

MAA Guidelines for Undertaking a Self-Study in the Mathematical Sciences

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1 Introduction

The purpose of this document is to provide a framework for undertaking an effective and purposeful self-study.

The MAA *Guidelines for Programs and Departments in Undergraduate Mathematical Sciences* recommends that departments perform periodic reviews of their academic programs. Many departments conduct self-studies as part of their institution's assessment plans or in response to requirements of accreditation agencies. Other departments conduct self-studies as part of their strategic planning process. Most likely, a department undertakes a self-study in response to a mandate from the administration, which instructs the department to analyze the role of the department within the institution; assess the content and quality of departmental programs, pedagogy, scholarship, and service; and identify potential curricular changes and opportunities for growth and contribution.

The good news is that undertaking a self-study enables members of a department to move beyond simply existing day to day—grappling with issues such as class scheduling and speaker arrangements—and instead have an opportunity to reflect on where the department has been, where it is now, and where it wants to be. An effective self-study is more than writing a report. It is a dynamic process.

This document attempts to provide some insight into the following types of questions:

- How does a purposeful program review play out?
- How does a department plan ahead while looking back?
- How does a department take ownership of the process?
- How can a department create a habit of ongoing review and assessment and an ongoing quest for excellence?
- How does a department overcome obstacles?
- How do members of a department develop an openness and willingness to change?
- How does a department dovetail its self-study with institutional priorities, financial realities, strategic plans, and so on?

This document is an outcome of two MAA PREP workshops and three MAA Minicourses. The PREP workshops were organized by Nancy Baxter Hastings and Joanne Weissman and were held at Dickinson College in the summers of 2005 and 2006. The participants in the 2005 summer workshop—Donna Beers from Simmons College, John Fulton from Clemson University, Nancy Baxter Hastings from Dickinson College, Bill Hawkins from the MAA, Michael Pearson from the MAA, Harriet Pollatsek from Mount Holyoke College, Jerry Porter from the University of Pennsylvania, Matt Richey from St. Olaf College, Kyle Riley from the South Dakota School of Mines and Technology, Carol Schumacher from Kenyon College, and Martha Siegel from Towson University—were experienced in undertaking departmental self-studies and serving as outside consultants. The goal of the 2005 workshop was to develop a set of training materials for external consultants. However, it quickly became evident that the effectiveness of an outside consultant

is closely linked to the effectiveness of a department's self-study process. The brainstorming that took place during the 2005 workshop became the basis for the second PREP workshop in summer 2006, which ran two concurrent sessions: one for helping departmental teams develop self-studies led by Donna Beers and Carol Schumacher and one for training consultants led by Kyle Riley. During the fall of 2006, as a visiting professor at the MAA, Donna developed an in-depth set of PowerPoint slides on developing self-studies. She presented these slides at the MAA Department Chairs Workshop that fall, and she and Richard Gillman used them at MAA Minicourses at the Joint Mathematics Meetings in 2008 and 2009. Donna's extensive set of PowerPoint slides form the basis for this document, which was written by Nancy Baxter Hastings.

We wish to thank our colleagues who attended the two PREP workshops at Dickinson, the participants in the MAA Minicourses, and the members of the MAA Committee on Consultants for helping to shape this document.

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2 Why Do a Self-Study?

Undertaking a self-study provides a department with an opportunity for renewal.

A self-study provides a department with an opportunity:

- to redefine its mission and develop a clearer sense of who it is and what it wants to accomplish
- to examine how its mission supports the mission of the institution
- to reflect on where it has been and why it was there, to examine where the department is now, and to develop a strategic plan that contains goals and objectives about where the department wants to go
- to strengthen the quality of its major(s) and to strengthen its curriculum
- to strengthen its relationship with its students
- to gather data that can be used to support scheduling decisions, staffing needs, budgetary requests, and grant proposals
- to receive guidance and suggestions from members of an external consultant team from peer and aspirant institutions
- to engage in dialogues with colleagues in partner disciplines to clarify the needs and expectations of other departments and identify interdisciplinary activities

And maybe most important of all, a self-study provides an opportunity for the members of a department to work together, discussing issues, making plans, examining what has worked and what hasn't, making decisions, and implementing changes. In the process, it provides an opportunity for the members of a department to move forward together with a shared understanding, a shared set of goals, and a shared commitment.

3 What Is the Self-Study Process?

A self-study is an ongoing process that involves writing a self-study report, receiving guidance from a team of outside consultants, doing strategic planning, and implementing an iterative assessment cycle.

The first phase of the self-study process involves putting together the self-study report. During this initial phase, the department searches for answers to broad questions such as:

- Where was the department five to ten years ago and why was it there? (See 5: “Retrospective: Looking Back.”)
- Where is the department now and how well is it doing? (See Section 6: “Introspective: Examining and Analyzing the Current Situation.”)
- Where does the department want to go and how can it get there? (See Section 7: “Prospective: Looking Forward.”)

The answers to these questions form the basis for the department’s self-study report. (See Section 8: “Writing the Self-Study Report.”)

The next phase in the self-study process is to involve a team of external consultants that will make an on-site visit and write a report detailing its findings and recommendations. It is important to note that the department’s self-study report is the primary tool consultants use to familiarize themselves with the department prior to their visit. The department should provide the report to the team well in advance of their visit so that team members have an opportunity to ask questions arising from the report, to ask for additional data, and to make suggestions that would strengthen the report. (See Section 9: “Utilizing a Team of Outside Consultants.”)

At this point, the department has to overcome the temptation to put the self-study report and the consultant team’s report on the shelf and forget about them. Remember, self-study is an *ongoing* process. A lot of work has been done to reach this point. The next phase in the process is to take advantage of what has been done so far. During this phase, the department carefully considers the recommendations and comments of the outside consultant team and uses its new insights to either write or revise the departmental strategic plan. (See Section 10: “Combining All the Input in a Strategic Plan.”)

The strategic plan provides the department with a set of clearly stated goals and objectives. In order to assess how well it is achieving these goals, the department needs to continue to gather and interpret evidence and make decisions about how to improve its program, its curriculum, and student learning. This is the iterative assessment portion of the self-study process. Moreover, by doing this the self-study process will become part of the departmental culture and the department will be well positioned for its next formal self-study. (See Section 11: “Launching an Iterative Assessment Cycle.”)

4 Getting Started

To get the self-study process started, someone needs to be identified to lead the process, members of the department need to buy into the process, goals need to be set, and time schedules need to be formalized.

The self-study leader and the department chair may or may not be the same person. Obviously if these roles are handled by different people, then these two individuals need to work together

closely. One possibility is for the self-study leader to serve as the manager of the process, while the department chair serves as a teacher and an advocate of the results to the administration and the department.

4.1 Role of the department chair as teacher and advocate

The department chair serves as a teacher.

The department chair helps departmental members understand what is meant by the self-study process (versus a self-study report).

The department chair makes sure the department understands the institution's strategic goals and budget priorities. (The chair should not assume that department members are tuned into institutional priorities.)

The department chair encourages faculty to explore the many sources of information on program development that are available to them.

The department chair serves as an advocate to the department.

Whereas the self-study leader needs to get the department to look beyond where it is now (see Section 4.2), the department chair gets the department to move beyond where it is now.

The department chair is responsible for making sure the self-study report and the consultants' report do not end up forgotten in some filing cabinet. The department chair needs to develop a timeline and define the procedures for implementing the changes and recommendations that result from the self-study process. The department chair needs to continue the assessment activities so that the department is well positioned to undertake its next formal self-study.

The department chair serves as an advocate to the administration.

During the self-study process, the department chair advocates the administration for access to needed data, funding of expenses, adjustments to timetables, and so on. In other words, the department chair advocates for anything that may be needed to ensure that the self-study process proceeds smoothly.

Typically, the department chair recommends members for the external consultant team to the dean or provost. The department chair should advocate to the administration for a team of two or three outside consultants and not just a single, stressed-out and overworked visitor. The department chair should handle all the logistics of the on-site visit. However, most important of all, the department chair needs to make sure that the consultant team's visit is purposeful to make sure that the team is coming to provide real advice on a well-defined and agreed upon set of issues, and not simply to validate the department's report. (See Section 9: "Utilizing a Team of Outside Consultants.")

After the consultants' report is submitted and the department's strategic plan is written, the department chair advocates for support in implementing the goals and objectives in the department's new plan.

Finally, the department chair advocates the administration on the value the department brings to the institution and gives credit to the whole department for a good job, well done.

4.2 Role of the self-study leader as manager of the process

The self-study leader works to win the buy-in of the department.

The self-study leader models the way. The leader needs to be able to show colleagues that an administrative mandate to undertake a self-study can be turned into an opportunity for department renewal and for individual professional renewal. The self-study leader needs to have a positive attitude about the process and high expectations of its potential. The self-study leader needs to be able to pacify the naysayers who claim that nothing will come of it and to overcome any fear of assessment. The self-study leader needs to maintain energy and commitment throughout the process.

The self-study leader manages the process.

As project manager, the self-study leader needs to provide colleagues with a clear road map of what needs to be done (which makes the process less daunting and also enhances buy-in) and establish reasonable timelines and clarity as to who has to do what by when. The leader tries to match tasks that need to be done with faculty member's interests and experiences.

The self-study leader tries to involve everyone in the department.

The self-study leader needs to involve all members of the departmental team in the decision-making process and not make all the decisions alone. Departmental decisions and actions should be arrived at from the bottom up, not from the top down.

The self-study leader gets the department to look beyond where it is now.

The self-study leader needs to be able to inspire the department to think about ways that the department can reach higher levels of achievement ways that the department can do what it does but do it better.

The self-study leader needs to be able to inspire the department to explore possible changes and new contributions—such as launching a new curriculum, implementing new pedagogies, taking on new roles at the institution in light of changes in the institution's strategic plan, responding to environmental changes such as workforce needs, responding to national calls for stronger preparation of elementary teachers in mathematics, and so on.

4.3 Avoiding potential stumbling blocks

Three potential stumbling blocks are not having enough time, not taking time to think, and not having the buy-in of the faculty.

The biggest potential stumbling block to conducting an effective self-study is the amount of time it takes to do a good job. Undertaking a self-study takes time, which understandably most faculty members feel they do not have and cannot afford. To help avoid this stumbling block, it is important that the expectations and procedures are clear and the time schedule is reasonable. Formal aspects of the self-study should be done over an extended period of time such as two or three semesters, meetings should be short and productive, and everyone should understand who is responsible for doing what and when he or she is supposed to do it.

Another potential stumbling block is to simply compile information without reflecting on what it all means. The self-study process provides the department with opportunities to ask questions and make observations and in response to these questions and observations to identify areas for

improvement and define new directions. For constructive changes to take place, the department needs to be reflective. It needs to take time to think.

The most important potential stumbling block, however, is the lack of buy-in by members of the department. An effective self-study process is a participatory process, where each member is committed to the project and has a sense of ownership and specific responsibilities. Buy-in is enhanced when everyone understands why the process is important and what it entails.

4.4 Kicking off the self-study process

A departmental retreat can provide a productive setting to get buy-in from the members of the department, to bring newer faculty members up to date, and to kick-start the self-study process.

The goals of the retreat would be to make sure that all the members of the department understand what the self-study process is, why the department is going to do it, what has happened since the last self-study, where this self-study process is going, and how the department is going to get there.

To ensure that everyone is on the same track, the best place to start may be at the beginning by discussing questions such as:

- What is a self-study?
- What are the components of the self-study process?
- What are the benefits to the department for undertaking the proposed self-study?

If the department did a previous self-study, the retreat might review the earlier self-study report and the associated report from the outside consultant team. In particular, it may be helpful, especially for colleagues who have joined the department since the last self-study took place, to discuss questions such as the following:

- What recommendations were made by the last consultant team?
- How did the department respond to the recommendations? In which areas has there been progress? In which areas has there been no progress or deterioration? What were the obstacles?
- What other changes have taken place? What were the drivers for these changes?

Members of the department can begin to develop a shared understanding of the intended outcomes of the self-study process by discussing questions such as the following:

- What is the purpose of doing this particular self-study? What does the department want to gain from the experience? What are the department's goals in undertaking the process? What are the expected outcomes? (These related questions are obviously the BIG questions.)
- What is the institution's mission? What are the institution's strategic goals and budget priorities?
- What are the expected uses of the self-study report? By what criteria will it be judged? What is the intended audience for the self-study report?

- What are some useful resources?

Finally, a kickoff retreat provides an opportunity for the department not only to discuss where the self-study process is going, but also how they are going to get there.

- What are the roles of the department chair and the self-study leader?
- What procedures will be followed with respect to meetings and preparation for meetings?
- Who will be in charge of what?
- What is the expected time schedule?

In particular, it is especially important that the department establish guidelines such as the following for conducting meetings:

- Hold only as many extra department meetings as are necessary to do self-study-related tasks. Keep the length of the meetings reasonable, for example, less than an hour.
- Focus on one topic (or a cluster of related topics) at each meeting.
- Establish the expectation that all work is to be done before the meetings. The self-study leader should ask the “keepers” of a topic to (1) circulate their data and tentative findings/recommendations in rough drafts in advance of a meeting, and (2) incorporate colleagues’ feedback (as much as possible). Note: Colleagues should have adequate time for reflection before meetings.
- Formulate a list of desired outcomes for a meeting. Without manipulating outcomes for a meeting, the self-study leader should plan sufficiently in advance and consult sufficiently with the “keepers” of a topic to have a good idea of the desired outcomes from the meeting.
- Use meetings to report out. Meetings should be for reporting out (“this is what I’ve done...”), making final modifications, and ratifying decisions. Meetings shouldn’t be spent word-smithing or undertaking analysis of reports for the first time. Keep in mind that buy-in to the self-study process is enhanced when people feel their time is well spent and that they have accomplished something.

5 Retrospective: Looking Back

The first phase of preparing to write a self-study report is to examine the department’s recent history.

5.1 Where was the department five to ten years ago?

To help answer this question, the department should examine its recent history, looking at its mission and roles, programs, distinctive features, faculty and students, service activities, administrative structure, and resources.

Mission

What was the mission of the department within the institution?

Roles

What roles did the department play in the institutional setting?

Programs

What programs, majors, and minors were offered? What were the course enrollment statistics? In what ways did the department collaborate with other disciplines?

Distinctive features

What made the department's programs stand out? What was the department known for? Why did students choose the department's programs?

Faculty

What were the faculty demographics?

Students

What were the student demographics? What were students expected to learn? How did the department determine whether or not they did?

Service activities

What service and outreach activities did the department, faculty, and students engage in?

Administrative structure

What was the administrative organization of the department?

Resources

What resources (library, technology, staffing, and so on) were available?

5.2 Why was the department there?

In addition to describing where the department was at the time of the previous self-study, the department should examine why it was there by looking at factors that impacted and shaped the program in the past.

- What was the institutional context? What internal factors, such as enrollment statistics, impacted the program?
- What were the environmental factors? What external factors, such as benchmarking with peer institutions, student demographics, or the status of STEM nationally, impacted the program?
- What was the influence of guidelines from professional associations, such as the MAA, on curriculum, pedagogy, and assessment?

5.3 What changes have occurred?

As we mentioned above in Section 4.4: “Kicking off the Self-Study Process,” an important part of the history of the department is the department’s responses to the recommendations made by the previous outside consultant team and any other changes that the department has made.

- What curricular recommendations were made by the previous outside consultant team?
- How did the department respond to these recommendations? In which areas has there been progress? In which areas has there been no progress or deterioration? What were the obstacles? Why were some recommendations ignored or not implemented?
- What other changes have taken place—for example, new degree programs, new courses, new curricular innovations, or new facilities? What was the impetus for each of these changes?
- What changes have occurred with respect to the faculty? Has the size of the faculty changed? Have colleagues retired? If so, were they replaced? Has the balance among the permanent, visiting and adjunct professors changed?

6 Introspective: Examining and Analyzing the Current Situation

The second phase of preparing to write a self-study report is to examine the department’s current situation and identify areas of excellence, gaps and deficiencies, unrealized potential, new realities, and new opportunities.

6.1 Where is the department now?

The answers to this question provide a detailed description of where the department is now. Again, the department needs to examine its mission, roles, programs, distinctive features, faculty and students, service activities, administrative structure, and resources, but instead of looking back, it should look at the present situation.

Mission

What is the institution’s vision that is, what is its long-term view? What is the institution’s mission that is, what is its fundamental purpose? What are the department’s vision and mission?

Roles

What are the department’s roles in the institutional setting? For example, what are the department’s roles with respect to math placement, the institution’s general education requirements, teacher preparation, and so on?

Programs

What majors and programs does the department offer? What courses are required for each one? What minors are offered and what courses are required?

What courses are offered and how often?

What independent learning and internship activities are available to majors? What research opportunities are available?

How is technology used?

What interdisciplinary fields does the department support?

What institutional demographics, such as students' age, geographic background, and so on, influence the department's curriculum?

Note: To make the document more readable, use course names, not numbers. Include course descriptions, sample syllabi, exams, and so on in the appendices.

Distinctive features

What makes the department's programs stand out?

What is the department known for?

Why do students choose the department's programs?

Faculty

What are the faculty demographics? In particular, what are the diversity demographics of the faculty? What is the number of faculty at each rank and what is the number of their years of service? What is the balance among permanent, visiting, and adjunct professors?

What are the faculty members' areas of expertise?

What courses do they teach?

Note: Include copies of the faculty members' curriculum vitae in the appendices.

Students

What is the size of the student body at the institution? What are the student demographics?

What is the average Math SAT score? What is the general mathematical preparedness of the students on campus? What is the first mathematics course most frequently taken by nonmajors and by majors?

What is the average number of majors per year?

What are the diversity demographics of the majors? What enrichment opportunities and support services does the department provide for women and minorities?

What student honors and awards are available?

How many students participate in REUs and other training and internship programs? What career plans do students have when they enter the institution? What do students do after they graduate?

Service activities

What are the advising procedures for majors?

What are the service activities of the faculty and the department? Does the department offer special events, such as Math Awareness programs, that support the mission of the

department? Does the department provide extracurricular activities for students, such as math chapters or math competitions?

What are the service activities of the students? Do students participate in service activities, such as America Counts or Gear Up?

Administrative structure

What is the administrative organization of the department? How is the department governed? How are records kept? Are minutes taken at meetings? If so, are they distributed?

Does the department have an annual retreat? If so, what are the intended outcomes?

Does the department write an annual report? If so, do individual faculty members contribute to the report?

How is the departmental budget developed? Who decides how funds are used?

What is the faculty teaching load? Does the department chair receive course-release time?

How is faculty teaching evaluated? What are the institution's expectations with regard to faculty professional development and scholarship?

Resources

What level of support for professional development and scholarly activities does the institution provide?

Is there a mentoring program for new faculty?

What is the state of the infrastructure?

What Web, library, and online resources are available?

What funding is available for departmental events, such as special lectures and career panels?

What support staff and technical services are available?

6.2 How well is the department doing?

Describing the current situation in the department is important, but even more important is analyzing how *well* the department is doing. In particular, how well does the department support the institution's mission? How well does the institution support the department's mission? How effective is the department in carrying out its own mission and roles? How strong are the department's programs? What are the trends in the enrollment figures? How diversified are the faculty and the students? How is student learning assessed and how are the results used? How is faculty teaching evaluated and how are the results used? How effective is the departmental structure? How adequate are departmental resources?

In today's environment, anecdotes are not considered evidence. Answering questions, such as the ones given below, involves gathering and analyzing data; consulting with partner disciplines, administrators, and alumni; and reflecting objectively on the current state of the department. It takes thought, it takes courage, and it takes honesty. The intended outcomes of answering these types of questions are to identify and to quantify:

- Areas of excellence
- Areas where there are gaps
- Areas where there are deficiencies
- Areas where there is unrealized potential
- New realities, such as changing needs in the workplace, emerging technologies, changes in student demographics, threats from competitors, and so on
- New opportunities, such as opportunities to collaborate with partner disciplines, opportunities to develop interdisciplinary majors, and so on

Analyzing mission

How well does the department support the institutional mission and strategic plan? Does the department's mission align with the mission of the institution? Does the department engage in developing programs and writing grants that support the institution's strategic plan?

Conversely, how well does the institution support the department's mission? To what extent and in what venues does the institution publicize departmental accomplishments or activities? Does the institution's strategic plan or current capital campaign establish goals for developing resources for mathematics, such as scholarships or endowed chairs, or for other STEM disciplines?

Finally, how effective is the department in carrying out its own mission?

Analyzing departmental roles

How effective is the department in carrying out its roles within the institution? For example, depending on the roles of the department:

What percentage of entering students is successfully placed in mathematics courses?

What is the pass rate for students in mathematics competency courses?

What is the pass rate for students on mathematics proficiency tests and licensure exams in professional programs?

Have departmental enrollments increased, decreased, or stayed the same?

How satisfied are partner disciplines with the mathematical preparation of their students? Do they feel that the department meets the changing needs of their students and majors?

What is the visibility and stature of the mathematics program compared with other academic programs at the institution? What percentage of students major in the mathematical sciences? To what extent are department members invited to speak at admissions, orientation, fund-raising, and alumnae events? Overall, to what extent does the department share in administrative rewards and recognition?

Analyzing departmental programs

How strong are departmental degree programs? How does the mathematics major compare with the CUPM Guidelines 2004? How do the departmental majors and minors compare with those at peer and aspirant institutions?

How effective is the department in meeting the needs of client departments, such as preservice teachers?

How effective are departmental programs in preparing students for careers?

How effective are departmental majors in preparing students for graduate study in fields that utilize mathematical concepts or techniques?

Analyzing student data

What percentage of students who declare a mathematics field as their intended major completes the major?

What percentage of students participates in REUs or other external research opportunities?

What percentage of students works on research projects?

What percentage of students participates in service activities?

What percentage of students obtains employment in their degree field, say within one year of graduation?

What percentage of students who apply to graduate school is accepted?

Analyzing diversity

What is the institution's diversity plan for recruiting STEM faculty and students? How effective has the institution been in attracting and retaining diversity candidates, specifically STEM faculty and STEM majors?

What percentage of first-year women and minority students plans to major in the mathematical sciences?

What percentage of women and minorities continues from Calculus I to Calculus II, from Calculus II to Calculus III, and from Calculus III to a mathematics major?

What percentage of women and minorities who major in the mathematical sciences enter a STEM career?

Analyzing teaching effectiveness

How is teaching quality assessed?

How do faculty members use the results to modify their teaching?

How does the chair utilize the results of course evaluations to provide instructors with feedback and recommendations for modifying teaching performance?

Analyzing student learning

What are the learning goals and objectives for each course? What methods are used to determine if these objectives are met? What are the outcomes of these assessment activities? How have faculty members used the results to modify their courses?

What are the learning goals and objectives for each departmental program? What methods are used to determine if these objectives are met? What are the outcomes of these assessment activities? How have the results been used to modify the program?

How does the department measure the success of its graduates? What are the results?

Analyzing administrative activities

If the department has an annual retreat, does the retreat meet its intended outcomes? If the department submits an annual report, how is the report used to inform planning for the next year?

How effective are department meetings and governance procedures in helping the department to set and reach goals?

How effective is the departmental environment and culture in helping the department to advance and prosper? To what extent do members share in a vision of where the department should be headed? How successful are members of the department at working together to set goals and to implement them? How effective is the department in recruiting and mentoring new faculty members? How and to what extent do faculty members collaborate for example, in pedagogical innovations, curriculum development, grant writing, and so on?

How responsive is the department to the scheduling and curricular needs of other departments?

How effective is the department in using the Web to share information with prospective and current students and to publicize its accomplishments?

How effective is the department in maintaining ties to alumnae and in engaging alums in institutional fund-raising and in providing mentoring, internships, and career advice to majors?

Analyzing resources

How adequate is the department's budget in supporting the department's mission? Is the institution's resource allocation to the department growing, staying the same, or decreasing, and what is the rate of change?

How adequate is current administrative staffing for the department in supporting the activities and programs of the department?

How adequate are the physical facilities, computer resources, and library holding in supporting the department's programs?

How adequate are the resources for faculty development and research?

7 Prospective: Looking Forward

The last phase of preparing to write a self-study report, and maybe the most important, is to identify future directions for the department and to target areas where the department needs guidance from the outside consultant team.

7.1 Where does the department want to go from here?

At this point, the department has identified its areas of excellence, where there are gaps and deficiencies and where there is unrealized potential. The department has identified new realities and new opportunities. The questions that need to be answered now are:

- What is the department's response to each of these findings?
- What areas does the department want/need to focus on?
- What resources are needed to get there?
- Where does the department want to be in, say, five years?

Finding answers to questions such as these may not be easy, but it is of utmost importance. The decisions that are made will set the tone and the direction of the department during the upcoming years (until the next formal self-study). They will become the backbone of the department's strategic plan.

Developing a set of answers should not be the work of a single individual. Everyone needs to be on board as the department begins to move forward. Consequently, grappling with these questions might be the focus of another departmental retreat.

7.2 Where does the department need guidance?

The department needs to develop a productive purpose for the on-site visit of the outside consultant team. The purpose of the consultant team's visit is not to tell the department what to do, nor is it to figure out what needs to be done. Instead, the role of the team is to provide the department with advice on a well-defined and agreed upon set of issues.

- What questions does the department have for the consultant team?
- What areas does the department want the consultant team to examine?
- Where does the department need support and guidance?

8 Writing the Self-Study Report

The self-study report describes where the department was, where it is, and where it wants to be. It is the primary source of information for the outside consultant team.

Part 1. Looking Back (See Section 5)

This part of the document is based on the information collected in Section 5. The purpose is two-fold. First, it provides the reader with an understanding of what the department was like at the time of the last self-study, without overwhelming the reader with details. Second, it brings the reader up to date by describing changes that have been made. It contains:

- A succinct overview of the recent history of the department (since the last self-study or five to ten years ago)
- A list of the recommendations that were made by the previous outside consultant team and a description of the department's responses to these recommendations
- A description of other changes that have been made and the rationale for each of these changes

This information forms a bridge to the next part.

Part II. Examining and Analyzing the Current Situation (See Section 6)

This portion of the document is based on the information collected in Section 6. It is the major descriptive portion of the document. Much of this information is supported by details in the appendices. It contains:

- An overview of where the department is now, describing the department's mission, role, distinctive features, curriculum, faculty, students, service, structure, and resources
- The outcomes of assessments measuring how well the department is doing

Part III. Looking Forward (See Section 7)

This portion of the document is based on the information collected in Section 7. This is the most reflective portion of the document since it points to the future. It may also be the shortest. It contains:

- A list of shared departmental aspirations, along with the rationale for each aspiration and the resources needed to achieve the aspiration
- A list of questions, areas of concern, and places where the department would like input and guidance from members of the outside consultant team

Appendices

The appendices contain information such as the following:

- The report from the previous consultant team
- Curriculum vitae for faculty members
- Faculty demographics
- Brief descriptions of courses
- Course enrollment data
- Sample syllabi and exams
- Requirements for majors
- Number of majors/year
- Assessment and evaluation tools
- Assessment data
- Student demographics

9 Utilizing an Outside Consultant Team¹

An important component of a department's self-study process is getting input from a team of external consultants.

¹The information in Section 9 is taken from "MAA Guidelines for Serving as a Consultant in the Mathematical Sciences," which is available on the MAA website.

The consultant team reviews the department's self-study documents, makes an on-site visit, and writes a report detailing its findings and recommendations. The department's self-study report is the primary tool consultants use to familiarize themselves with the department prior to their visit.

The department chair normally handles the logistics for the on-site visit.

9.1 Choosing a consultant team

Ideally, a program and/or departmental external consultant team should involve a team of two to three people, since it is difficult, if not impossible, for one person to effectively capture the complexities of an entire review by him or herself. A good consultant team is greater than the sum of its parts and brings a greater wealth of expertise than any one individual can. A team will generally be more balanced in its observations and will benefit from a larger accumulation of wisdom. A team has the ability to provide more detailed analysis and more thoughtful feedback. Consequently, to ensure a high-quality review, an institution should fund a team of consultants, not a single individual. It is the role of the department chair to advocate to the administration for a team of two or three consultants and not just a single stressed-out and overworked visitor.

One member of the team should be designated as the chair. The chair serves as the primary liaison between the institution and the consultant team. Although the team shares responsibilities regarding the review and shares in writing the report, the chair oversees the process. The chair is responsible for submitting the final version of the report, which is signed by all members.

Typically, members of the team are chosen six months ahead of the actual site visit. The MAA Committee on Consultants can help the department identify colleagues who might be a good fit based on the department's needs.

9.2 Clarifying expectations

The department chair should clarify the role of each consultant and the issues on which the team is expected to concentrate.

Other expectations with regard to the consultant visit should be discussed in advance and possibly reiterated in writing. For instance, as early as possible, the department chair or an administrator should clarify details such as the following:

- What are the actual dates of the visit?
- Who will make travel and lodging arrangements?
- What is the reimbursement procedure for expenses?
- How much is the honorarium?

It is also helpful to clarify institutional expectations for the consultant team's report and deadlines for submission of the report.

- What are the institution's expectations with respect to the size and scope of the report?
- How long after the site visit will the report be due?

9.3 Preparing the consultants prior to their visit

The department chair should try to provide members of the team with copies of the departmental self-study report and any other materials one to two months prior to the site visit. This will enable the members to review the documents and provide feedback.

After the consultant team has had an opportunity to review the self-study report it may be helpful for the chair of the department and/or the self-study leader to participate in a conference call with members of the team prior to their visit to discuss any questions, observations, or suggestions the members might have.

9.4 Formulating an agenda for the on-campus visit

The self-study report is a comprehensive document with a vast amount of information and data, yet it cannot compare to the value of a good campus visit, which provides the outside consultants with an opportunity to immerse themselves in the culture of the campus and the department. The on-site visit usually lasts two to two-and-a-half days, is densely scheduled, and is very intense.

The agenda for the consultant team's visit typically includes:

Meetings with the department chair and high-level administrator(s)

At the very beginning of the campus visit, it is helpful to schedule separate meetings with the department chair and with high-level administrator(s), such as a dean or provost and/or president. These meetings provide an opportunity for members of the team to clarify any issues related to the purpose of the review and the administrative structure that governs the department.

Meetings with other administrators

Depending on the department's concerns, it might be helpful to have members of the team meet with the director of admissions, head of academic computing, head of the library, and so on.

Meetings with faculty members

Depending on the size of the consultant team and the size of the department, it may not be feasible to schedule individual conversations with every member of the department. However, the agenda should include as many one-on-one meetings, of say 45 minutes each, with full-time faculty members as possible, even if it means splitting up the team. The team can also meet with some clusters of faculty—for example, adjunct/part-time faculty.

Meetings with faculty in partner disciplines

In addition to the departmental faculty, the team should meet the department's stakeholders—e.g., the heads of departments/programs that require their students to take mathematics courses, the chairs of the science departments, and so on. Scheduling an early breakfast meeting tends to work well.

Meetings with students

The agenda should contain time for the team to meet with students, without other faculty or administrators in attendance. One way to do this is to arrange a lunch with student represen-

tatives, both majors and nonmajors. Another possibility is to arrange for the consultants to meet with the students in a particular class—say, for 15 minutes at the beginning or the end of the class period. A third possibility is to hold a student reception, although there would have to be some sort of carrot to motivate students to come (food always helps).

Classes

If the department's self-study focuses on a particular set of courses, such as the introductory calculus sequence, or on a particular pedagogical approach, such as the use of computer labs, then the agenda should include time for members of the team to sit in on a class or lab session. In addition, if the department teaches some innovative classes or is using an innovative teaching style, the department should arrange for the consultants to visit one of these classes, at least for part of a class period.

Tours

If courses have a computer laboratory component, then the agenda should include a tour of the computerized classrooms and labs. In addition, the team should have an opportunity to tour the library holdings and investigate the institution's Internet access to scholarly works.

Social events

To help get to know the members of the faculty and to see how they interact with one another, it is useful to schedule the team to meet with them in a more social setting (such as a luncheon, a dinner, or a reception) early in the visit.

Downtime for the consultant team

Typically the agenda for the consultants is packed with one meeting after another beginning with breakfast and going through dinner. This is fine. That is what they are on campus to do. However, it is important to schedule some time for the consultant team to meet by themselves, to share notes and make a first pass at consolidating their ideas. In particular, downtime should be scheduled before the exit sessions with the department and the administration so that the team has time to discuss among themselves its initial findings and recommendations.

Exit sessions

At the conclusion of the site visit, there are usually two exit sessions: one with the members of the department and the other with the high-level administrator with whom the team spoke at the start of their visit. During these sessions, members of the team are expected to give an informal overview of their findings and recommendations. The agenda should provide time for the consultants to get their thoughts together and to reflect on their observations prior to these final meetings.

9.5 Receiving guidance from the consultant team

The exit session with the department is usually a positive, spirited discussion. The department has worked hard on its self-study report and is eager to hear what the consultant team has to say. The consultant team has read the department's self-study report, analyzed the information in its

appendices, and learned as much as they can about the institution and the department from its website. While on campus, the team has fully immersed itself in the department. Consequently, by the end of the team's visit, it has a good sense about what is going on. The exit session provides an opportunity for the team to share its observations and suggestions and to receive feedback from the faculty. It provides the department with an opportunity to clear up any misconceptions the team might have. It provides a time for the team to talk openly with department members so that the consultant report does not contain any surprises.

The consultant team's formal report is meant to help guide the department. It describes the team's observations, discusses its findings, and makes recommendations. The report is typically ten to twenty pages in length, but may be longer based on the complexity of the situation.

10 Combining All the Input in a Strategic Plan

The next step is to combine what the department has learned from writing its self-study report with the feedback it has received from the outside consultants in a departmental strategic plan, which details where the department wants to go and how it plans to get there.

Writing the self-study report and receiving feedback and guidance from the outside consultant team are important components of the department's strategic planning process. At this point, the department has determined where it stands. It has identified its strengths, weaknesses, and opportunities. The consultant team's report has provided feedback and guidance. Now it is time to put everything together in the form of a departmental strategic plan.

A strategic plan is a broadly defined plan aimed at creating a desired future. It serves as a road map for where the department would like to be in three, five, or ten years, and it serves as a guide to implementing new programs and evaluating how these programs are doing. The plan is flexible and practical. It is simple and clear.

A strategic plan is comprised of vision and mission statements (which may be combined), a list of goals, a list of measurable objectives corresponding to each goal, and a set of strategies associated with each objective.

The *vision statement* defines the department's desired long-term view—that is, what it wants to be. The vision statement answers the question: What is/are the aspiration(s) of the department? For example, the vision statement of the Department of Mathematics at Rose-Hulman University for 2003–2006 was:

To be a model for excellence in undergraduate education in mathematics.¹

The *mission statement* defines the fundamental purpose of the department—that is, why it exists and what it does to achieve its vision. The mission statement answers the question: What can the department do to fulfill its aspiration(s)? For example, the mission statement of the Department of Mathematics at Rose-Hulman University for 2003–2006 was:

To provide every undergraduate student at Rose-Hulman with mathematical experiences and mathematical ideas as a foundation for careers and further study in engineering, mathematics, and science.

¹The strategic plan of Department of Mathematics at Rose-Hulman University for 2003–2006 is available at www.rose-hulman.edu/math/IPPublic/StratPlan/.

A *goal* is a broad statement of what the department hopes to achieve. It is a time-bound statement (short-term, medium-term, or long-term) of what the department wants to accomplish. The list of goals may be prioritized. For example, the goals for the Department of Mathematics at Rose-Hulman for 2003–2006 include:

Improve student recruitment, placement, and persistence

Improve curriculum, program, and learning environment

Faculty and staff development

Assessment of student learning and program success

Space allocation/upgrade, infrastructure, and other resource needs

Communicate with stakeholders

Associated with each goal is a list of *measurable objectives* that provide an action plan for how the department will achieve a particular goal.

Corresponding to each objective is a set of *strategies* or *tactics* for achieving the specific and measurable objective. Each tactic has a timeline and status and lists the parties who are responsible for carrying out the tactic.

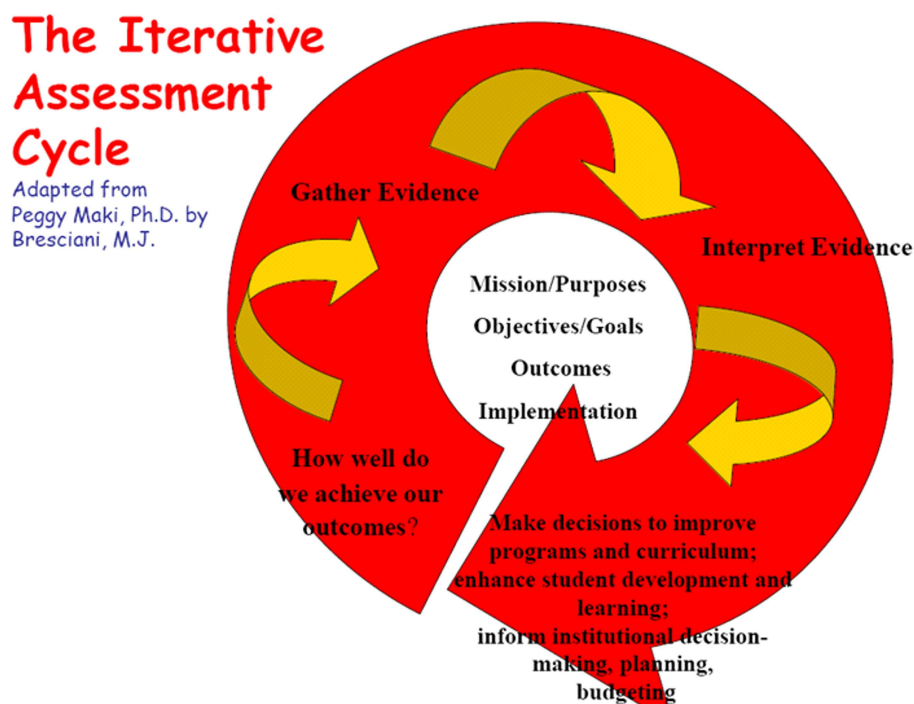
The details of a strategic plan can be shown in a table, such as the following, which shows Rose-Hulman's first goal, the first objective associated with this goal, and the tactics for implementing this objective.

Goals (where you want to be in 3 years)	Objectives (measurable)	Tactics (what are we doing to get there?)	Timeline	Status As of 1 July 2003	Person(s) Responsible
1. Improve student recruitment, placement, and persistence					
	Math majors & minors: Continue to increase the number of majors in mathematics both primary and double majors and the number of students taking upper-division mathematical courses	a. Take an active role in recruitment of math majors from off campus and internally	a. Ongoing	a. Major and double majors have reached 20/yr. "Early outreach" program for double majors in place. Recruiting brochure produced.	a. Department head & faculty assigned to recruitment activities
		b. Increase the number of students taking the Statistics concentration...	b. Ongoing	b. Upper-division statistics enrollments are increasing. PhD statistician hired to replace...	b. Statistics Curriculum Development Group
		c. Increase the number of students taking Continuous Applied Math...	c. By May 03, then ongoing	c. Course modifications planned	c. Continuous Applied Math Curriculum Development Group

11 Launching an Iterative Assessment Cycle

Now that the department has defined its goals and objectives, it needs to measure its success at meeting its objectives and thereby achieving its goals.

As illustrated in the diagram below, measuring how the department is doing is an iterative process. The department gathers and interprets evidence, analyzes how well it is doing, makes adjustments based on what it has learned from the evidence, and then starts the assessment process again. All of this is part of the ongoing self-study process and assures that the department is well positioned to begin the self-study process the next time around.



12 Resources

12.1 General resources

- *Assessment of Student Learning in College Mathematics: Towards Improved Programs and Courses*, edited by Bernard Madison, Association for Institutional Research, 2008. This volume includes 10 case studies, representing a sample of assessment activities in U.S. mathematics departments.
- *Guidelines for Programs and Departments in Undergraduate Mathematical Sciences, Revised Edition*, MAA, February 2003. Available at www.maa.org/guidelines/welcome.html. This is a must-read for departments. It contains suggestions for undertaking a periodic review, guidelines for appropriate workloads, curricula and teaching methodologies, and so on.

- *Statistical Abstract of Undergraduate Programs in the Mathematical Sciences in the United States (CBMS Survey 2005)*, by David J. Lutzer, Stephen B. Rodi, Ellen E. Kirkman, and James W. Maxwell, AMS, 2007. Available at www.ams.org/cbms/cbms2005.html. Every five years since 1965, the Conference Board of the Mathematical Sciences (CBMS) has compiled a report that examines the status of undergraduate mathematics and statistics in U.S. colleges and universities. The report contains detailed data on timely topics such as enrollments, bachelors' degrees granted, available academic resources, and faculty demographics.
- *Towards Excellence (Leading a Doctoral Mathematics Department in the 21st Century)*, edited by John Ewing, AMS, 1999. Available at www.ams.org/towardsexcellence/. In particular, Chapter 15 discusses the ways deans and provosts view a department with respect to mission money and impact. Chapters 16–18 give the points of view of three department chairs. Chapter 20 specifically focuses on the self-study process and explains how to conduct an external review.
- *Undergraduate Programs and Courses in the Mathematical Sciences: CUPM Curriculum Guide 2004*, written by Harriet Pollatsek et al, MAA. Available online at www.maa.org/cupm/curr_guide.html. This report by the Committee on the Undergraduate Program in Mathematics provides recommendations to guide mathematics departments in designing curriculum for their undergraduate students. It provides details relevant to particular audiences (general education, math majors, teacher education, majors in partner disciplines, and so on). Appendix 5 contains a summary of all the recommendations contained in the document and provides a useful list of criteria for evaluating a department. Appendix 6 contains sample questions for a department self-study.

12.2 Sister disciplines (often within the department)

12.2.1. Computer science

- “A 2007 Model Curriculum for a Liberal Arts Degree in Computer Science,” by the Liberal Arts Computer Science Consortium, *Journal on Educational Resources in Computing (JERIC)*, Vol. 7, Issue 2, June 2007, article 2.
- ABET-CSAC resources. For guidance on assessment planning, see www.abet.org/assessment.shtml. For accreditation criteria, see www.abet.org/forms.shtml#For_Computing_Programs_Only. For information on assessment of student learning, see programassessment.blogspot.com/.
- ACM/IEEE Task Force on the Curriculum, *Computing Curricula 2001*, ACM and IEEE Press, 2002.
- “A Revised Model Curriculum for a Liberal Arts Degree in Computer Science,” by H. M. Walker and G. M. Schneider, *Communications of the ACM*, December 1996, pp. 85–95.
- “A Model Curriculum for a Liberal Arts Degree in Computer Science,” by N. Gibbs and A. Tucker, *Communications of the ACM*, March 1986, pp. 202–210.

12.2.2. Statistics

- *Guidelines for Assessment and Instruction in Statistics Education (GAISE): College Report*, 2005. Available at www.amstat.org/education/gaise/. Endorsed by the American Statistical Association and the American Mathematical Association of Two-Year Colleges.
- “Examples of Statistics Undergraduate Minors/Concentrations/Tracks/ Programs,” by Mary Parker et al, July 29, 2002. Available at www.ma.utexas.edu/users/parker/minors/topexamples.htm.
- “Mathematics and Statistics: Tension and Cooperation,” by George W. Cobb and David S. Moore, *American Mathematical Monthly*, August–September 2002, pp. 615–630.
- “Mathematics, Statistics, and Teaching,” by George W. Cobb and David S. Moore, *American Mathematical Monthly*, November 1997, pp. 1–14.
- “Survey on Statistics within the Liberal Arts,” by Thomas Moore and George Cobb. Available at www.math.grinnell.edu/mooret/reports/LASurvey2003.pdf

12.2.3. Teacher preparation

- *The Mathematical Education of Teachers*, Conference Board on Mathematical Sciences, Issues in Mathematics Education, v. 11, 2001. Available at www.cbmsweb.org/MET_Document/index.htm.
- *Preparing Mathematicians to Educate Teachers* (PMET). PMET is an MAA project funded by the NSF. The PMET Web site contains a comprehensive list of national reports, textbooks, books, bibliographies, Web links, and so on. Available at www.maa.org/PMET/resources.html.
- *Principles and Standards for School Mathematics*, National Council of Teachers of Mathematics (NCTM), 2000. Available at www.nctm.org/standards/.

12.3 Partner disciplines

- *Curriculum Foundations Project: Voices of the Partner Disciplines*, edited by Susan Ganter and William Barker, MAA, 2004. This is a CUPM project to identify needs and trends in other disciplines. The report is often referred to as the “Curriculum Renewal Across the First Two Years” or “CRAFTY” project. Available at www.maa.org/cupm/crafty/cf_project.html.
- *Math & Bio 2010: Linking Undergraduate Disciplines*, edited by Lynn Arthur Steen, MAA, 2005. This volume explores linkages between mathematics and what some are calling the “new biology,” which is increasingly more quantitative, computational, and mathematical. See www.maa.org/mtc/ for project reports and additional references.

12.4 Preparing Students for the Workplace

- *The Society for Industrial and Applied Mathematics (SIAM) Report on Mathematics in Industry (MII)*, 2008. The findings of this report involve both mathematics as a discipline and

mathematicians as practitioners of that discipline. See www.siam.org/about/mii/report.php. This website also contains information and data about the roles of mathematics within nonacademic organizations, applications of mathematics, and opportunities for mathematics. See www.siam.org/about/mii/roles.php.

12.5 Departmental Chairs

- *Leading the Mathematical Sciences Department: A Resource for Chairs*, edited by Tina Straley, Marcia Sward, and Jon Scott, MAA Notes #64, MAA, 2005.
- *Towards Excellence (Leading a Doctoral Mathematics Department in the 21st Century)*, edited by John Ewing, AMS, 1999. Available at www.ams.org/towardsexcellence/.

12.6 Assessment

- *Assessment of Student learning in College Mathematics: Towards Improved Programs and Courses*, edited by Bernard Madison, Association for Institutional Research, 2008.
- *Assessment Practices in Undergraduate Mathematics*, edited by Bonnie Gold, Sandra Keith, and William Marion, MAA Notes #49, MAA, 1999. Available at www.maa.org/saum/maanotes49/.
- CUPM Guidelines for Assessment of Student Learning. See www.maa.org/saum/cases/cupm-guidelines1105-saum.pdf.
- The Indicators Project. See www.mste.uiuc.edu/indicators/default.html. This is a project funded by the NSF; the principal investigator was Kenneth Travers. The main purpose of the project was to develop statistical measures to assist departments in assessing their undergraduate mathematics courses.
- Supporting Assessment in Undergraduate Mathematics (SAUM). See www.maa.org/saum. The SAUM website contains a comprehensive list of assessment references, including “Assessment websites”; “Assessment of Mathematics: Policy and Philosophy”; “Assessment of Mathematics: Case Studies”; and “Postsecondary Assessment: Policy and Best Practices.”
- *Supporting Assessment in Undergraduate Mathematics*, edited by Lynn Arthur Steen, MAA, 2006. See www.maa.org/saum/cases/welcome.html.

12.7 Research Councils

- Council on Undergraduate Research (CUR): Learning Through Research. See www.cur.org/. The mission of the CUR is to support and promote high-quality undergraduate student-faculty collaborative research and scholarship.
- National Research Council (NRC). See www.nas.edu/nrc/. The mission of the NRC is to improve government decision-making and public policy, increase public education and understanding, and promote the acquisition and dissemination of knowledge in matters involving science, engineering, technology, and health.