AC 2012-5387: ASSESSMENT OF STUDENT OUTCOMES USING INDUSTRY-ACADEMIA ASSESSMENT TEAMS

Dr. Kevin G. Sutterer, Rose-Hulman Institute of Technology

Kevin Sutterer is pofessor and Head of civil engineering at Rose-Hulman Institute of Technology in Terre Haute, Ind. He received B.S. and M.S. degrees in civil engineering at the University of Missouri, Rolla, a second M.S. in civil engineering at Purdue University, and a Ph.D. from Georgia Institute of Technology. Although his specialization is geotechnical engineering, he has consulted in environmental and structural engineering as well and currently teaches courses in geotechnical and structural engineering. Sutterer was a geotechnical consultant with Soil Consultants, Inc. of St. Peters, Mo., from 1984-1988. He also served as Director of Engineering Services for SCI Environmental of Chesterfield, Mo., from 1988-89 before leaving practice to pursue his Ph.D. Sutterer was an Assistant Professor at the University of Kentucky from 1993-1998, and has been a faculty member at Rose-Hulman since then. He is currently Director of Rose-Hulman's Engineering Forensics Research Institute, and he continues to do some consulting along with his other academic duties. Sutterer has served the Civil Engineering Division of ASEE for nearly 10 years and was Division Chair in 2010-11. He has also served on numerous ASCE committees. In addition to receiving numerous teaching awards over the years, he was selected by Kentucky Society of Professional Engineering and National Society of Professional Engineers as their 1996 Young Engineer of the Year.

Dr. Michael Robinson P.E., Rose-Hulman Institute of Technology
Prof. James H. Hanson, Rose-Hulman Institute of Technology

James Hanson is an Associate Professor of civil engineering at the Rose-Hulman Institute of Technology, where his teaching emphasis is structural analysis and design. He is a member of Rose-Hulman's Commission on the Assessment of Student Outcomes, and has been rating student portfolios for more than eight years.

Mr. Michael C. Reeves P.E., Civil & Environmental Consultants, Inc.
Mr. Andrew B Twarek P.E., Ruby+Associates, Inc.

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Assessment of Student Outcomes
Using Industry-Academia Assessment Teams

Abstract

Rose-Hulman Institute of Technology's (RHIT) Department of Civil Engineering is using assessment teams comprised of industry professionals and faculty members working together to assess student outcomes for continuous improvement. Two approaches are being used for assessment by industry professionals. For the first approach, assessment of some student outcomes is performed by teams of four industry experts during the department's annual Board of Advisors' meeting. This assessment is conducted specifically on senior capstone design reports from the prior academic year. In this approach, faculty members are available to answer questions about the students' work and to receive advice, but not to assess. The department rates multiple student outcomes using this approach.

The second assessment approach is conducted on all other student work submitted for assessment of department-specific student outcomes. In a single year, this requires rating a total of approximately 30 different sets of submissions from students. This assessment is facilitated using RHIT's online electronic portfolio system to allow remote access and rating of student work. Each industry professional is teamed with one faculty member to conduct rating of student work submissions. The teams meet by phone and email regularly during each rating session to discuss the outcome criterion, student submissions, the rubrics for rating submissions, and inter-rater reliability. Upon completion of each rating session, the team provides the department with an overview that includes advice for improving student learning and for criterion or rubric revision, if appropriate.

Permitting industry professionals to work directly with student submissions has accelerated the continuous improvement process in the department. External industry professionals are likely to apply an even higher standard of expectation to student work, and provide insights not readily apparent to faculty members who are immersed daily in facilitating the learning process. This has resulted in a reduction in passing rates for some student work, thus fostering greater leaps in improvement of learning in those outcomes. Team review of student work also facilitates greater levels of cooperation and more frequent deliberate communication between faculty members and industry colleagues, ultimately enhancing student learning through the sharing of ideas between these two groups.

Findings are reported as:
(1) a comparison of passing rate statistics before and after inclusion of industry raters,
(2) reflections on the process by both industry and faculty raters, and
(3) reflections on the process by the administrators of the rating.

We recommend that other institutes consider use of industry raters for student outcomes because of the enhanced continuous improvement and increased collaboration between industry and academia. Programs are cautioned that inclusion of industry raters adds another dimension to the planning that increases the administrative burden, and that passing percentages for student work will likely decrease when industry raters are included.

Introduction

Change is inevitable; growth is intentional. Change in our education programs can be driven by many factors such as the adoption of new technologies, the need to adapt to student learning styles and abilities, or the desire to improve learning efficiency. If we seek to excel in fostering student learning under changing conditions we must be intentional in how we attempt to improve our education programs. To quote Dr. H. James Harrington (Miller and Cioffi, 2004):

> "*Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it.*"

Without measurement of student learning through a quality assessment program we cannot know if change has improved student learning. For engineering programs to excel in fostering student learning, assessment is just as inevitable as change and, more critically, needed for growth.

Continuous quality improvement (CQI) in engineering education involves processes addressing five principles (Rogers, 2010):

(1) Constituent input
(2) Clearly stated educational objectives and student outcomes
(3) Alignment of curricular processes which enable student learning
(4) Collection of evidence through valid and reliable assessment methodology
(5) The use of assessment results to drive decision making for improvement

Program and institution efforts to refine (2), (3) and (5) in the above list can often be successful, but many programs are challenged in development of sustainable programs to address (1) constituent input and (4) valid and reliable assessment methodology.

Rose-Hulman Institute of Technology's (RHIT) institutional research and program assessment unit has a strong foundation for assuring valid and reliable assessment methodology within its processes (Rogers and Williams, 1999). Refinement of constituent input processes, how constituent input can improve the reliability of assessment and impact of constituent input on program improvement is the subject of this paper. Specifically, as a part of its CQI process, RHIT's Department of Civil Engineering is using assessment teams comprised of industry professionals and faculty members working together to assess student learning outcomes for continuous improvement.

Student Outcomes Assessment by Industry Professionals

In addition to students and their families, program constituents include employers, the engineering community, and society at large. Industry professionals, as employers and members of the engineering community and as stewards of society, are primary program constituents. Many engineering programs make use of industry professionals to affirm program educational objectives and to provide input about general preparation of engineering graduates. For example, program industry advisory boards need to cyclically affirm overall program educational objectives and participate in program strategic planning, and sometimes teams of industry

professionals participate in evaluation of student learning through capstone projects (Scales et al., 1998; Napper and Hales, 1999). These efforts are more "top level" reviews or evaluations of the final efforts of the program, but do not address evaluation points throughout the learning process.

Assessment of specific student outcomes by industry professionals is much less common. In a study of 15 engineering colleges who participated in the NSF Engineering Education Coalitions program McMartin and McGourty (1999) found that many of the programs struggled to integrate industry professionals into the assessment process. Cited as a potential barrier to better integration was a lack of trust by faculty that industry professionals would understand what is required to educate an engineer. Yet, it is possible no other body of professionals is better suited to assess and advise program improvement than the very industry professionals who have put to use their acquired knowledge and engineering skills immediately after graduation. In this way they may provide specific input and feedback to bridge the gap between the academic environment and the expectations and realities of the industry.

Face-to-Face Assessment Teams. RHIT's Department of Civil Engineering is using two approaches for industry assessment. The face-to-face approach is not unlike assessment processes used by some other programs in which assessment of some student outcomes is performed by teams of industry experts working face-to-face during the department's annual winter Board of Advisors' meeting. Each team of four industry experts is provided two capstone design reports from the prior academic year and is asked to rate the reports for evidence of satisfactory demonstration of specific student learning outcomes. During these rating sessions, each industry team member independently rates each report, after which the team as a whole comes to a consensus about each report to assure inter-rater reliability. A faculty member is present during each team rating session to answer questions about the work conducted by the students, but does not contribute to the rating. This rating process works well when a collection of student learning outcomes are addressed by a single work of significant volume in which the presence or absence of learning can be quickly identified. The department's senior design reports are well suited for assessing four department student learning criterion related to the **Design** outcome:

Outcome:

Design a system or process in more than one civil engineering context to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, constructability, and sustainability.

Criterion:

(1) Develop design requirements and a project approach that addresses client needs within the constraints imposed by the client, appropriate design standards/laws, and natural limitations.
(2) Identify appropriate alternatives to meet client desires within the constraint imposed and evaluate the feasibility of the alternatives choosing the "best" based upon developed criteria.
(3) Synthesize a detail-level design solution using appropriate design methods and tools.
(4) Document the finished product or process according to standard practice.

Additionally, the department identified senior design reports for the assessment of its second criterion related to **Engineering Impact**:

Outcome:
Explain the impact of engineering solutions on the economy, environment, political landscape, and society; apply the principles of sustainability to the design of engineering systems.
Criterion:
(2) Incorporate sustainability principles in the design of a civil engineering project.

As described later herein, assessment of this last criterion by industry experts helped the department identify necessary improvements in student learning and to incorporate student-specific assessment of this criterion.

"Distance Assessment" Teams. The Department of Civil Engineering collects approximately 30 different sets of submissions of student work for rating through the institute's electronic portfolio system, mostly from junior- and senior-year required courses. Rating of these submissions by teams of two raters is easily facilitated through a web browser interface, with the system automated to regularly check inter-rater reliability and to keep independent raters apprised of each other's progress while rating. This system had been used for years by teams of faculty raters, primarily on campus and often working side-by-side, but there was no reason the system could not be used by non-faculty raters from any location with internet access and a web browser. To improve the department's CQI process with constituent input and to advance collaboration between faculty and industry, the department decided to develop a program for rating student work with teams comprised of one faculty member partnered with one industry professional. The faculty member assigned to each rating session was never the faculty member affiliated with the class assignment. Industry professionals were generally licensed professional civil engineers who remain actively involved in civil engineering practice.

For each rating session, the "distance assessment" teams met by telephone to review the rating process, the assigned student outcome, and the rating rubric to be used. The teams then proceeded with rating student work, meeting by phone and email regularly to address inter-rater reliability conflicts and to complete the rating by preparing guidance for the department and the faculty member(s) associated with the work submitted. Rating sessions generally proceeded over several weeks, with both raters choosing to work on their assigned rating when convenient to their schedules.

The overall distance assessment effort, including rater training, was facilitated by department administration and the staff of the RHIT's institutional research and program assessment office.

Findings

Program educational objectives and student learning outcomes were revised at RHIT between the prior accreditation cycle, 2001-2006, and the current accreditation cycle, 2007-2012. Over that time, the curriculum did not change dramatically and, except for continuing improvement efforts, much of the learning in the department retained similar focus. Changes in objectives and

outcomes were thus a matter of adjusting to trends in civil engineering, accreditation guidelines, and also based on what was learned during the prior accreditation cycle. If CQI is successful, student assessment results would hopefully demonstrate improvement from one accreditation cycle to the next.

Comparison of Passing Percentages. Table 1 depicts simplified student learning outcomes for the prior and current accreditation cycles. The table depicts only those outcomes from both accreditation cycles for which rating teams assessed student work. Similar outcomes between the two cycles are depicted adjacent to each other in the table. New outcomes were added for the current accreditation cycle, so there are no prior outcomes adjacent to those. All rating of student work in the prior accreditation cycle was performed by teams of faculty members. For the current accreditation cycle, rating performed by faculty teams has been differentiated from rating performed by industry teams. The percentage values reported are average student passing percentages for each outcome, keeping in mind that each outcome typically featured multiple

Table 1. Comparison of Average Student Outcomes Assessment Results as Percent Passing for Prior and Current Accreditation Cycles

Prior Accreditation Cycle		Current Accreditation Cycle		Change from Prior to Current
All Are Faculty-Assessed Outcomes		**Faculty-Assessed Outcomes**		
Global	41%	Cultural and Global	82%	+43%
Culture	38%			
Teams	33%	Teamwork	49%	+16%
Communication	39%	Communication	67%	+28%
Ethics	89%	Professional/Ethical	76%	-13%
		Leadership	34%	
		Service	57%	
		Average =	*61%*	*+18%*
		Industry-Assessed Outcomes		
Problem Solving	61%	Engineering Problems*	78%	+12%
		Engineering Tools*	69%	
Interpreting Data	35%	Experiments*	35%	-13%
Experiments	60%			
Design	68%	Design†	98%	+30%
Contemporary Issues	69%	Contemporary Issues*	79%	+7%
		Engineering Impact‡	73%	
Lifelong Learning	98%	Life Long Learning*	92%	-6%
		Business and Public Admin.*	84%	
Average =	*57%*	*Average =*	*68%*	*+6%*

*Assessed by industry/faculty teams using "distance rating."
†Assessed by industry teams during face-to-face rating sessions.
‡Criterion 2, sustainability, assessed first using face-to-face rating, and later using "distance rating"

criteria under the outcome, so the average is reported for student work over multiple years and for multiple criteria. Data unavailable at the time of paper submission has been omitted from the table.

The table shows evidence of the institute and department's effort to improve learning in the program. The average gain of 18% in the passing rate for faculty-assessed outcomes in the upper half of the table can be partly attributed to better rating rubrics, identification of appropriate student work for rating, and student acclimation to preparing appropriately documented work for rating. However, revision of student learning outcomes between accreditation cycles included a decision to "raise the bar" in terms of institute and department expectations for student work, so the improved performance for most outcome areas is encouraging.

The lower half of Table 1 depicts those outcomes for which industry rating was used in the current accreditation cycle. The average improvement for those outcomes is only 6% compared to the 18% gain in the passing rate for faculty-assessed outcomes. Assuming that faculty made the same efforts in improvement of faculty-assessed outcomes and industry assessed outcomes, this reduced rate of improvement in rated student performance may be attributed to the department's efforts to set a higher standard for student learning or unexpected differences revised the outcomes, but it could also be due to the influence of industry raters on the process. As discussed below, the raters believe the inclusion of industry professionals raised the expectations for student work.

In Table 1, all of the industry-assessed outcomes were rated by teams comprised of one industry professional and one faculty member, except for the Design and Engineering Impact criteria. The Design criterion has been and continues to be rated by teams of four industry professionals reviewing senior design reports. The second criterion under Engineering Impact, Sustainability, was rated for several annual cycles using teams of four industry professionals. For that rating, industry professionals challenged whether all members of a senior project team really understood sustainable design principles if only one or two members had actually incorporated sustainable principles into their contribution to the senior project. Because of their daily involvement in the student projects, the department had not discerned this possibility. The department was encouraged by the industry experts to separately ask seniors to describe and reflect on the application of sustainable principles to their senior design project. This change was made, and the students' reflections were then rated using "distance rating" as described herein. This has completed for one annual rating cycle, with students achieving an 81% passing rate with their submissions.

Results of Raters' Surveys. After completion of the 2011 rating sessions, both industry and faculty raters were asked four questions to characterize their impression of the rating experience. The raters were also invited to elaborate on their answer to the questions, if they wished to do so. Table 2 provides the numeric results of this simple survey.

There were a total of five faculty raters and seven industry raters (all responded to the survey), so the results are not statistically significant, although they provide some insights about the perspectives of the raters with respect to the process. Comments made by the raters were found insightful by the authors and are shown in their entirety in Table 3 through Table 6.

Table 2. Results of Survey of Industry and Faculty Raters.

Raters were asked to respond to each statement using the following selection of values: 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree			
Question	Faculty Average	Industry Average	Overall Average
1) Rating submissions of student work using the WXYU electronic portfolio system was NOT difficult.	4.3	4.4	4.3
2) Rating submissions of student work in collaboration with a partner in industry/academia helped me to better understand expectations about student learning from my partner's perspective.	4.3	4.4	4.3
3) Rating submissions of student work in collaboration with a partner in industry/academia caused me to reconsider my own expectations about student learning.	3.8	3.6	3.7
4) Upon completion of a rating session, I believe my partner and I were able to provide input to the Department of Civil Engineering that, if implemented, could improve student learning.	4.0	4.2	4.1

Table 3. Comments Provided about Responses to Question 1: Ease of Using the Electronic Portfolio

Having an on-line document repository that is easily accessible for both the faculty and industry rater is very convenient and an essential part of making the rating process trouble free.
The electronic portfolio system is very intuitive making it easy to navigate and utilize during rating of student submissions.
The user rating system was very user friendly and made it easy to keep organized and on task in reviewing the student submissions. The system provided immediate conflict checks for tracking internal rating reviews and allowed easy navigation through the system to work through any concerns with the partnering reviewer. The one downfall of the system was that in some cases, student work was unorganized in the submittal and a significant amount of time was spent hunting down the information that was actually needed to compare to the criterion. There was no search option to find specific key-words that might lead to the information to accurately review the student submission.
The process of rating documents, in itself, was not difficult. The difficulty arose sometimes in determining how to apply the criteria of the rubric—working with the faculty teammate to decide what divided a "passing" submittal from a "failing." Some submittals were quicker than others, but none seemed too time-consuming.

Table 4. Comments Provided about Responses to Question 2: Helped Me Better Understand My Partner's Expectations about Student Learning

It was very useful to have a second point to calibrate my rating evaluation. For example, there was a rating session where I dismissed a student error as a minor point commonly made by our students. The industry rater pointed out that from their perspective the error was an important point that we needed to consider. Our discussion led me to consider a broader perspective when I consider what the important aspects of an assignment are.
Collaborating during the rating process definitely helped me better understand the expectations of student learning from my partner's perspective. As a person in the industry, my expectations usually always differ at least slightly from that of my partner in academia. I believe combining the expectations of someone from both industry and academia allows the strengths and weaknesses of both viewpoints to complement one another, producing a more balanced expectation.
There were multiple instances where my partner and I rated our initial 3 submissions to find that we varied greatly on deciding which submissions to pass. It was through much thorough discussion and deliberation that we were able to reach a common understanding on what a passing submission should include. Pairing an engineer from industry and academia allowed us to listen to the other's interpretation of the criterion and justify how we thought it best applied to the students' learning expectations.

Table 5. Comments Provided about Responses to Question 3: Caused Me to Reconsider My Own Expectations about Student Learning

Very informative. Especially to know the level of expectations of student learning from a practicing engineer's perspective.
As reported in question 2, it was very useful to have a second point to calibrate my rating evaluation. For example, there was a rating session where I dismissed a student error as a minor point commonly made by our students. The industry rater pointed out that from their perspective the error was an important point that we needed to consider. Our discussion led me to consider a broader perspective when I consider what the important aspects of an assignment are.
During the rating process I never had any of my expectations differ greatly enough from my partner's to make me reconsider. I can definitely see, and agree, that it could cause expectations to be reconsidered though.
The review process allowed me to step back and look at a broader overview of my expectations for student work and the expectation of what is passing. From the industrial side, I quickly realized how little partial credit is given in the real world but also understand I have colleagues that assist in my work. The key in paring with a member from academia was his ability to meet my perception in the middle and find a fair compromise for what should be expected from student performance.
There were definite differences in expectation between myself and my academic partner, but that is part of the process. I think my expectations were a little higher, so it was good to temper that with the faculty's view.

Table 6. Comments Provided about Responses to Question 4: I Believe We Provided Input that Could Improve Student Learning

It is important that the raters' feedback is provided to the course instructor to close the loop and that the course instructor formally addresses the raters' feedback.
In each review case, my partner and I were provided the opportunity to summarize the submissions, their general performance and any themes that were noted throughout the grading process. In particular cases, we were able to make suggestions regarding the technique used to capture the students' understanding of the criterion, the teaching method used to educate the criterion or a curriculum shortcoming that failed to properly introduce the criterion to the student. The input process was collaborative and utilized both the academic perspective and industrial perspective to make the best recommendations based on familiarities of reviewing the submissions. Feedback was constructive and could provide valuable information on improving future coursework or modifying methods of capturing students' understandings.
In some cases, we came up with definitions of how to apply the rubric that we felt comfortable with, but it may be useful for the faculty to discuss our applications and modify the rubric for more consistent expectations in the future. We decided some of the criteria weren't adequately met by the type of submission, or that a different submission (homework, senior project chapter, written commentary, etc) could better serve the learning category.

Tables 2 through 6 provide some useful insight into rating using teams comprised of faculty members and industry professionals. Some general themes are worth noting:

- The rating was not difficult, improved understanding between academia and industry, and left raters with the impression they could prepare the department for improved learning through this process.
- Industry and academic raters had different perspectives and found it necessary to work to calibrate their expectations of student performance.
- Having raters reflect on each rating session and recommend revisions to outcomes, rubrics, or learning activities was an important element for CQI.

Administrators' Reflections. Administration of the face-to-face rating by teams of industry experts was effective. This rating facilitated constituent input on the quality of the prior year's senior design reports. Because many of the industry experts had observed project presentations by some of the prior year's seniors, they appreciated being able to review the final product of the students' work. At the 2011 winter Board of Advisors meeting, however, the Board recommended the rating need no longer occur during face-to-face meetings in order to allow more time for strategic planning and other Board business. The department has thus agreed to continue rating of senior design reports for some outcomes using teams of four industry experts, but to allow the teams to manage the rating by phone call, email, and other remote methods.

Administrators of the "distance rating" conducted rater training, rater scheduling, setup of rating sessions, and interpretation of results. To facilitate training, the department faculty member administrating the rating scheduled a rating session with himself and each new industry rater. The two met by telephone for 45-60 minutes to familiarize the industry rater with the electronic portfolio system and to start the rating session, and then the two raters completed the rating process with reflection and recommendations to the department. The department administrator

also trained those faculty members unfamiliar with the electronic portfolio rating process by scheduling the new faculty member with an experienced industry rater, reviewing the use of the rating system, and then making sure they were available to answer the faculty member's questions during their first rating session. Although this process took significant time, it worked well and assured some consistency in how rating was conducted.

The department administrator also scheduled rating sessions, assigning faculty members to student submissions only if the faculty had not been the instructor for the course from which the submissions had originated. Industry and faculty raters were partnered based on experience, differing but complimentary knowledge of the engineering profession, and other perceived differences in their approaches to rating. Faculty and industry raters did not normally remain rating partners for numerous sessions, as the department administrator judged it beneficial to mix up the rating teams with the eventual objective being to improve consistency of rating between sessions. Because different teams were rating at different paces, and because of schedule mixing of team assignments, the scheduling became confusing at times. This will become less problematic with more experience, but will always be an element that could delay the rating process. To make rating more efficient in the spring of 2012, teams of one industry and one faculty rater were assigned multiple sets of submissions and asked to maintain their own schedule in completing multiple sets of submissions.

Setup of rating and reporting of results was managed by the institute's Director of Institutional Research. Because institute rating of student submissions is conducted annually, setting up industry raters was very similar to the process used to set up on-campus faculty raters for institute-wide rating. Reduction of data was also similar. However, the rating by the department is a continuous process throughout the year, while other institute rating is restricted mostly to summer months. Thus, set up and results reporting was provided on more of an as needed basis and sometimes was needed during times of heavy workload for the institute administrator. This resulted in some long hours working to prepare rating sessions for department needs or summarizing results to meet last minute needs. This could be corrected by better advance planning and scheduling of rating activities.

Perceived Impact of Industry Rating on Learning. The results shown for questions 2-4 in Table 2, and comments in Tables 3-6, suggest both industry and faculty raters learned from each other as part of the rating. The results also suggest student learning was improved. While several examples could be cited to support this, one will be provided herein with respect to students' performance on the Experiments outcome. It is not uncommon for civil engineering students to struggle with meeting expectations related to outcomes in this category. The department has identified two criteria for the Experiments outcome:

> Criterion 1: Develop an experimental program that would obtain the data needed to make an engineering decision in a particular situation.
>
> Criterion 2: Evaluate the validity of results from a civil engineering test.

The department sought to have students demonstrate learning in these two criteria with their work on planning, conducting, and interpreting a geotechnical investigation for their required

junior year soil mechanics course. Similar student work had been used during the prior accreditation cycle with minor success, albeit with some compromises on the part of the faculty raters for those early submissions. While acknowledging the challenge they represent to students, industry raters affirmed the crucial importance of being able to develop and evaluate original data collection efforts, and set high standards for the student submissions. As shown in Table 1, average passing rates for student submissions dropped 35% between the prior and current accreditation cycles. For successive years, industry/faculty rating teams concluded student submissions to these criteria were generally unacceptable. The annual results for the two criteria are shown in Figure 1. The raters provided advice to the department and particularly the course instructor for improving student learning, and continued to emphasize the importance of this learning. Revisions were made annually by the instructor to improve learning, with limited success until the most recent rating cycle. As shown in Figure 1, the student passing percentages have increased to over 65%, a significant improvement over most prior years' results. The instructor and department are optimistic the improvement in student performance for this outcome is a direct outcome of the rating process.

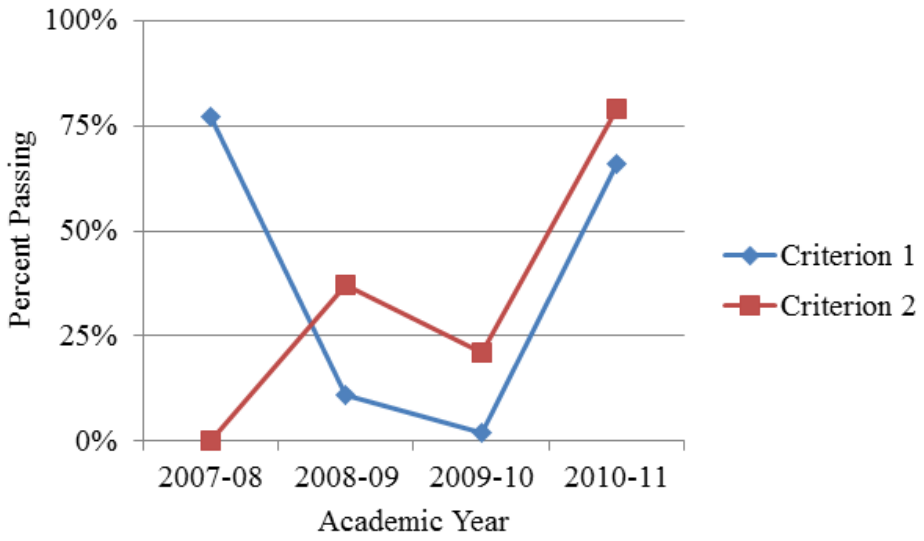

Figure 1. Percent passing of student submissions to Criterion 1 and Criterion 2.

Keys to Adoption

There are only three key ingredients needed to successfully implement an industry-academia assessment program:

1. Enthusiastic, recent alums
2. Engaged faculty
3. Telephone and internet

<u>Enthusiastic, Recent Alums</u>. Lack of enthusiasm to help can significantly slow the process. Long delays between parts of a rating session require the raters to recalibrate. Recalibrating multiples times in order to finish a rating session over several weeks is an inefficient use of time.

Industry raters who are alumni of the program will tend to have a higher interest in helping the program improve. Therefore, alumni raters will tend to be more enthusiastic.

Senior industry representatives often struggle to calibrate their expectations to the undergraduate level. Our experience has been that senior engineers often compare the level of student work with what they expect of their junior engineers with 2-3 years of experience. Recent graduates, say 4-6 years out, have proven to be better able to calibrate their expectations to a brand new graduate. The recent graduates do have the tendency to expect high quality work though. This appears to be motivated by their experiences. Many have commented that the subtle details play a much larger role in their designs than they expected coming out of college. This tendency underscores the importance of pairing industry raters with faculty raters who can help the pair calibrate to expectations of a brand new graduate.

Engaged Faculty. The faculty raters need not understand how the CQI process works in their department in order to rate student work. They must, however, be engaged participants in the process. As with industry raters, if the faculty rater does not value the activity the time required to complete the assessment increases unnecessarily and the quality of feedback to the program decreases.

Some faculty are motivated to participate in the rating process to better understand how the submissions from their courses are being evaluated and how those evaluations are helping the program. Other faculty are motivated by quality interaction with alumni raters. The interaction provides an opportunity to discuss what the alum has found most helpful in their career preparation and what might have been missing.

Technology. This process does not require an electronic portfolio system. The data recorded from a rating session is basically “pass” or “fail” for each example of student work. In order to ensure that the raters are consistently applying the rubric, they rate some of the same submissions. Our first experiences rating student work with faculty-industry pairs used only a telephone and email. We first implemented rating sessions by sending a PDF of the student submissions and a spreadsheet with only two columns: Submission # and Rating. With each rater sitting at a computer and with speaker phones nearby, we rated the first three submissions then compared results to ensure consistency. Once we came to agreement on the ratings, one rater evaluated numbers 4-14 and the other evaluated numbers 14-24. When those blocks were completed, we compared the common submission, #14, and discussed our ratings until we came to a consensus. Once we agreed to the rating of #14, if we did not feel a need to go back and adjust other ratings we proceeded with the next block. A typical rating session of 30-40 student submissions would take one hour.

Adding electronic portfolio software might reduce the upfront work since there is no need to compile all student submissions into a single file. The software also makes it easier for the rating pair to work at different times, but they must wait for the common file to be completed before moving on.

Conclusions

We recommend that other institutes consider use of industry raters for student outcomes because of the enhanced continuous improvement and increased collaboration between industry and academia. Programs are cautioned that inclusion of industry raters adds another dimension to the planning that increases the administrative burden and lengthens the rating schedule, and that passing percentages for student work will likely decrease when industry raters are included.

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