

**Findings**

<table>
<thead>
<tr>
<th>Observation</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge of subject.</td>
<td>4.8</td>
</tr>
<tr>
<td>2. Instructor seems interested in topic.</td>
<td>4.6</td>
</tr>
<tr>
<td>3. Clarity of presentation.</td>
<td>4.5</td>
</tr>
<tr>
<td>4. Organization of the day's class.</td>
<td>4.4</td>
</tr>
<tr>
<td>5. Quality of board/technology work.</td>
<td>4.5</td>
</tr>
<tr>
<td>6. Appropriate amount of material covered today.</td>
<td>4.1</td>
</tr>
<tr>
<td>7. Today's work at appropriate level of rigor.</td>
<td>4.4</td>
</tr>
<tr>
<td>8. Instructor included appropriate application of the material.</td>
<td>3.5</td>
</tr>
<tr>
<td>9. Students seem interested &amp; attentive.</td>
<td>4.0</td>
</tr>
<tr>
<td>10. Rapport between instructor and class members.</td>
<td>4.1</td>
</tr>
<tr>
<td>11. Students given a chance to ask questions and/or to participate actively in learning process.</td>
<td>4.3</td>
</tr>
</tbody>
</table>
How did you use findings for improvement?

The GSC discussed the results with the faculty member responsible for GTA training.

Additional Comments
None

Assessment Method 2: University Level Evaluation of Preparation for Teaching by Graduating Students (Indirect Evidence)

Assessment Method Description

Graduating students were asked by the University whether or not the program prepared them for teaching.

Findings

<table>
<thead>
<tr>
<th>Responses</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0 (0%)</td>
<td>1 (13%)</td>
<td>2 (26%)</td>
<td>5 (61%)</td>
</tr>
</tbody>
</table>

How did you use findings for improvement?

The GSC discussed the results with the faculty member responsible for GTA training.

Additional Comments

Not all graduate students are supported by a GTA appointment. Only those with such an appointment receive GTA training.