Outline for the Institution's Quality Initiative Report

Date: August 31, 2012

Name of Institution: Colorado School of Mines **State:** Colorado

Contact Person for Report: Dr. Terry Parker, Provost

Contact Person's email address: tparker@mines.edu

Indicate one of the following: ____ would like a letter of consultation
__X__ do not want a letter of consultation

Overview of the Quality Initiative

1. ***Provide a one-page executive summary that describes the Quality Initiative, summarizes what was accomplished, and explains any changes made to the initiative over the time period.***

   The Colorado School of Mines (CSM or Mines) submitted a proposal to the HLC titled "Developing a Unified Approach to Assessment at Colorado School of Mines." As part of that proposal and at the request of the Provost, the Assessment Committee developed the following goals for the Quality Initiative:

   A. CSM will implement a unified approach to assessment at both the undergraduate and graduate levels that will satisfy both HLC and ABET requirements. Objectives, outcomes, and assessment methods will be developed by individual programs.

      Progress: We created a five-step process to guide programs' development of a complete cycle of assessment. This process is based on best practices (as defined by the HLC and ABET) in assessing student learning outcomes. It requires programs to develop outcomes and objectives, develop a plan to measure the outcomes and objectives, implement these measures on a regular basis, use the information for improvement, and document those improvements. Faculty have autonomy in developing objectives and outcomes, selecting assessment measures, implementing their assessment plans, and determining how they will use the results. The Assessment Committee developed a new annual assessment reporting process to hold undergraduate programs' accountable for implementing this assessment process. The committee developed a rubric for evaluating the assessment reports and provided written feedback, based on the rubric, to the faculty. The Assessment Director also met individually with each program to discuss the committee's feedback. The review of the annual reports highlighted opportunities for improvement and served as the basis for the Assessment Committee's and Director's efforts to educate and assist faculty with implementing best practices in student learning assessment.

   B. All undergraduate and graduate programs, as well as the Core Curriculum, will develop and implement assessment plans and participate fully in the assessment process.

      Progress: While undergraduate programs had engaged in assessment prior to the implementation of this Quality Initiative project, substantial progress has been made in refining outcomes, developing a wider variety of meaningful assessment measures, and using assessment results to improve students' learning at the undergraduate level. The Core Curriculum committee implemented several new initiatives to assess the entire Core; assessment of individual Core Curriculum courses is ongoing. The Dean of Graduate Studies implemented a pilot project to develop and assess learning outcomes and objectives for the Ph.D-granting programs. We pilot tested four assessment methods to assess Ph.D.-level outcomes and objectives. A similar assessment process will be implemented in 2012-13 for the master's programs.

   C. CSM will communicate the efforts of assessment activities to various constituencies.

      Progress: A newsletter, website, campus-wide meetings, and individual consultations have been the primary strategies used to communicate best practices and support our unified approach to assessing student learning outcomes. Assessment information is communicated to faculty, administrators, students, and the Board of Trustees.

   D. The School will hire an Assessment Director to support departmental efforts and to coordinate institution-wide assessment of student learning outcomes.

      Progress: Mines' first Assessment Director, who has 20+ years of experience in supporting both regional (HLC) and programmatic accreditation efforts, assumed her duties in May 2011. The Director meets with department chairs and assessment coordinators on an ongoing basis to assist departments in enhancing their assessment efforts.

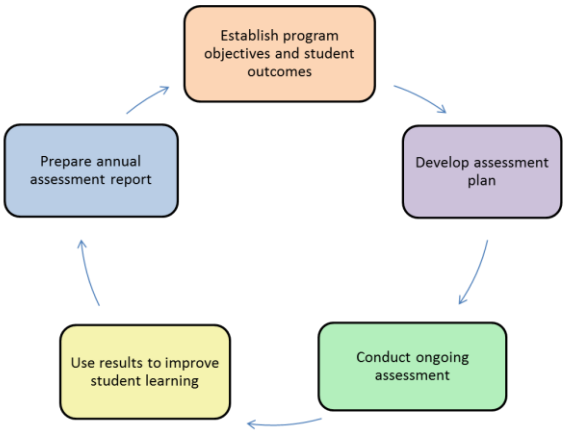
Scope and Impact of the Initiative

2. ***Explain in more detail what was accomplished in the Quality Initiative in relation to its purposes and goals. (If applicable, explain the initiative's hypotheses and findings.)***

Overview

At Mines, objectives, outcomes, and methods of assessment have historically been developed by individual academic programs. However, we are moving to a more central and uniform assessment process that looks at both programs and coupled pieces of the curriculum. We have developed a uniform assessment process (Figure 1) that guides our efforts regardless of program or program level. Newsletters, websites, and partnerships with entities such as Mines' Center for Engineering Education communicated the steps in this process to the campus community.

Figure 1: Programmatic Assessment of Student Learning Process



CSM has adopted ABET definitions for campus-wide use, to reduce the potential confusion that could arise as a result of using varying terminology among programs. Below are the definitions that we adopted:

Program Educational Objectives: Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation.

Student Outcomes: Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.

Significant progress in assessing student learning outcomes is described below for the following academic areas: undergraduate degree granting programs, the Core Curriculum, and graduate degree-granting programs.

2A. Assessment Accomplishments Related to Undergraduate Degree-Granting Programs

In Summer 2011, a steering committee of the Assessment Committee designed a uniform annual report process for undergraduate programs. (See http://inside.mines.edu/UserFiles/File/Assessment/Annual%20Assessment%20Report.docx) The annual report process was intended to

1.) Provide documentation of the critical steps in developing and implementing an assessment plan (see Figure 1).

2.) Regularize the reporting of programmatic efforts related to assessment.

3.) Provide a structure for programs to report assessment information that would meet the needs of the School, ABET, and the Higher Learning Commission.

4.) Reinforce the importance of using assessment results and engaging in ongoing continuous improvement efforts.

In Fall 2011, undergraduate programs submitted their assessment reports for activities undertaken in 2010-11. (Note that Mines restructured some of its academic programs in 2011-12. Programs that are listed below were in existence in 2010-11.)

The Assessment Committee reviewed the assessment plans and assigned a rating (undeveloped, developing, established, or exemplary) for each of the five components of a complete assessment plan. These ratings are based on a rubric that was developed by the committee. (See the rubric at http://inside.mines.edu/UserFiles/File/Assessment/rubric.pdf). Using the rubric has resulted in the committee providing consistent feedback to departments regarding their assessment efforts. To encourage faculty to carefully consider the Assessment Committee's feedback, the Fall 2012 annual report will include a question asking how faculty used the committee's feedback to improve their assessment efforts. In addition, the Provost's office will engage programs with low levels of assessment to improve their overall effort to acceptable levels. Below is a summary of our review of the assessment plans:

Strengths:

- All ABET accredited programs have developed objectives and outcomes that are consistent with ABET expectations.
- Many programs have implemented a variety of direct and indirect assessment methods to measure attainment of the objectives and outcomes.
- Many programs that have undeveloped or developing plans have identified strategies for addressing their shortcomings.
- Most programs engage in informal assessment activities and in discussions regarding strategies for improving student learning.

Opportunities for improvement:

- Several programs are gathering quite a bit of information, but not documenting how they have used that information to improve student learning.
- Faculty involvement in formal assessment activities is limited to a small subset of faculty in some departments.
- Faculty are continually making improvements to their courses, but these improvements are often based on anecdotal evidence rather than on evidence resulting from assessment activities.
- Some programs have not yet defined performance criteria for the objectives and outcomes.

Table 1: Assessment Committee's Review of Undergraduate Program Assessment Reports: Academic Year 2010-2011

Program	Program Objectives	Student Outcomes	Plan	Implementation	Action/ Response
Chemical Engineering	Exemplary	Established	Established	Established	Established
Chemical and Biochemical Engineering	Exemplary	Established	Established	Established	Established
Chemistry and Geochemistry	Established	Established	Undeveloped	Developing	Developing
Economics and Business	Developing	Developing	Undeveloped	Undeveloped	Undeveloped
Engineering	Developing	Developing	Developing	Developing	Developing
Engineering Physics	Established	Established	Exemplary	Exemplary	Developing
Geology and Geological Engineering	Developing	Developing	Developing	Undeveloped	Undeveloped
Geophysics	Established	Established	Established	Developing	Developing
Liberal Arts and International Studies	N/A*	Established	Developing	Developing	Undeveloped
Math and Computer Science	Established	Established	Established	Established	Developing
Metallurgical and Materials Engineering	Exemplary	Established	Developing	Developing	Developing
Mining Engineering	Developing	Developing	Developing	Undeveloped	Undeveloped
Petroleum Engineering	Developing	Established	Developing	Developing	Undeveloped

*This department does not award undergraduate degrees, so objectives are not relevant to the department.

Table 2: Summary of Undergraduate Assessment Plans: Academic Year 2010-11

	Program Objectives	Student Outcomes	Plan	Implementation	Action/ Response
Undeveloped	0	0	2	3	5
Developing	5	4	6	6	6
Established	4	9	4	3	2
Exemplary	3	0	1	1	0

Figure 2: Summary of Undergraduate Assessment Plans: Academic Year 2010-11

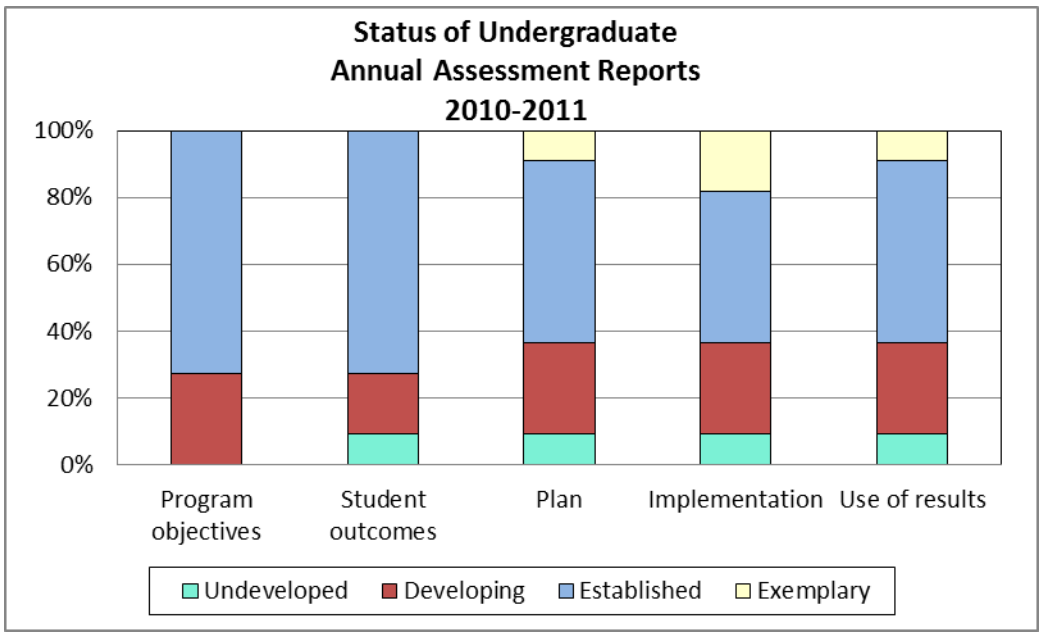


Table 3: Assessment Methods in Use by Undergraduate Programs: Academic Year 2010-2011

	Chemical Engineering	Chemical and Biochemical Engineering	Chemistry and Geochemistry	Economics and Business	Engineering	Engineering Physics	Geology and Geological Engineering	Geophysics	Liberal Arts and International Studies*	Math and Computer Science	Metallurgical and Materials Engineering	Mining Engineering	Petroleum Engineering
Direct Methods													
Senior Exam	X	X					X			X	X		
FE Exam	X	X			X								
Course Assignment/Exam			X			X	X	X	X	X	X	X	X
Design Competition												X	
Portfolio							X						X
Oral Presentation	X	X					X			X		X	X
Written Report								X		X			
Lab Assignment	X	X				X		X				X	
Poster						X							
Final Project	X	X			X	X		X		X		X	
Teamwork Form	X	X											
Recruiter Survey	X	X	X	X	X	X	X	X		X	X	X	X
Visiting Committee							X	X			X		X
Employer Survey/Interview					X		X	X					
Field Session Project						X		X					
Resume Analysis													X
Indirect Methods													
Alumni Survey	X	X			X	X	X	X		X	X	X	X
Senior Interview							X	X			X		X
Senior Survey	X	X				X	X				X	X	
Field Session Survey			X										

*Note that this program does not award undergraduate degrees.

The Assessment Committee's written response to each department included recommendations for strategies that faculty could use to enhance their assessment efforts. The committee supported departments' efforts to make these enhancements by doing the following:

1. The committee sponsored a workshop with the Center for Engineering Education to showcase the use of assessment results to improve student learning. Presenters included faculty members from four programs.

2. The Assessment Director contacted each program in January 2012 to offer assistance and/or clarification regarding the written feedback provided by the committee. These consultations are ongoing.

3. We developed a mini-grant process to support new and innovative assessment efforts. See http://inside.mines.edu/Assessment-Resources.

4. In order to reduce the need for departments to assess all outcomes, we have discussed strategies for assessing skills, such as communication, which are relevant to all undergraduate programs.

5. We shared information about best practices by:
   - Creating a repository of sample plans on the assessment website. See http://inside.mines.edu/Assessment-Resources.
   - Distributing a "best practices" checklist. See http://inside.mines.edu/Assessment-Create-Implement-Plan
   - Including examples of best practices at Mines and at peer institutions in the assessment newsletter (*Achieving Student Learning Outcomes*, which is online at http://inside.mines.edu/Newsletters).

6. A subcommittee of the Assessment Committee (along with other campus representatives, including Student Life) evaluated software options to support data management/analysis functions that would support assessment and accreditation. We made a recommendation to the Provost regarding this software.

7. A subcommittee of the Assessment Committee collaborated with the Dean of Graduate Studies to implement a pilot project to assess Ph.D. program outcomes/objectives.

As a result of this committee's efforts, faculty have shifted their focus from gathering assessment information to using that information to support student learning achievement. While many departments have been "closing the loop" and making program improvements based on assessment information, we have made substantial progress in increasing faculty engagement in making data-based decisions related to student outcomes.

2B. Assessment Accomplishments Related to the Core Curriculum

In 2009, faculty began the process of Core Curriculum revision and changes to the Core were implemented in 2010-11. To assess the effectiveness of these changes, the Core Curriculum Committee took the following actions in 2011-12:

1. The committee reviewed the core curricula at peer and aspirant institutions. As a result of this review, we determined that our Core, while uniquely focused on STEM disciplines, was consistent with requirements at other institutions.

2. The committee discussed the *Engineer of 2020* report and examined the Fundamentals of Engineering exam content, which provide insights regarding employers' expectations of engineers.

3. We developed an alumni survey; response rates were very low. However, most respondents gave high ratings to the extent to which Mines contributed to their development of essential learning outcomes.

4. We conducted focus groups of senior students to obtain their feedback regarding the effectiveness of the Core. Students reported that the Core provided the necessary foundation for upper level courses. They found value in the breadth/depth of classes required in the Core, but were frustrated by the non-standardization of Core course content.

5. We surveyed faculty regarding their knowledge of and perceived effectiveness of the Core. Results indicated that a large proportion of survey respondents were not knowledgeable about and/or were unable to rate the Core. We are brainstorming strategies to address this issue.

6. We administered a senior survey to obtain students' feedback about their learning experiences at Mines. Most students gave high ratings to the extent to which their education at Mines contributed to their development of essential skills and abilities.

7. We have evaluated standardized exams as possible mechanisms for measuring Core learning outcomes. As a result of our review, we concluded that nationally normed exams do not adequately assess our STEM-focused curriculum.

8. We are collaborating with the Student Life administrators to modify new student orientation so that it places a greater emphasis on the purpose, structure, and content of the Core.

9. In addition to creating a Blackboard site, we created a repository of information at http://inside.mines.edu/Assessment-Core-Curriculum.

While the Core Curriculum Committee has focused on the effectiveness of the Core as a whole, departments are responsible for assessing the individual Core courses. These efforts have been underway for many years and documentation of changes to individual Core courses is extensive. Table 4 displays the departmental assessment methods used to assess Core courses.

As part of this Quality Initiative, we have developed assessment processes that verify that the Core curriculum provides a strong foundation which supports students' learning and success in upper level courses. Our assessment efforts have enabled us to verify that that the Core is appropriate in size, scope, depth, and breadth to enable our students to be successful employees and graduate students.

Table 4: Course-level Assessment of the Core Curriculum
Academic Year 2011-12

	Direct Methods									Indirect Methods		
Common Core:	FE Exam	Nationally Normed/ Standardized Exam	Lab Quizzes/ Reports	Exams, Quizzes, Assignments	Portfolio	Group Activities	Client Survey	Pre and Post-Test	Peer Evaluation	Alumni Survey	Current Student Survey	Senior Survey
CHGN121: Principles of Chemistry I			X	X								
CSM101: Freshman Orientation and Success				X							X	
EBGN201: Principles of Economics		X		X								
EPIC151: Design EPICS I				X	X	X	X		X		X	
EPIC251: Design EPICS II				X	X	X	X		X		X	
LAIS100: Nature and Human Values				X								
MACS111: Calculus for Engineers I				X		X						
MACS112: Calculus for Engineers II				X		X						
MACS213: Calculus for Engineers III				X		X						
MACS315: Differential Equations				X								
PAGN101: Physical Education I				X								
PAGN102: Physical Education II				X								
PHGN100: Physics I		X		X		X						
SYGN200: Human Systems				X							X	
Distributed Core:												
BELS101: Biological and Environmental Systems				X				X			X	
CHGN122: Principles of Chemistry II			X	X								
CSCI101: Introduction to Computer Science				X								
DCGN 209: Chemical Thermodynamics			X	X								
DCGN 210: Engineering Thermodynamics	X			X								
DCGN241: Statics	X											
DCGN381: Electrical Circuits, Electronics, and Power				X								
EGGN371: Thermodynamics				X								
LAIS4/3xx: Humanities and Social Sciences				X								
PHGN200: Physics II		X	X	X		X					X	
SYGN101: Earth and Environmental Systems												

Our culture of assessment is expanding beyond undergraduate degree-granting programs and beyond the Core Curriculum. During 2011-12, we began implementing assessment methods for academic enrichment offerings that are offered at Mines. Space limitations prevent us from describing all of our efforts, selected examples are below.

- The Assessment Director collaborated with the Director of International Programs to implement an overseas study student feedback process. While student feedback had been solicited in the past, it focused on students' satisfaction with their overseas study experiences rather than on the achievement of learning outcomes. Results of this assessment have informed our efforts to increase the number of students who study off campus, measured students' achievement of the ABET outcome related to understanding engineering in a global context, and provided insights into best practices for structuring a variety of off-campus learning opportunities.
- When the Engineering Department piloted its first three-week (rather than 16-week) offering of the Dynamics course, the Assessment Director met with the faulty member who taught the course to develop a plan for assessing this course.
- The Chemical and Biological Engineering department received a NSF-funded Research Experiences for Undergraduates grant. The Assessment Director and Principal Investigator developed outcomes, assessment methods, and a plan for implementing these assessment measures for this grant.
- The Assessment Director collaborated with the Ethics Across Campus Committee regarding assessment of a course, online ethics training, and an experimental online ethics discussion project.
- Collaboration between the McBride Honors program director and the Assessment Director is ongoing. We are in developing outcomes and assessment methods for the newly restructured honors program.

These assessment activities have enabled us to strengthen our academic programs and enhance our culture of using assessment information to improve students' learning and experiences. We recognize the importance of assessing pilot projects prior to implementing these projects campus-wide. We strive to make the best use of instructional funds and the assessment information that we have gathered enables us to justify funding programs that enable students to achieve institutional, programmatic, and course-level learning outcomes. Our assessment of grant-funded projects enables us to demonstrate to funders that we allocate resources to maximize students' achievement of learning outcomes.

2C. Assessment Accomplishments Related to Graduate Degree-Granting Programs

Nationally, assessment of graduate programs mirrors our experience in that assessment of our graduate programs lags behind that of our undergraduate programs. The transition to implementing graduate assessment has necessitated a change in our culture.

The committee drafted objectives and outcomes for the Ph.D. programs. These objectives and outcomes were presented to the academic community in September, 2011 and were formally approved by the Graduate Council and Faculty Senate in Spring, 2012. To assess these outcomes and objectives, the committee implemented a pilot doctoral assessment project to achieve the following: 1.) Obtain baseline assessment information from which we could compare future programmatic progress. 2.) Implement a variety of assessment methods, get feedback from programs on the usefulness of these methods, and begin to build a suite of graduate assessment best practices that all programs could use.

The pilot project initially focused on doctoral programs, with future efforts planned for the master's programs. The pilot project consisted of five assessment activities that were implemented in various Ph.D.-granting departments during 2011-12. The assessment activities included the following:

~~1.~~ Graduate Student Exit Survey: This survey requests students' input on disciplinary aspects of the program and the cultural experiences of working toward degree. This assessment activity is

directly aligned with the institutional objectives/outcomes and with the draft Graduate Student Bill of Rights and Responsibilities.

2. Thesis Committee Reporting Form: This form provides systematic documentation of students' progress toward degree completion. It is intended to enable students and faculty members to address any concerns about the quality of students' work as the students progress through their programs.

3. Oral Presentation Assessment Rubric: This rubric provides systematic documentation of students' oral presentation skills.

4. Research Impact Questionnaire: This questionnaire is completed by Ph.D. advisors (who have had candidates who defended within the past three years) to determine the extent to which students' work advances the state of the art of their disciplines.

5. Ph.D. Retention and Completion Analysis: The Office of Graduate studies completed a detailed review of retention and completion rates for all doctoral degree granting programs. This activity included time-to-degree analysis and comparison to national norms.

Table 5: Ph.D. Assessment Methods and Relationship to Objectives and Outcomes

	Educational Objective 1	Educational Objective 2	Educational Objective 3	Student Outcome 1	Student Outcome 2	Student Outcome 3
Exit Survey				X	X	X
Thesis Committee Reporting Form	X	X				
Oral Presentation Rubric				X	X	X
Research Impact Questionnaire	X		X	X		X

To distribute the workload of this pilot project, the Graduate Dean chose different departments to participate in different components of the project. This schedule was based on the assessment methods several departments had already been using and on a desire to ensure that no department was burdened with implementing more than two of assessment activities.

We obtained IRB approval for these projects, assisted departments in compiling results of these assessment methods, and shared results with the Research Council, Graduate Council, and Assessment Committee. In Summer 2012, we will solicit feedback from faculty regarding the usefulness of the information gathered and facilitate discussions of how faculty can use the assessment information to improve students' achievement of the objectives and student outcomes.

The Dean of Graduate Studies has played a significant role in promoting assessment of student learning outcomes. The Dean approved revisions to the new course proposal form to emphasize student learning outcomes and pedagogies to enhance student learning. An example of the School's dedication to improving student success is the piloting and formal implementation of a graduate student orientation course (SYGN503: Tools for Success: Integrating into the Mines Community). The course was an opportunity for students who had the foundational communication skills to be admitted into a highly competitive degree program but who may have needed additional support in fully acclimating to our campus environment. The course was intended to assist students in understanding expectations, developing effective professional relationships, and adapting to change. As part of the first pilot offering of this course, the Assessment Director collaborated with the faculty member who taught the course to develop learning outcomes and assess the course.

These assessment activities have enabled us to identify best practices in supporting student learning across departments. We have begun to share these best practices campus-wide so that all graduate

students can achieve the program objectives and learning outcomes that characterize a successful graduate education. We recognize the importance of faculty autonomy in creating and delivering graduate programs, but have used results of the graduate assessment pilot project to engage faculty in discussions of variations in student quality (as measured by research impact of the students' dissertations.) We have engaged faculty in conversations regarding publication expectations for graduate students at Mines, to ensure that our expectations result in all students successfully advancing the state of the art of their disciplines.

3. ***Evaluate what worked and what did not during implementation.***

Our successes included the following:

- Reconvening of the Core Curriculum Committee.
- Implementing a standardized annual reporting process for undergraduate programs.
- Using a rubric to evaluate the annual reports.
- Implementing a pilot project to assess Ph.D. level learning outcomes and objectives.
- Hiring a full-time Assessment Director who developed resources, shared best practices, provided many individualized consultations, and centralized the gathering of some assessment information.
- Allocating a budget for assessment support.
- Forming an ad hoc software review committee.

We are still developing a shared understanding that assessment goes beyond ABET and that it is a mechanism for continuous improvement throughout the institution, not just in ABET-accredited programs. Some departments are in the early stages of implementing their assessment plans.

Various faculty from each department participate in assessment activities related to their programs. However, not all faculty members have expertise or interest in assessment activities. It would be beneficial if a broader range of faculty would engage in assessment of student learning outcomes.

4. ***Evaluate the impact of the initiative, including any changes in processes, policies, technology, curricula, programs, student learning and success that are now in place in consequence of the initiative.***

Overall impact: We conclude that the assessment process that we have implemented has accomplished two primary objectives: 1. Provided faculty with a consistent method, based on best practices, for implementing assessment at the institution, program, and course levels. 2. Facilitated the use of assessment information for the improvement of student learning. Each department can describe how they have changed program requirements, individual assignments, advising strategies, lab experiences, off-campus learning experiences, the use of technology, etc. based on assessment information that they have gathered.

One strategy we implemented to help build a culture of assessment was recognition of the importance of listening to faculty members' ideas regarding student learning and assessment. The Assessment Director met with department chairs and/or assessment contacts on a regular basis and has helped them develop solutions to challenges related to assessment. For example, in Summer 2011, the Assessment Director received feedback from faculty that the management of assessment data was time consuming and inefficient. In response, she convened an ad hoc committee to evaluate assessment and accreditation software options. The ad hoc committee included faculty and administrators from several academic departments and Student Life. We developed criteria for evaluating the software, attended webinars, spoke with vendors, and made a recommendation to the Provost regarding this initiative.

During 2011-12, departments made significant strides in transitioning from implementing "undeveloped" or "developing" to "established" assessment plans. Faculty continually modify courses, assignments, and programs. We have extensive documentation that demonstrates how assessment results have influenced these modifications (although some departments need to enhance their documentation of improvements that occur in response to the assessment information.) Examples below demonstrate that faculty are committed to using assessment information for program improvement and are engaging in continuous improvement of their assessment plans.

- Most departments convene an annual faculty retreat where they discuss assessment results for individual courses and/or the program as a whole. Faculty continually modify courses based on assessment results. They discussed the impact of these modifications at the subsequent year's retreat, to ensure that the modifications were successful.

- Faculty who teach Core Curriculum courses have been particularly attentive to the importance of students' achievement of learning outcomes as preparation for subsequent Core and major courses. At the Physics Department annual assessment retreat, faculty discussed Physics II within the context of the required calculus sequence to ensure proper sequencing of mathematical concepts. At the retreat, faculty also discussed the effectiveness of their restructured introductory Physics sequences courses. Several years ago, Physics implemented a Studio Physics environment in order to improve student learning outcomes, increase success rates in the course (by lowering the number of student who earn failing grades and/or withdraw from the course), and support learning by supplementing very large lecture courses with smaller course sessions. The department's success in achieving these goals has inspired other departments to consider pedagogical strategies that are similar to Studio Physics.

- As a result of assessment information that revealed that students were enrolling in EGGN320 (Mechanics of Materials) without sufficient knowledge of the analysis of determinate systems, Statics (DCGN241, the prerequisite course to EGGN320) implemented online homework. The online homework system (called "Mastering Engineering") served as a mechanism for students to reinforce critical concepts and apply those concepts in both DCGN241 and EGGN320. Exam scores increased significantly after the implementation of "Mastering Engineering" (which is now used in both EGGN320 and DCGN241).

- The College of Engineering's assessment results indicated that outcomes were not being achieved in EGGN382 (Linear Circuit Analysis). In response, the faculty revised the course to emphasize circuit analysis techniques while removing content regarding electronics and power systems. This is just one of many examples of a change made by faculty to improve student learning. Assessment results have resulted in substantial curriculum revisions (adding free electives, changing co-requisites, and changing pre-requisites) in the College of Engineering.

5. ***Explain any tools, data, or other information that resulted from the work of the initiative.***

- The Assessment Director created a website, which is a repository of best practices, a FAQ, rubrics, sample assessment plans, a list of classroom assessment techniques, and other resources. She also created a Core Curriculum website to share the work of that committee.
- We convened an ad hoc committee to evaluate assessment and accreditation software options. Currently Blackboard serves as a central repository of assessment plans.
- In Fall 2011, the Assessment Director began to publish the "Achieving Student Learning Outcomes" newsletter, which includes examples of how assessment results have been used to impact student learning. Engineering departments at other institutions, as well as units at Mines, serve as examples of best practice. The newsletter includes examples of classroom assessment techniques, links to national debates related to student learning, and results of School-wide surveys.

- The Assessment Committee developed a new annual reporting template for the undergraduate programs. This template is consistent with ABET expectations and emphasizes the importance of using information for program improvement.
- The Assessment Committee developed a rubric to assess the undergraduate assessment reports.
- We administer alumni surveys, senior surveys, and employer surveys in order to provide departments with assessment information related to the School-wide learning outcomes. We offer to customize the surveys in order to provide faculty with program specific outcome information.
- School-wide information about Ph.D. outcomes and objectives is now available.

6. ***Describe the biggest challenges and opportunities encountered in implementing the initiative.***

   Challenges remain in the following areas:

   - Developing a shared understanding that assessment is a mechanism for continuous improvement of student learning throughout the institution, not just in ABET-accredited programs.
   - Using existing information to inform program improvement.
   - Expanding our culture of assessment by engaging faculty who are not currently involved in assessment.
   - Continuing initiatives related to assessment of graduate programs and institutionalizing effective assessment activities.

   Our successes have resulted from taking advantage of the following opportunities and strategies:

   - Reconvening the Core Curriculum Committee.
   - Implementing a standardized annual reporting process for undergraduate programs.
   - Creating a rubric for the review of the annual reports.
   - Assessing outcomes in overseas study programs, in new course structures (three-week off-campus courses), and in new course offerings.
   - Implementing an extensive pilot project to assess learning outcomes and objectives at the Ph.D. level.
   - Using a variety of strategies to communicate assessment information to the campus.
   - Centralizing the gathering of information to measure School-wide outcomes and objectives.
   - Allocating an operating budget to support initiatives such as mini-grant projects.

Commitment to and Engagement in the Quality Initiative

7. ***Describe the individuals and groups involved at stages throughout the initiative and their perceptions of its worth and impact.***

   The Provost, Dean of the College of Engineering and Computational Sciences, and Dean of the Graduate School have been strong advocates for assessment at Mines. The Provost supported the hiring of an Assessment Director and provides funding for the ongoing assessment of student learning outcomes. As described in Section 2C, the Dean of the Graduate School has led substantial efforts to assess graduate outcomes. The Assessment Director has initiated many new programs and has developed extensive resources to support faculty members' efforts.

   Assessment Committee members include the Director of the Center for Engineering Education, the Assessment Director (who chairs the committee), and faculty members who represent various

programs. The Core Curriculum Committee also includes faculty from across the campus as well as a representative from Student Life. Influential faculty members who serve on these committees have been strong advocates for student learning and assessment.

8. ***Describe the most important points learned by those involved in the initiative.***

   Faculty participation has been crucial to the success of this Quality Initiative. We are fortunate that very dedicated faculty members serve on the Assessment Committee and the Core Curriculum Committee.

   Faculty appreciate the centralized gathering of assessment information via focus groups and surveys. We are seeking additional opportunities for School-wide assessment of learning outcomes that are common to all programs, so that faculty can focus their efforts on assessing outcomes and objectives that are unique to their programs.

   As departments have developed their ABET self study reports, they have appreciated the very intentional overlap between the annual reporting requirements and the ABET self study report requirements. Rather than implementing assessment reporting as an "add-on" that is perceived as additional work that is of limited value, we created an annual reporting process that is directly aligned with the ABET requirements.

   The Provost has strongly supported Mines' assessment efforts. Funds are sufficient to support our ongoing assessment of student learning outcomes. Although Mines is a very research focused institution, student learning remains an important priority for faculty and administrators. We have a shared understanding of the challenges that remain and have identified potential strategies for addressing these challenges. We view assessment as a long-term cyclical process, not as a one-time event, so we expect that opportunities and challenges will arise as we continue to institutionalize our assessment efforts.

Resource Provision

9. ***Explain the human, financial, physical, and technological resources that supported the initiative.***

   - Hiring a full-time Assessment Director has been a substantial commitment of resources.
   - Despite declining state funds available to the School, we are very fortunate that operating funds are sufficient to support current assessment efforts and to fund mini-grants.
   - Another significant resource that we have employed is faculty time. As described above, faculty graciously serve on the Assessment Committee and the Core Curriculum Committee. Department chairs, assessment coordinators, (and administrators such as the Graduate Dean) have all invested considerable time and energy to improving student learning.
   - The department of Computing, Communications and Information Technologies has provided needed resources related to website development.

Plans for the Future

10. ***Describe plans for ongoing work related to or as a result of the initiative.***

    - Ownership of the Core is dispersed among the departments that offer Core courses. As a result, additional efforts to assess the Core Curriculum are needed. The Core and Assessment Committees will evaluate options for direct measures of institution-wide student learning outcomes. However, we do not support the idea of administering standardized exams just for the sake of doing so.
    - The Provost has supported the formation of a working group to develop strategies for enhancing teaching, learning, assessment, and student success. This group will be very intentional about

emphasizing student learning outcomes within the context of best practices in teaching. One of the goals of this group is to enhance the alignment between learning, teaching, and assessment.

- Mines aspires to achieve the following level of maturity in our assessment efforts:

  > "An effective assessment program should spend more time and money on using data than on gathering it…providing support for making changes in response to the evidence."
  >
  > Banta T., Blaich, C. (2011, January/February). Closing the assessment loop. Change: The Magazine of Higher Learning, 22-27.

- Many faculty agree that assessment of student learning outcomes is an important aspect of our continuous improvement efforts. Despite this, we need to be diligent in continuing the good efforts that are underway after the ABET visits occur in September/October 2012.
- As displayed in Table 1, some departments need to enhance their assessment efforts so that they achieve a rating of "established" on an annual basis. The Assessment Director and the Assessment Committee will provide support for these efforts.
- Graduate level assessment will be formalized. We anticipate developing an annual reporting process for the graduate programs that is similar to the process for undergraduate programs. We will also develop mechanisms for assessing master's level objectives and outcomes.
- Several members of the Student Life division are expanding efforts to develop and assess student learning outcomes. The Assessment Director has consulted with staff in new student orientation, housing, and student development regarding assessment of outcomes in those areas. These efforts will be ongoing.

11. ***Describe any practices or artifacts from the initiative that other institutions might find meaningful or useful.***

- Assessment mini-grant funds are a useful mechanism for supporting faculty members' efforts.
- In many departments, the assessment coordinator is not the department chair, which is beneficial because it disperses the workload and develops expertise among the faculty.
- The pilot assessment projects at the graduate level could inform other institutions' assessment efforts.
- Providing opportunities for faculty members to share examples of how they use assessment results has been beneficial.