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To: P.W. Davis, Dean IGSD
From: D. DiBiasio, Assessment Coordinator, IGSD

Subject: Results of Summer 2004 IQP Review

Introduction

Periodically WPI evaluates IQP reports completed during selected calendar years. The last full review was in summer 2000. In subsequent years, efforts were directed toward on-campus IQP quality including a focus on the Worcester Community Project Center (WCPC). This past summer we conducted a scaled down review using a random sampling of completed reports. Our goals were to assess current IQP quality and pilot test a sampling protocol. Sampling can reduce the substantial review costs while retaining statistical validity. Those results might then inform continuous improvement and be used as evidence for departments involved in outcomes based accreditation.

Methodology

After two training and calibration sessions, eleven faculty reviewers each read eight reports. This year's evaluation team had five experienced IQP advisors/reviewers and six people who were either relatively new to IQP advising or had not been part of a previous summer review. Eight different academic departments were represented. Reviewers used the IQP review form developed for the summer 2000 review. The form's 33 items probe all aspects of report content and include six outcomes related to engineering department ABET accreditation. At the request of the study committee for a Human Studies Institutional Review Board (IRB) we included a question regarding use of human subjects. Data from that question was forwarded the IRB committee.

I followed the sampling process recommend by Miller, et al.¹ The timeline for recruiting and training reviewers precedes knowing the exact total number of completed reports. I estimated there would be 200 completed reports. Miller, et al recommends sampling about 100 for 90% confidence that the results represent the total cohort. Logistics and lack of more reviewers resulted in eighty seven projects being randomly selected and read from the total list of IQP reports submitted from A03 through E04. The total number of reports completed was 261—quite a bit higher than anticipated.

¹ Miller, J. S. Johnson, and J. Petrucelli, *Sample Size Recommendations for Project Reviews*, WPI memo, March, 2000.

Results

Sampling

The random sample resulted in the review of 57 on-campus reports and 30 off-campus reports. There were 155 on-campus reports and 106 off-campus reports completed during the review period. The reviewed cohort is skewed toward the on-campus group but this was the result from the random sample. Because average team sizes differ between on and off campus, the reviewed cohort is representative of the total cohort on a number-of-students basis. The average on-campus team is 2.1 while that for off-campus is 3.5.

Using the formulas provided in Miller, et al¹ I calculated precisions for the rating item “Overall Report Evaluation”. The five-point rating scale is 1=poor, 3=acceptable, and 5=excellent. The total reviewed cohort had an average rating of 2.79. The calculated precision was 0.19, meaning that there is “90% confidence that the true average”¹ is 2.79 ± 0.19 . Calculations for the on- and off-campus cohorts resulted in averages of 2.37 ± 0.22 and 3.6 ± 0.24 , respectively. Precisions calculated for all other rated items gave similar results. Calculations for the difference in means for the overall quality rating gave an average difference of 1.23 ± 0.18 .

Report Content

Table 1 shows the average ratings for several items related to report content. The results show that, like all previous summer reviews, the off-campus cohorts had substantially higher ratings than on-campus cohorts.

Table 1. Average Ratings for Report Content Items

	On-Campus	Off-Campus
Objectives	3.2	4.3
Background	2.7	3.7
Methodology	2.3	3.5
Results and Analysis	2.3	3.5
Writing/Presentation (ABET 3g)	2.8	3.7
Overall Evaluation	2.4	3.6

Table 2 shows the distribution for the overall evaluation rating. This shows that 63% of the on-campus reports were rated below acceptable compared to 13% for the off-campus reports. And, it shows that 57% of the off-campus cohort produced reports rated very good/excellent compared to 20% for the on-campus cohort.

Table 2. Distribution Results for Overall Report Evaluation Item

Rating:	1	2	3	4	5
ON # projects	16	20	10	6	5
%	28	35	17	11	9
OFF # projects	0	4	9	12	5
%	0	13	30	40	17

Reviewers were also asked to evaluate: “quantity of work seemed appropriate for team size”. This is a Yes=1 and No=0 response. The results are constrained since reviewers only have the report, not knowledge of the total project. The average rating for on-campus reports was 0.63 compared to 0.87 for off-campus reports.

Two review items rate the report for project balance in terms of technological and societal concerns and achievement of IQP goals. The rating scales are different from items reported above. The balance rating is 1=primarily social, 3=well balanced, and 5=primarily technical. The educational goals item lists seven possible goals and reviewers check as many as apply. Table 3 shows the results. They indicate that both cohorts tend to be fairly balanced and both demonstrate about two IQP goals. These numbers are similar to previous years’ results.

Table 3. Average Ratings for Project Balance and IQP Goals

	On-Campus	Off-Campus
Project Balance	3.0	2.6
# IQP Goals	1.9	2.3

Evidence of Accreditation Outcomes

Table 4 show results for the ABET Criterion 3 evaluations. Note that Criterion 3g “ability to communicate effectively” appears in Table 1. With the exception of 3j, ABET outcomes, on average, are not demonstrated by evidence available in reports for the on-campus cohort, but are demonstrated for the off-campus cohort. The implication for departments subject to ABET accreditation is that these outcomes must be demonstrated elsewhere in the curriculum for many students completing on-campus IQPs. Since we did not analyze department-specific data this year (see discussion below), an individual department can get a sense of the problem’s magnitude by examining the percent of its students doing on-campus IQPs.

Table 4. Average Ratings for ABET Criterion 3 Abilities Consistent with IQP Goals

ABET Outcome	On-Campus	Off-Campus
3d—multidisciplinary team ability	2.4	3.9
3f—ethical and professional responsibility	2.7	3.4
3h—impact of engineering in global/societal context	2.3	3.5
3i—life long learning	2.8	3.9
3j—knowledge of contemporary issues	3.1	4.0

I tried to get some sense of the grade distributions since this topic frequently arises in conversations about IQPs. I did not attempt to correlate grade with reviewer rating since the reviewers have only the report for evidence and have no knowledge of the project process and evolution. The database was missing about 50 cases for grade data. The results from the available data are shown in Table 5.

Table 5. Grade Distributions for Reviewed Projects

	On-Campus	Off-Campus
%A	59	74
%B	35	26
%C	6	0

Although the local lore of “go away get an A” is not really discredited, it also appears that “just stay and get an A” might also apply.

Conclusions

Assessing IQP Quality

This summer’s results were no different from all recent reviews in showing the difference between on- and off-campus IQP reports. The problem is not new and we have made no progress in closing the quality gap. We do not currently collect data from students about their IQP experiences so it may be possible that those doing on-campus IQPs (approximately 50% of our students) value their experience. Yet, based upon our own standards a troublesome percentage of project reports do not reflect acceptable work. Another disturbing result is that the percent of reports rated unacceptable (on-campus cohort) was substantially larger this year compared to the summer 2000 results. However, we have to be careful about comparing numbers from previous reviews because reviewers are only calibrated during a given review period and the population of reviewed reports is different for each review period.

Sampling Protocol

I believe a sampling protocol can be used in future reviews to provide a cost-effective IQP evaluation compared to reading all reports. Future reviews should be carefully designed (for example, by engaging statistical expertise) if we want to provide department-specific data. Subgroups should be independently randomized¹ and we need to account for the problem of multiple disciplines within one IQP report. Also, as total populations decrease, the percent of that population that must be sampled for high confidence levels increases and we begin to approach needing to read all reports, if department-specific data is required.

Due to the low sampled cohort this summer I did not report department-specific results. Based upon this year’s summary data and past experience, we can probably predict that such data would look similar to previous reviews.

Recommendations

- Future reviews should use a carefully designed, rigorous sampling procedure to minimize cost and maximize result validity.

- The on-campus IQP experience needs focused attention. If we devote the kind of energy, intensity, and passion that went into improving the off-campus experience we might see similar quality improvements on-campus. Some encouraging efforts are in-progress:
 - Appointment of a faculty member (Kent Rissmiller) devoted to the problem
 - Appointment of the President's IQP commission

- Future reviews of IQP reports are unlikely to yield results any different from this year's until substantial changes are implemented and had time to take effect. We should consider directing evaluating resources toward two understudied areas:
 1. The short and long-term impacts of sponsored projects at the local level. This work would provide evidence, useful in external contexts, about the lasting value of IQPs. It might be particularly valuable in resource development or in generating publications.
 2. The impact of the IQP experience at the student level. This work would provide useful results informing efforts to improve the on-campus experience, and to better understand student attitudes and perceptions about the IQP experience.