1. What student learning outcomes were assessed this year, and why?

The Physics Department Assessment Committee has evaluated one of the Department’s six SLOs for the 2012 fall quarter.

SLO 1  Content Knowledge: Graduates demonstrate a comprehensive knowledge base of the major areas of physics and related disciplines.

This SLO was chosen to investigate whether there was a correlation between a student’s performance on the Major Field Test and their GPA for courses in the major? From a practical point of view, data related to this SLO has been collected over the past several years and was available for evaluation.

The above SLO is related to the following Department, College and University Goals.

- Physics Department Goal 1: Promote Student Learning.
- COTS Goals I & II: Maintain and strengthen an outstanding academic and student life at all sites.
- University Goals I & II: Maintain and strengthen an outstanding academic and student life at all sites.

2. How were they assessed?

A) What methods were used?

Method A: The PHYS 489 course instructor (Dr. Bruce Palmquist) evaluated the first section in the student portfolio: “The graduate will apply the physics concepts to analyze and interpret the physical behavior of systems of intermediate complexity.”

Criteria used to assess this item

Exceeds standard means the artifact: 1) clearly addresses the outcome, 2) is exceptionally well presented, 3) has no errors or the errors have been corrected or reflected upon in a written reflection, and 4) provides overwhelming evidence that the student has met the outcome.
Meets standard means the artifact: 1) clearly addresses the outcome, 2) is well presented, 3) has no distracting errors, and 4) provides sufficient evidence that the student has met the outcome.

Fails standard means the artifact: 1) does not address the outcome OR 1) is not well presented and 2) has numerous errors.

Method B: All students majoring in Physics (BS or BA) are required to take the MFT. Dual-degree physics/engineering students have been permitted to opt out of the MFT. This standardized test is an assessment tool with which the performance of CWU physics students can be compared with physics students across the country. It is expected that performance on the MFT should correlate with GPA for courses in the major. To quantify this relationship, the following indices are defined using the ratio of GPA to MFT score:

\[
\text{MRB Index}_{\text{Intro}} = \frac{25 \times \text{Physics GPA (Intro)}}{\text{MFT Subscore (Intro)}}
\]

\[
\text{MRB Index}_{\text{Advanced}} = \frac{25 \times \text{Physics GPA (Advanced)}}{\text{MFT Subscore (Advanced)}}
\]

\[
\text{MRB Index}_{\text{Coupled - Version A}} = \frac{25 \times [\text{Physics GPA (Intro) + Physics GPA (Advanced)}]}{[\text{MFT Subscore (Intro) + MFT Subscore (Advanced)}]}
\]

\[
\text{MRB Index}_{\text{Coupled - Version B}} = \frac{50 \times \text{Physics GPA (overall)}}{\text{MFT Total Score}}
\]

The CWU courses included in the GPA calculation for the MFT_{Intro} section are PHYS 181, 182, 183, 317, 318, 342, 351, 363, 381, 382, and 383. The CWU courses included in the GPA calculation for the MFT_{Advanced} section are PHYS 301, 331, 333, 334, 352, 361, 463, 474, and 475.

The MRB indices are scaled such that a student with a 4.0 GPA and a perfect MFT score would have an MRB index of 1.0. An index value larger than 1.0 indicates a higher GPA relative to the MFT score, while a value less than 1.0 indicates a higher MFT performance relative to their GPA. Because a perfect MFT score is more difficult to obtain than a 4.0 GPA, typical values of this index are likely to be greater than 1.0.

The average and standard deviation were calculated for each respective MRB index. The number of students within one, two and three standard deviations from the mean was tabulated and used for comparisons.
With baseline values established (as described above), the MRB index can be used to analyze “outliers” in the distribution (students whose index was beyond one standard deviation from the respective mean). The department assessment committee looks at the full record of “outlier” students to identify trends in student performance that may be predictors of an index significantly larger or smaller than the mean.

B) Who was assessed?
- Method B: Physics majors.

C) When was it assessed?
- Method A: Artifacts entered into this section were from upper-division physics courses typically taken during their junior and senior years.
- Method B: GPAs are evaluated throughout the program while the MFT scores are acquired during their senior year.

3. What was learned?
- Preliminary evaluation via artifacts in the student portfolio indicates the vast majority of students meet the Physics Department’s Content Knowledge learning objective.

<table>
<thead>
<tr>
<th>Internal Assessment – Portfolio Results‡ (Department Outcome 1)</th>
</tr>
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<tbody>
<tr>
<td>Exceeds</td>
</tr>
<tr>
<td>Students</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
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‡ Evaluation of student portfolios were performed by the PHYS 489 instructor at the time they were collected.

- The table below lists the mean values and distributions for the MRB indices. As the numbers suggest, there is a moderate correlation between GPA and MFT score.

<table>
<thead>
<tr>
<th>Mean values for the MRB Indices (see additional table for details)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRB Index Intro</td>
</tr>
<tr>
<td>Mean</td>
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<tr>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>
MFT and GPA Comparisons via the MRB Indices

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>MRB Index Intro</th>
<th>MRB Index Advanced</th>
<th>MRB Index Coupled - A</th>
<th>MRB Index Coupled - B</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 1 S.D.</td>
<td>20 (65%)</td>
<td>19 (61%)</td>
<td>19 (61%)</td>
<td>27 (87%)</td>
</tr>
<tr>
<td>within 2 S.D.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>above</td>
<td>5 (16%)</td>
<td>7 (23%)</td>
<td>7 (23%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>below</td>
<td>6 (19%)</td>
<td>5 (16%)</td>
<td>5 (16%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>within 3 S.D.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Therefore assessment of student performance in the physics curriculum as determined by GPA appears consistent with an independent measure of physics content knowledge as determined by the MFT. In all but a few cases, the “outliers” can be attributed to student idiosyncrasies (time management, class attendance, “over-achiever” vs. “under-achiever”, etc.).

Note: The MRB indices were developed to expose trends that could facilitate discussion about the physics curriculum and should not be used for detailed statistical analysis. The examination of this data was limited to determining whether the committee could understand, in the case of individual students, why there might be a lack of correspondence between their GPA and MFT score. As presented above, in all but a few cases, any significant discrepancies between GPA and MFT scores were attributed to student idiosyncrasies.

4. What will the department or program do as a result of that information?

- No changes to the Physics Department’s curricula are planned at this time. However, the Physics Department Assessment Committee recognizes the instruments used to assess SLO 1 results in only a partial evaluation. Thus the committee will continue its assessment of this learning objective using additional instruments at future meetings.

5. What did the department or program do in response to last year’s assessment information?

- All introductory physics courses were moved from a traditional lecture/laboratory course to a Scale-Up classroom using an integrated lecture/lab model.

6. Questions or suggestions concerning Assessment of Student Learning at Central Washington University: