

# Assessing Student Oral Presentation of Mathematics

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**Abstract.** Like many colleges and universities, the overall mathematics program at Keene State College (KSC) includes programs supporting the mathematics major, teacher preparation, developmental mathematics, general education, and service courses for other departments. For our initial assessment effort, we decided to focus on our major, and on one particular aspect of that program specifically. One of the department's goals is that our majors graduate with an ability to communicate mathematics effectively. We identified a specific learning outcome tied to that goal: that students demonstrate an ability to communicate mathematics effectively by giving oral presentations. This case study will address how we planned and implemented an assessment of that learning outcome in the fall semester of 2002, to include how we intend to use the assessment results to modify our program.

## Background and Goals

KSC is a public liberal arts college, a Council of Public Liberal Arts Colleges (COPLAC) institution. We have 4,200 undergraduates, and we graduate 8 to 10 mathematics majors each year. The core of our mathematics major includes a statistics course, the first two courses of the traditional three-course calculus sequence, a transition course (Introduction to Abstract Math), and linear algebra. Students then choose an option (another eight or more courses) which focus on teacher preparation at the middle or secondary level, pure mathematics, applied mathematics, computer mathematics, and math-physics.

Our department established the following goals (based on our department mission in Figure 1) and provides the environment to enable students to accomplish those goals while a mathematics major at KSC. We expect that a KSC mathematics major will possess:

- Technical skill in completing mathematical processes;
- Breadth and depth of knowledge of mathematics;
- An understanding and appreciation of the relationship of mathematics to other disciplines;
- An ability to communicate mathematics effectively;
- A capability of understanding and interpreting written materials in mathematics;
- An ability to use technology to do mathematics.

In keeping with the mission of the college, the Mathematics Department of Keene State College provides and maintains a supportive intellectual environment that offers students mathematical experiences appropriate to their individual needs and chosen programs of study. The department provides an in-depth study of mathematics in preparation for either an immediate career, especially teaching, or graduate school; supports the mathematical needs of other academic disciplines; and maintains a program available to all students to enhance their ability to think mathematically and to reason quantitatively.

Figure 1. Department Mission

Our initial assessment effort focused on our graduates' ability to communicate mathematics effectively. A specific learning outcome tied to that goal is that our students demonstrate an ability to communicate mathematics effectively by giving oral presentations. There is consensus in the department that this is an important outcome, and as a department we chose to focus attention on that objective to begin the overall assessment of our major. Figure 2 provides an outline of the assessment process we implemented.

| Learning outcome  | Strategy to accomplish objective  | Assessment plan  | Data collection & interpretation  | Program improvement   |
|---|---|--|---|---|
| Students will demonstrate an ability to communicate mathematics effectively by<br>a. giving oral presentations; | Student oral presentations part of undergraduate experience through many courses;<br>Requirements and presentation expectations clearly communicated to the student;<br>Students follow timeline leading to successful presentation;<br>Students attend seminars to see examples of presentations by faculty and peers. | Rubric developed for faculty evaluation of seminar presentation.<br>Rubric developed for student evaluation of seminar presentation.<br>Student self-evaluation and interview conducted by instructor. | Completed rubrics compiled by course instructors.<br>Instructors identification of strengths and weaknesses recorded. | Assessment subcommittee assembles information and reports to the department with recommendations for change, as needed.<br>Department discusses implementation of recommended modifications, as needed. |

Figure 2. Assessment Framework for Oral Presentation

### Outcome

Many of our students begin making formal presentations early in our program; all of our majors make presentations later in the program. For example, students in an Introductory Statistics course make brief but formal PowerPoint presentations on group projects they have completed. One such project involved the use of descriptive statistics to compare populations of trout in local streams, based on data from the NH Fish and Game department. In those early courses, students are acquainted with the guidelines for making presentations and the rubrics instructors use to set the standards for student presentations. Our faculty use variations of the rubric in other mathematics courses that require presentations.

Students in most of our upper level mathematics courses make longer presentations of their project work, and some of those presentations are made not only before their instructor and peers, but also before department faculty as part of our weekly Friday Department Seminar. Additionally, our students have made presentations outside the department at our college-wide Academic Excellence Conference, at MAA Northeastern Section regional meetings, and at the Hudson River Undergraduate Mathematics Conference. As an example, a student in a recent history of mathematics course presented his project on fractal geometry in the course, at a department seminar, and at the college Academic Excellence Conference. By formalizing the assessment process, we have improved our students' abilities to make effective mathematical presentations through implementing a well-thought out strategy to ensure student success.

### Description: What did we do?

We identified two courses for implementation of this initial assessment effort: MATH310 History of Mathematics and MATH463 Complex Variables. Students in those courses comprised a large percentage of our majors. The department agreed that students in those courses would make presentations at the end of the semester in the Department Seminar scheduled for the last week of classes. Faculty attending the seminar would evaluate the student presentations using the rubric (Appendix A) already in use. The results would be assembled by an assessment team and briefed to the department at the beginning of the spring semester, with recommendations offered by the team for improvement of our program and in the assessment process.

At the beginning of the fall semester, students in both courses, all mathematics majors, learned of the department mission and majors program goals. They understood that oral presentation skills were to be developed and assessed over the course of the semester, with evaluation of their presentations in the Department Seminar the last week of classes.

Several steps were taken to develop student presentation skills. Students were given a brief presentation on the effective use of PowerPoint in making presentations. In order to eliminate misunderstanding of the standards, their instructor explained the rubric to be used to evaluate their presentations. Students were encouraged to attend the weekly Department Seminars to observe faculty presentations. Over the course of the semester, students in both courses made several informal and formal presentations, some of which were assessed using the rubric, to increase their experience and comfort level with public speaking.

At the end of the semester, their instructor, other faculty members, and their peers evaluated the final student presentations of course projects. The rubrics were accumulated, and many students were interviewed for their self-evaluation. The data was analyzed by the assessment committee (two faculty members) and presented to the department for discussion at a department meeting.

### Insights: What did we learn?

First, we learned that our students give good presentations. In general, they are confident speakers who enjoy talking about mathematics. They have a very good ability to generate very effective visuals.

Some general areas that students need to improve:

- Keeping presentations to the allocated time (in our case, 10–15 minutes)
- Including a good introduction to the talk
- Familiarizing the audience with notation and definitions
- Including a good conclusion to the talk.

As a result, we will continue to require students to include introductory and concluding comments in all their presentations, and we will encourage them to rehearse with a clock to ensure the time limits are met. We recommend that we continue to include oral presentations by our majors in as many of their courses as is purposeful.

Second, with regard to the assessment process, we learned that we needed a better rubric (e.g., to include the time

requirement; see Appendix B). Also, it would be better to schedule the assessment earlier in the semester so that more effective feedback can be obtained from the students and given to the students. Additionally, students would not be burdened with so many competing end-of-semester requirements. The end of the semester also made it difficult for faculty to come together to discuss the student presentations.

Third, we gained useful insight into the assessment process as a result of this initial effort. One significant lesson learned in the process included the need to have a rubric briefing for all faculty participating in the assessment prior to the actual evaluations. Faculty raters agreed qualitatively about each presentation, but interpretation of what was meant by a numerical score varied among some raters more than is desirable. It is important to get consensus by the graders about what distinguishes a score of 1 from a score of 2. Additionally, there is no need that the one rubric be the department standard for every course. For our students' sake, there should not be wide variation from course to course with regard to format and standards for presentations, but instructors should be granted the flexibility to modify the rubric appropriately, based on their own emphasis. Videos were made for some of the student presentations, and those were marginally helpful to the students involved, but did not contribute significantly to the assessment results. Most importantly, getting all of our faculty together to talk about this issue helped create a common sense of purpose toward improving an aspect of our program that we feel is very important.

## Appendix A. Initial Rubric

### Oral Presentation Checklist

Student: \_\_\_\_\_

|   | Points | Comments |
|---|--------|----------|
| <b>1. Introduction</b>                      |        |          |
| a. Introduces group members                 | /1     |          |
| b. Provides topic overview                  | /2     |          |
| c. States major result clearly              | /2     |          |
| <b>2. Presentation</b>                      |        |          |
| a. Presents correct content                 | /5     |          |
| b. Communicates with mathematical reasoning | /5     |          |
| c. Presents support for conclusions         | /5     |          |
| <b>3. Conclusion</b>                        |        |          |
| a. Reviews significant results              | /3     |          |
| <b>4. Style</b>                             |        |          |
| a. Quality of visuals                       | /2     |          |
| b. Apparent preparation (rehearsal)         | /3     |          |
| c. Clarity of communication                 | /2     |          |

General Comments:

Grade: \_\_\_ out of 30

## Appendix B. Revised Rubric

### Oral Presentation Checklist

Name(s) \_\_\_\_\_

\_\_\_\_\_

|  | Points |   |   |
|--|--------|---|---|
| <b>1. Introduction</b>                             |        |   |   |
| a. Introduce self (and teammates)                  | 0      | 1 |   |
| b. Provide topic overview                          | 0      | 1 | 2 |
| c. State major results                             | 0      | 1 | 2 |
| <b>2. Presentation</b>                             |        |   |   |
| a. Present correct assigned content                | 0      | 2 | 4 |
| b. Communicate with correct mathematical reasoning | 0      | 2 | 4 |
| c. Present adequate support for conclusions        | 0      | 1 | 2 |
| <b>3. Conclusion</b>                               |        |   |   |
| Review significant results                         | 0      | 1 | 2 |
| <b>4. Organization and Style</b>                   |        |   |   |
| a. Timing  | 0      | 2 |   |
| b. Quality of visuals                              | 0      | 1 | 2 |
| c. Clarity of communication, eye contact           | 0      | 1 | 2 |
| d. Apparent preparation                            | 0      | 1 | 2 |
| <b>Bonus:</b> Creativity, appropriate humor        | 0      | 1 | 2 |

General comments:

Presentation Grade \_\_\_\_\_