Annual Report on Assessment
in the Department of Mathematics and Computer Science

July, 2015

Introduction

There have been two major phases in the way assessment was handled by the Mathematics and Computer Science Dept. in the past. Prior to 2010, the dept. conducted exit interviews and also maintained portfolios for each student in key required courses of the major. The exit interviews were useful as they uncovered some areas of dissatisfaction among some of our majors (discussed below). However not every student agreed to an exit interview so the results were not uniform and bordered on anecdotal. On the other hand, the portfolios were almost useless. They were a chore to maintain and took up a large amount of storage space in the department. Moreover, I am not aware of any instances where a faculty member actually used information gleaned from a portfolio in order to change their pedagogy or their syllabus.

In the spring of 2010 the MCS Department approved new assessment plans for both the mathematics and computer science programs (those plans are included below). Both the exit interviews and the student portfolios were terminated in the new plans. Along with articulating the goals of the two programs, the plans called for the use of two basic tools: **course data sheets** and **senior survey/focus group**; please see the assessment plan documents for details. Professor von Kaenel has acted as assessment coordinator for the department, from 2010 until his retirement this spring. His service is very much appreciated.

However, there are several reasons why this will be the final year of implementing this assessment plan, and we will embark on a new approach beginning next year. These reasons are:

1) **We have gleaned all that we can from the current plan**. The **senior survey/focus groups** are what replaced the exit interviews in the old plan. A complaint we heard more than once in both the exit interviews, and later in the focus groups, was that the MCS dept. was deficient in both Statistics courses and Applied Mathematics or Discrete Mathematics courses. By and large, students were happy with all of the pure mathematics and computer science courses, aside from the normal variations between teaching styles. The Department has responded to these concerns by new hiring in two of these three areas: the hiring of Mike Lopez in the fall of 2014 in a tenure-track line in Statistics, and the hiring of Lucy Spardy in the coming fall of 2015 in a tenure-track line in Applied Mathematics, supplementing and complementing the position held by Rachel Roe-Dale, our sole applied mathematician up to now. Furthermore, we hope to hire a discrete mathematician (to replace Alice Dean) in the very near future, and down the road to hire a second Statistician. Since we have moved in the direction to fix these perceived deficiencies in our curriculum, we have had far fewer complaints in the focus groups and senior surveys. In fact, last year, the focus group was attended by only one or two students, and this year no students were interested in a focus group meeting at all. On the other hand, the **course data sheets** seem to not be a fine enough tool to uncover problems in our curriculum. Year after year, they show that we are doing fine in all our courses. Either this tool cannot detect any problems we are having, or else we ARE doing fine in all our courses! Regardless of which is true, we no longer see a need for a comprehensive compiling of data for many individual courses. We aim to replace the current

Assessment plan with a less cumbersome plan which has a narrower focus which we can adjust from year to year. We plan to identify each year one aspect of our department or curriculum, and assess how that aspect is going. For example, the area which we will most likely focus on in the coming year is our drop-in tutoring program. There has long been an undercurrent of feeling among several of the faculty that we could make some improvements in our tutoring program.

2) **Pierre von Kaenel is now retired** and the course data sheets were developed by him and maintained by him each year. His retirement is a natural time to transition into a new plan.

3) **Impending Departmental Fission**. For various good reasons, the Department has plans to divide into two separate departments in the coming year. The Computer Science major and curriculum is under the leadership of a Computer Science Program Director (currently Mike Eckmann.) Mike indicates to me that Computer Science plans to focus on a different aspect of their curriculum than the Mathematics program to assess next year (they do not use the drop-in tutoring program as much as the mathematics students do.) Since we plan to split, each department would have to develop its own assessment plan anyway.

In summary, all things seem to point to the inevitable conclusion that it is time for a new assessment plan next year. So this will be the final report on the Course Data Sheet Results, and the fall of 2015 will mark the beginning of the third phase of assessment in the MCS Dept. Because we are phasing out this plan, we did not conduct senior surveys this year.

Course Data Sheet Procedure and Results

Here is a brief summary of how the course data sheets are being collected and used; for more detail please see the Assessment Plans for both CS and Math included after the main body of this document. For each major student, her/his final grade in each of the core courses listed below is recorded as a percentage (A+ = 98, A = 95, A- = 92, etc.). In addition, each instructor each semester gives weights, adding up to 1.0, to various desired learning outcomes in that course (9 outcomes in each discipline). Each student then gets a "grade" for each outcome, and finally the average is taken over all the students, arriving at an **outcome grade** for each of the 9 outcomes.

Pierre has, at this point, collected ten semesters of data (Fall 10 through Spring 15) for our majors in the Classes of 2012 through 2015 from the following courses (if possible):
Math majors: CS106 or CS206, MA200, MA202, MA303, MA319, MA376, MC215;
CS majors: CS206, CS230, CS305, CS306, CS318, MA200, MC215.

The data is displayed on the following page. Note that, for example, "2012" means "average over all CS (or MA) majors in the Class of 2012 and over all (measured) courses". We will make some remarks after the data is presented based on comparing the data from year to year. However, we note that data from the classes of 2012 & 2013 are incomplete. The class of 2014 was the first year when we had a complete set of data.

This presents the weighted averages for the CS goals

appreciate aesthetics of CS

write software w/ documentation, good code style

write clear expository on exams or homework

hardware component design & software interaction with

know foundations/solve problems in applied areas

Proficient at designing software using variety of languages

Knowledge of math foundations

Use appropriate data structures to store data

Can evaluate efficiency of algorithm

Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4
2012	84.95	89.33	87.54	88.64	88.99	91.20	85.89	89.78	87.28
2013	87.52	87.76	86.23	87.56	87.98	89.00	86.61	87.37	87.67
2014	90.01	87.55	86.08	87.48	85.98	88.60	87.36	87.37	88.28
2015	87.16	88.03	87.15	87.87	87.14	87.67	87.46	88.27	87.85

This presents the weighted averages for the Math goals

Year	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5
2012	86.23	90.51	90.35	90.99	88.36	88.69	88.94	89.09	89.62
2013	85.77	85.47	86.46	87.24	86.48	86.01	86.33	87.44	87.55
2014	90.84	89.94	91.00	90.11	90.53	90.45	90.41	90.02	90.25
2015	88.70	87.70	87.40	85.10	87.90	87.90	88.00	87.70	88.00

appreciate aesthetics of math

presentations - clear, organized

write clear, correct papers/proofs

use math reasoning for convincing arguments

apply proof techniques to prove statements

utilize computing technology to solve problems

apply algorithms, formulas to solve problems

know fundamental concepts - discrete

know fundamental concepts - calculus

Observations on the Data

The Computer Science data over the four classes shows few contrasts and no strong outliers. Probably the only observations worth making are, first, that Goals 1.3 (knowledge of math foundations) and 2.2 (know foundations/solve problems in applied areas) are both somewhat lower than the other outcomes, so attention should be given to improvement in those areas; and second, that there seems to be a slight downward trend in goal 2.3 (hardware component design), although the overall outcome grade is still acceptable. The hardware component of computer science is typically handled in the CS318 course. Over the years, this course has been taught by Pierre von Kaenel and Leo Porter. Since Pierre has been on phased retirement the past couple of years (and is now fully retired), and since Leo suddenly left the college this year after taking a year leave of absence, perhaps this trend is understandable. The Dept. hopes to hire a hardware person soon to replace Pierre and Leo, and once this person has taught CS318 a couple times, we ought to be able to reverse this trend.

The Mathematics data shows strong results across the board and much improvement on goal 1.1 (know fundamental concepts - calculus) over 2012 and 2013. In 2015, there appears to be a somewhat lower outcome grade in goal 2.2 (utilizing computing technology to solve problems.) Since this is represents data for only one year and the outcome score is still within an acceptable range, we can't be sure if this is just a blip in the data, or if this is an issue that needs to be addressed in the future. The use of computing technology to solve problems in mathematics classes might be a good narrow focus for our new assessment plan in a future year.

Recommendations:

- Our CS faculty will continue to try to offer as wide a variety of courses as they can, given the constraints of staffing and required courses. Additional CS staff in the not-too-distant future will be required for this rapidly expanding program. This year, a search will be conducted to replace Leo Porter (whose position was, in turn, created to replace Pierre von Kaenel while he was on phased retirement.)
- The department has added more applied math courses, but again, we are constrained by staffing, service courses and required courses. We have added a statistician (Mike Lopez) in the fall of 2014 and will add an applied mathematician (Lucy Spardy) to our department this coming fall. These additions should dramatically improve our standing in these two crucial areas, although we are still short both in the discrete mathematics area (we need to replace Alice Dean), and in overall staffing as indicated by recent huge enrollment increases at all levels, sufficient to merit the hiring of two full-time visiting mathematicians for AY 2015-2016 in addition to a CS visitor and several adjuncts in both math and CS.
- We have made an effort to improve our advising for our students' post-college years. Our website has been substantially improved and we have hosted a Living the Liberal Arts session for the second consecutive year toward this end. We still need to make further improvements as we move ahead.
- We need to continue making a conscious effort to be the open, friendly, supportive department which a vast majority of our students perceive us to be.

Supporting Documents

Below I have included the following supporting documents:

1. The Assessment Plan for Computer Science
2. The Assessment Plan for Mathematics

Respectfully submitted by:

David Vella
Chair, Department of Mathematics and Computer Science

Assessment Plan for Computer Science

Mission

Computer science is the study of computation. Computer scientists study computational problems, algorithms to solve those problems, and the implementation of algorithms on physical computing devices. Computer scientists also design and analyze computing and communication infrastructure and simulate natural and artificial computational systems.

The fundamental mission of Skidmore's computer science program is to provide students with the background necessary to:

- understand computation,
- design efficient algorithms to solve problems, and
- develop software using current software design methodologies, programming languages, and systems.

Furthermore, since computer science is a rapidly developing field, the computer science program at Skidmore must provide computer science majors with a deep enough understanding of the principles of computer science that they will be able to learn new technologies and methodologies independently after their time at Skidmore is over. By focusing on the underlying principles of computer science, the computer science major will prepare students to:

- be successful graduate students;
- be productive software developers in a wide variety of fields;
- be able to apply computational principles to systems in other disciplines.

The computer science program should also provide students majoring in other fields with the opportunity to develop some skills in algorithm and software design appropriate for their majors.

Goals and Outcomes

Computer Science is a precise discipline defined by the types of problems it addresses and the methods it uses to address these problems. In designing solutions students must know how to write programs using an appropriate language chosen from among different language paradigms. The programs may include a variety of data structures, and students must be familiar with algorithms that can be used to access and manipulate these structures. Each algorithm will have advantages and disadvantages compared to others, and students must be familiar with the efficiency of each in order to use the most appropriate to solve the problem at hand.

Upon completion of the Major (and to a lesser extent the Minor) in Computer Science, a student shall have achieved the following:

Goal 1: Students can compare and evaluate data structures and algorithms and know how to use the most appropriate data structures with respect to the requisite algorithms to solve a variety of problems efficiently.

Outcome 1.1: Students can evaluate the efficiency of algorithms with respect to time and memory and understand related issues such as unsolvability and computational complexity.
Outcome 1.2: Students use appropriate data structures to store data and use relevant algorithms that interact with these data structures.
Outcome 1.3: Students will demonstrate knowledge of mathematical foundations required to study data structures and algorithms.

Goal 2: Students can develop software solutions that solve a variety of problems using appropriate languages and software designs, and understand how software interacts with hardware.

Outcome 2.1: Students are proficient at designing software using a variety of programming languages and paradigms.
Outcome 2.2: Students know the foundations of and can solve problems in important applied fields of computer science such as artificial intelligence, computer graphics, and concurrent programming.
Outcome 2.3: Students understand how some hardware components are designed and how software interacts with components and systems.

Goal 3: Students can communicate effectively using accepted standards of the profession.

Outcome 3.1: Students can write clear and well-organized expository work either on exams or homework.
Outcome 3.2: Students can write software that includes a) documentation explaining the algorithms used in sections of code, and b) proper writing and formatting styles that adhere to accepted coding conventions.

Goal 4: Students will appreciate the creative aspects of computer science.

Implementation of Assessment

Because of the preciseness of algorithms, the theory supporting data structures and algorithm analysis, and software, faculty members receive ample feedback on their students' learning and on their teaching methodologies in all courses by way of graded problem sets, software programs, exams, in-class activities, and occasional theses and other papers. Thus, student grades accurately reflect how well they have learned the material.

The primary assessment tool to be used relies on these student grades. The rubric by which individual grades can be teased into a collection of ratings for each of the outcomes can establish a benchmark against which yearly evaluations are compared.

Each fall, the department will gather the results from these assessment activities. In even years, the even numbered goals and their outcomes will be assessed. Likewise during odd years an examination of the odd numbered goals and outcomes are conducted. The department will then discuss the findings and consider possible improvements to the mathematics program.

<u>Assessment tools</u>

1. The department will collect a **course data sheet** for each course taken by current and future majors. The sheet consists of two data sets, 1) final grades for each student, and 2) a weighting factor (0.0-1.0) that indicates how heavily the course addresses each outcome. The sum of the weighting factors for each course must equal 1. For example, a weight of .2 for Outcome 2.1 indicates that 20% of the course grade addresses that outcome. Each year the grades and weights for each senior are combined to yield a "grade" for each outcome. These grades will be averaged over all students and will result in an **outcomes grade** for each outcome. These averages will be saved and used to form a benchmark with which new *outcomes grades* can be compared. As described in the opening paragraphs of this section, grades provide a precise measurement of student learning, and *outcomes grades* represent a translation of student grades into a measure of success for each outcome.
2. Each year the department will conduct a **senior survey** and **focus group** whose purpose is to gather information on students' self-assessment of their experience in the major and preparation for embarking on a career in computer science.

<u>Assessing the goals and outcomes</u>

The following segments discuss a) which courses align with each of the five goals, b) which assessment tools are used to evaluate each goal, and c) how the results of each assessment method is used to evaluate the curriculum.

Goal 1: Students can compare and evaluate data structures and algorithms and know how to use the most appropriate data structures with respect to the requisite algorithms to solve a variety of problems efficiently.

a. The goal is addressed in CS 206, CS 305, and MC 316.
b. The course data sheets and *outcomes grades* are used to assess each outcome of this goal and to compare these grades with the benchmark established over time using past *outcomes grades*. The senior survey and focus group ask students to measure their confidence in implementing and explaining algorithms.
c. The *outcomes grades* associated with Goal 1 measure student understanding of the theory and implementation of algorithms, the use of appropriate data structures in software projects, and topics in mathematics that provide a foundation for understanding algorithms. Weakness in the foundations, for example, may point to problems in theoretical courses. A comparison of the *outcomes grades* to the benchmark and review of the senior survey and focus group would help faculty uncover negative or positive trends in student outcomes.

Goal 2: Students can develop software solutions that solve a variety of problems using appropriate languages and software designs, and understand how software interacts with hardware.

a. CS 106, CS 206, CS 230, CS 318, CS 322, CS 323, and CS 324 introduce the fundamentals of programming, designing programs, understanding languages and how software interacts with hardware, and cover a number of applied fields in computer science.
b. The course data sheets and *outcomes grades* are used to assess each outcome of this goal. The senior survey and focus group ask students to measure their confidence in learning new languages, designing programs, and understanding the relationship between hardware and software.
c. This goal involves learning to write programs using a number of languages to solve problems in applied fields of computer science. Since one weak outcome of Goal 2 may impact other outcomes, it is important to measure success in each of these activities. The *outcomes grades* can be used to compare each of the three outcomes to be sure there is a balance in these grades. The senior survey and focus group results can be used to confirm discrepancies in *outcomes grades.* A comparison of the *outcomes grades* of work in CS 206 with that in upper level courses should show improvements in students' abilities to design software as they advance to senior year. If improvements were not found, the faculty would examine individual *outcomes grades* as well as overall averages to find areas of the curriculum that need strengthening.

Goal 3: Students can communicate effectively using accepted standards of the profession.
a. CS 106, CS206, CS 323, and CS 324 require code documentation and software that adheres to coding conventions. CS 381/382 are senior thesis courses that require a treatise on some topic in computer science. MC 215 is the department's "writing" course. It introduces the study and practice of mathematical reasoning and its written and spoken expression in the form of mathematical proofs and algorithm specifications.
b. The senior survey and focus group probe student self-assessments of their communications skills and ask whether the department and the college as a whole have provided sufficient instruction in communications. Finally, the *outcomes grades* for Goal 3 indicate how well students write papers and software and how well they have improved over time.
c. As with other goals, the proper application of the *course data sheets* to extract grades for Goal 3, based on faculty weights assigned to outcomes, provides a history of student achievement in writing and speaking. Should communication expectations fall short, a review of outcome-weighted grades in MC 215 compared with those in upper level courses, and an examination of recent senior theses may provide insights that lead to recommendations on improving student performance.

Goal 4: Students will appreciate the creative aspects of computer science.
a. This goal is difficult to assess directly, if not impossible, however the department feels strongly that our students should achieve such an appreciation. All courses should contribute to this goal.
b. The senior survey asks students to comment on their creativity while doing computer science. The focus group may also follow up with further discussions.
c. One cannot rate creativity, but the results of the survey and focus group may reassure the faculty that Goal 4 is being attained.

Assessment Plan for Mathematics

Mission

The mission of the Mathematics Major and Minor programs at Skidmore College is to prepare graduates for fulfilling and useful lives through the discipline of mathematics. Majors and minors acquire knowledge and an appreciation of mathematics as a theoretical endeavor, as an analytical tool of broad scope (which they become adept at using), and as a creative expression of the human spirit.

Goals and Outcomes

Mathematics is a precise discipline defined by the types of problems it addresses and the methods it uses to address these problems. Mathematical problems can be of an applied or computational nature, or theoretical, having to do with the careful logical development of a subject on the basis of clear starting concepts, axioms, and definitions. In the lower-division courses, the emphasis is more on the development of computational fluency and a sound intuitive understanding of the basic concepts and computational algorithms. Upper-division courses continue the development of technical facility and problem-solving skills, but also emphasize the logical structure of a subject and the rigorous proof of its theorems.

Upon completion of the Major (and to a lesser extent the Minor) in Mathematics, a student shall have achieved the following:

Goal 1: Students will develop a fundamental conceptual knowledge of continuous and discrete Mathematics.

- Outcome 1.1: Students will demonstrate knowledge of fundamental concepts, definitions and theorems in single- and multi-variable Calculus.
- Outcome 1.2: Students will demonstrate an understanding of the fundamental concepts, definitions, and theorems in discrete fields such as Linear Algebra, Theory of Numbers and Graph Theory.

Goal 2: Students will apply a variety of techniques to solve applied or computational problems.

- Outcome 2.1: Students will apply mathematical algorithms, formulas, and models that can be used to solve problems.
- Outcome 2.2: Students will utilize computing technology to solve problems.

Goal 3: Students will have a facility in mathematical reasoning, an understanding of definitions, axioms, and theorems, and an ability to use them appropriately in formulating proofs.

- Outcome 3.1: Students will apply a variety of proof techniques used in analysis, algebra, topology, and other fields of mathematics to prove statements in these fields.

Outcome 3.2: Students will demonstrate an ability to use mathematical reasoning to provide convincing arguments that support or undercut mathematical conjectures.

Goal 4: Students will communicate mathematics effectively in both written and oral form.

Outcome 4.1: Students will write clear, correct, and well-organized expository papers and proofs of mathematical statements.
Outcome 4.2: Students will give clear, well-organized presentations on mathematical topics.

Goal 5: Students will appreciate the cultural and aesthetic aspects of mathematics.

Implementation of Assessment

Because of the preciseness of mathematics, faculty members receive ample feedback on their students' learning and on their teaching methodologies in all courses by way of graded problem sets and written proofs, exams, in-class activities, and occasional theses and other papers. Thus, student grades accurately reflect how well they have learned the material.

The primary assessment tool to be used relies on these course grades. The rubric by which individual student grades can be teased into a collection of ratings for each of the outcomes can establish a benchmark against which yearly evaluations are compared.

Each fall, the department will gather the results from these assessment activities. In even years, the even numbered goals and their outcomes will be assessed. Likewise during odd years an examination of the odd numbered goals and outcomes are conducted. The department will then discuss the findings and consider possible improvements to the mathematics program.

<u>Assessment tools</u>

3. The department will collect a **course data sheet** for each course taken by current and future majors. The sheet consists of two data sets, 1) final grades for each student, and 2) a weighting factor (0.0-1.0) that indicates how heavily the course addresses each outcome. The sum of the weighting factors for each course must equal 1. For example, a weight of .2 for Outcome 2.1 indicates that 20% of the course grade addresses that outcome. Each year the grades and weights for each senior are combined to yield a "grade" for each outcome. These grades will be averaged over all students and will result in an **outcomes grade** for each outcome. These averages will be saved and used to form a benchmark with which new *outcomes grades* can be compared. As described in the opening paragraphs of this section, grades provide a precise measurement of student learning, and *outcomes grades* represent a translation of student grades into a measure of success for each outcome.

4. Each year the department will conduct a **senior survey** and **focus group** whose purpose is to gather information on students' self-assessment of their experience in the major and

preparation for embarking on a career in the mathematical sciences.

<u>Assessing the goals and outcomes</u>

The following segments discuss a) which courses align with each of the five goals, b) which assessment tools are used to evaluate each goal, and c) how the results of each assessment method are used to evaluate the curriculum.

Goal 1: Students will develop a fundamental conceptual knowledge of continuous and discrete Mathematics.

d. The goal is addressed in most courses of the mathematics curriculum. Introductory courses such as MA 108/109/111/113 and MA200 spend considerable time introducing fundamental definitions, concepts, and theorems in an intuitive way, whereas intermediate and some upper level courses pay more attention to the rigorous logical development of the subject; in particular, the proofs of its theorems.
e. The course data sheets and *outcomes grades* are used to assess each outcome of this goal. The senior survey and focus group ask students to self-assess their understanding of important fields in mathematics.
f. A low relative *outcomes grade* may indicate insufficient learning of the fundamental material in courses. This coupled with the results of the survey and focus group may suggest needed improvements in course content and emphasis on the fundamentals.

Goal 2: Students will apply a variety of techniques to solve applied or computational problems.

d. The formulation of mathematical models and use of algorithms, formulas and computer technology to solve problems are addressed in MA 102, MA 111-113, MA 200, MA 202, MA 204, MC 215, MA 270, and other courses. In addition, problem-solving skills are honed in the one-credit courses MA 125-126, 225-226, and 325-326.
e. The senior survey and focus group ask students to measure their confidence in and ability to apply mathematical tools to solve problems. The course data sheets and *outcomes grades* are used to assess each outcome of this goal.
f. A low *outcomes grades* when compared to the benchmark may indicate insufficient practice in problem solving. The results of the survey and focus group may help pinpoint specific fields in which students do not feel confident in solving problems. A review of student grades in all courses that include problem solving may also pinpoint specific areas in the curriculum that need strengthening.

Goal 3: Students will have a facility in mathematical reasoning, an understanding of definitions, axioms, and theorems, and an ability to use them appropriately in formulating proofs.

d. Most mathematics courses beyond the calculus level involve some or substantial instruction in reasoning and proofs, and a key focus of MC 215 is to lay the groundwork for the increased rigor of the upper-level courses..
e. The course data sheets and *outcomes grades* are used to assess each outcome of this goal. Student confidence in reasoning and proof writing is also measured in the survey.
f. The *outcomes grades* for Goal 3 may alert us to weaknesses in reasoning and formulating proofs. Reviewing student confidence from the senior survey would confirm such weaknesses.

Goal 4: Students will communicate mathematics effectively in both written and oral form.

a. MC 215 is the department's "writing" course. It introduces the study and practice of mathematical reasoning and its written and spoken expression in the form of mathematical proofs and algorithm specifications. The course also introduces a number of discrete mathematics topics, which are used as subjects for proofs and algorithms. MA 376 (Senior Seminar) also tests student writing ability and assigns a number of presentations. Many other courses above the 100 level include elements of writing proofs and/or oral presentations. Invited speakers expose students to mathematical talks; these colloquia offer templates for presenting information to audiences. The department also encourages students to make presentations at local mathematical conferences as well as at Skidmore's Academic Festival. The collaborative research program provides another opportunity for students to give talks, and students writing honors theses must present the results of their work to the department.
b. In some courses, faculty members instruct students on oral presentation and have them practice their presentations before giving them at student symposiums. For written assignments, students are at times asked to submit drafts of their work resulting in suggestions for improvements. For upper level courses that focus primarily on theory, many assignments rely on good writing. Finally, senior thesis grades are based in part on the written thesis as well as presentations before the department. For all these courses, the outcomes grades for Goal 4 reflect how successful students have been in meeting faculty expectations. The senior survey and focus group also probe student self-assessments of their communications skills and ask whether the department and the college as a whole have provided sufficient instruction in written and oral communications.
c. As with other goals, the proper application of the *course data sheets* to extract grades for Goal 4, based on faculty weights assigned to outcomes, provides a measure of student achievement in writing and speaking. Should communication expectations fall short, a review of outcome-weighted grades in MC 215 compared with those in upper level courses, an examination of recent senior theses, and faculty impressions of oral presentations in various courses and symposiums may provide insights that lead to recommendations on improving student performance.

Goal 5: Students will appreciate the cultural and aesthetic aspects of mathematics.

d. This goal is difficult to assess directly, if not impossible; however, the department feels strongly that our students should achieve such an appreciation. All courses should contribute to this goal.
e. The senior survey asks students to comment on their appreciation of mathematics. The focus group may also follow up with further discussions.
f. One cannot rate beauty or its appreciation quantitatively, but the results of the survey and focus group may reassure the faculty that Goal 5 is being attained.

August 28, 2015

Dear David,

We appreciate your excellent work on this assessment and your planning for next year and beyond.

As before, we are responding to the department and program reports with particular attention to the ways faculty are framing goals for our students; analyzing student work directly (and also considering indirect information such as surveys and interviews) to see how well they are meeting our goals; discussing the results together; and making use of the results to change courses, requirements, and/or pedagogies.

To meet the standards for accreditation, we are asked to analyze our students' work directly on a regular basis. As always, the key is to do assessment that you find meaningful. Everything lines up behind that.

Student Learning Goals: Math and Computer Science each has clearly stated student learning outcomes; each learning outcome lists the courses in which it is addressed, the assessment method, and the implications of the assessment results. It looks as though you plan to maintain the same learning goals for the time being. Is there a consensus that these remain your goals, as your department divides and evolves?

Assessments—Direct: You have been gathering data using the course data sheets for several years and have found that this method has not yielded useful results. You plan to discontinue this practice. Nevertheless, you analyze the data this year with quite a few useful observations.

Assessments—Indirect: Your department made some important hires in response to student feedback on surveys, and you will continue to collect data to determine if these hires address the perceived deficiencies. At this time, you plan to discontinue the regular exit survey.

Results: The last four years' worth of data have shown that students do well enough in all of the areas tested, but that the course data sheet is not a useful way to clearly identify strengths and weaknesses in student learning. That said, you draw conclusions that bear further discussion, and you indicate potential actions in response to the conclusions.

Discussion, implementation: We trust that you will discuss this report with your faculty in the fall. We also look forward to seeing the results of the new assessments you have planned, and in seeing how the new hires can help as you implement curricular changes. It will also be interesting if you can track the effects of your enhanced advising for students' post-graduation experiences.

Looking ahead: With the retirement of several faculty members and as Math and Computer Science divide into two separate departments, you are developing new assessment plans, one for each department.

Math plans to identify one aspect of the department or curriculum each year to assess, starting with the drop-in tutoring program in 2015/16. Your faculty has long felt that this program could be improved – we applaud your decision to use assessment as a means of gathering data to make improvements. Please do bear in mind that you will also need to be looking directly at your students' work together on a regular basis; we trust that some form of direct inquiry into their learning will be part of your plan.

Please let us know if we can help in any way as you plan your upcoming assessments.

Overall: Excellent work! Thank you for a thoughtful report on the changes in Math and Computer Science.

Sincerely,

Sarah Goodwin
Lisa Christenson