PLO assessment in Chemistry and Biochemistry Graduate program

The role of the Qualifying Exam (QE) in the PhD program

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Some Background
The PhD program in Chemistry and Biochemistry

- 85-90 PhD students. 15-20 new each year.
- 22 faculty → 22 research groups (average: 4 students/group)
- Research funded by federal and industry ($5-6M/year)
- 5-6 years to degree
- Spend first two years completing all course work, while also working as teaching assistants and starting their research projects
- Qualifying exam at the beginning of the third year
- Must join a research group by the end of the winter quarter of their first year
Outline of the presentation

• PLO statements
• Assessment Plan
• QE
• PLO rubric
• Process of Data Collection: Online rubric
• Assessment as Teaching (email to students)
• Preliminary results: faculty (rubric) and student self-assessment
• Conclusions
Chemistry and Biochemistry Ph.D. graduates will be able to:

1. demonstrate understanding of fundamental concepts, mastery of relevant experimental and theoretical techniques and empirical knowledge in their specific field.

2. identify a novel research project/problem, develop a plan to execute/solve it and complete the project with the goal of adding new knowledge to their field.

3. communicate fundamental knowledge of their field of research, as well as details of their own research in both written and oral form to expert and non-expert audience.
Assessment Plan

In 2014-15 the Graduate Affairs Committee and the chair developed the PLO assessment plan and the evaluation rubric for the QE.

It was decided to collect two years worth of data (2 cohorts).
QE

• Taken in the beginning of the student’s third year
• Includes written dissertation proposal and oral presentation
• Evaluated by a Committee of 5 faculty, including advisor and outside member
• PLO rubric was introduced in October 2014

  This rubric serves two purposes: it (1) collects data on each of the three program learning outcomes for program assessment and improvement, and

  (2) helps faculty provide students with supplemental feedback.
<table>
<thead>
<tr>
<th>PLO</th>
<th>&quot;Primary traits&quot; that are evaluated</th>
<th>Below expectation</th>
<th>Almost meets expectation</th>
<th>Meets expectation</th>
<th>Exceeds expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLO 1</td>
<td>Mastery of fundamental concepts, paradigms, and methods in specific field</td>
<td>Incomplete or incorrect knowledge of important concepts, paradigms, and methods in field</td>
<td>Incomplete or incorrect knowledge of some details regarding concepts, paradigms, and methods in field</td>
<td>Knowledge of concepts, paradigms, and methods in field is largely complete.</td>
<td>Complete and highly detailed knowledge of concepts, paradigms, and methods in field.</td>
</tr>
<tr>
<td>PLO 2</td>
<td>Research plan contains interesting and novel proposed work</td>
<td>The proposal lacks innovative content, or lacks a coherent or realistic plan for success</td>
<td>Ideas are marginally innovative but largely derivative or incremental, or the plan has questionable feasibility</td>
<td>Feasible plan to conduct research; proposed work contains innovative ideas</td>
<td>Feasible and well articulated plan to conduct research; proposed work is highly innovative and has the potential to make a large contribution to the field</td>
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<tr>
<td>PLO 2</td>
<td>Proper implementation plan of the methodology</td>
<td>Implementation plan lacks sufficient detail or is incorrect</td>
<td>Implementation plan omits some details or contains items of questionable accuracy</td>
<td>Implementation plan is sufficiently articulated and technically correct</td>
<td>Implementation is partially complete, fully correct, and producing useful preliminary results</td>
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<tr>
<td>PLO 3</td>
<td>&quot;Primary traits&quot; that are evaluated</td>
<td>Below Expectation</td>
<td>Almost meets Expectation</td>
<td>Meets Expectation</td>
<td>Exceeds Expectation</td>
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<td></td>
<td>Technical communication, appropriate use of terminology</td>
<td>Oral presentation and/or written document lacks sufficient organization and clarity, or uses terminology or symbolic communication incorrectly or inappropriately, or does not communicate at a sufficiently technical level</td>
<td>Occasional problems with the use of terminology or symbolic communication, or the level of communication</td>
<td>Technical language and symbols are used correctly and appropriately, with sufficient technical detail; an expert would fully understand the concepts and most of the implementation</td>
<td>An expert would understand all of the concepts and (given sufficient time) be able to fully reproduce the results</td>
</tr>
<tr>
<td></td>
<td>Understanding by a non-expert audience</td>
<td>A majority of components of the presentation and written document would not be understood by the outside member of the committee or by other graduate students</td>
<td>Roughly half the components of the presentation and some of the written document would be understood by the outside committee member or by other graduate students</td>
<td>Most components of the presentation and a reasonable amount of the written document would be understood by the outside committee member and by other graduate students</td>
<td>All but a relatively small number of highly technical pieces of the presentation and written document would be understood by the whole audience</td>
</tr>
</tbody>
</table>
Process of data collection: Online PLO rubric

Chemistry PhD Qualifying Examination Rubric (Written dissertation proposal and oral presentation)

This rubric serves two purposes: it (1) collects data on each of the three program learning outcomes for program assessment and improvement, and (2) helps faculty provide students with supplemental feedback.

Please enter relevant information below:

Date of Qualifying Exam mm/dd/yyyy
Student's Name
Name of QE Committee Chair
Committee member 1
Committee member 2
Committee member 3
Online PLO rubric

PLO 2: Students will be able to identify a novel research project/problem, develop a plan to execute/solve it and complete the project with the goal of adding new knowledge to their field.

Trait: Research plan contains interesting and novel proposed work

- The proposal lacks innovative content, or lacks a coherent or realistic plan for success. (Below expectations)
- Ideas are marginally innovative but largely derivative or incremental, or the plan has questionable feasibility. (Almost meets expectations)
- Feasible plan to conduct research proposed work contains innovative ideas. (Meets expectations)
- Feasible and well articulated plan to conduct research; proposed work is highly innovative and has the potential to make a large contribution to the field. (Exceeds expectations)

Trait: Proper implementation plan of the methodology

- Implementation plan lacks sufficient detail or is incorrect (Does not meet expectations)
- Implementation plan omits some details or contains items of questionable accuracy (Almost meets expectations)
- Implementation plan is sufficiently articulated and technically correct (Meets expectations)
- Implementation is partially complete, fully correct, and producing useful preliminary results (Exceeds expectations)

Comments
Assessment as Teaching: Student receives email with results

Date of the QE: 5/20/2015
Student’s Name: XXX
Committee’s Chair: Seth Rubin
Members of QE Committee:
Vicki Stone (advisor)
Ted Holman and Scott Lokey
Fitnat Yldiz (outside).

**PLO1**: Students will be able to demonstrate understanding of fundamental concepts, mastery of relevant experimental and theoretical techniques and empirical knowledge in their specific field.

   Evaluation: Knowledge of concepts, paradigms, and methods in field is largely complete. *(Meets expectations)*

 Comments:

**PLO2**: Students will be able to identify a novel research project/problem, develop a plan to execute/solve it and complete the project with the goal of adding new knowledge to their field.

   Evaluation (a): Feasible plan to conduct research proposed work contains innovative ideas. *(Meets expectations)*

   Evaluation (b): Implementation plan is sufficiently articulated and technically correct *(Meets expectations)*

 Comments:

**PLO3**: Students will be able to communicate fundamental knowledge of their field of research, as well as details of their own research in both written and oral form to expert and non-expert audience.

   Evaluation (a): Technical language and symbols are used correctly and appropriately, with sufficient technical detail; an expert would fully understand the concepts and most of the implementation *(Meets expectations)*

   Evaluation (b): Most components of the presentation and a reasonable amount of the written document would be understood by the outside committee member and by other graduate students *(Meets expectations)*

 Comments:
Overview of results (one cohort)

Faculty assessment with the rubric showed the following percent of students who met or exceeded expectations:

PLO 1 Fundamental Knowledge (84%)
PLO 2 Innovative Research (83%) and
   Articulated Implementation Plan (72%)
PLO 3 Communication to experts (94%)
   Communication to non-experts (83%)
Overview of student self-assessment

Source: UCSC Graduate Student Survey 2015
23 respondents who completed coursework

Percent of students rated their skills as “good,” “very good,” or “excellent”

PLO 1. Mastery of theory, research and methods fundamental to the field (92-95%)

PLO 2. Independent research skills (87%)

PLO 3. Communication to experts (96%)
    Communication to non-experts (95%)

⇒ Consistent with the faculty evaluation (somewhat higher because among students who completed their coursework, some were close to finishing their dissertation).
Department of Chemistry and Biochemistry Graduating Ph.D.

Self Evaluation Survey

For each question, indicate whether you strongly agree, agree, disagree, or strongly disagree.

1) I have learned fundamental concepts relevant to my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

2) I have mastered experimental and/or theoretical techniques important in my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

3) I have learned the central empirical knowledge and paradigms relevant to my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

4) I am able to identify a novel research project or problem in my specific field.
   □ strongly agree □ agree □ disagree □ strongly disagree

5) I am able to develop a plan to complete a project or solve a novel problem in my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

6) I am able to execute a plan to complete a project or solve a novel problem in my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

7) I am able to communicate through oral and written presentations to experts in my field.
   □ strongly agree □ agree □ disagree □ strongly disagree

8) I am able to communicate through oral and written presentations to nonexperts.
   □ strongly agree □ agree □ disagree □ strongly disagree
Conclusions

- PLO rubric is part of the established process of student evaluation
- Data collected for program evaluation (the results to be discussed)
- Immediate written feedback provided to students (assessment as teaching considered among ‘best practices’)
- Our students reported a significantly higher level of satisfaction with the quality of academic progress assessment (Graduate Student Survey, Spring 2015) and noted clarity of QE process that helps to prepare for the PhD work.

“Satisfied” or “very satisfied”:
- 70% of Chemistry students vs.
- 48% of PhD students in other PBSci programs

www.chemistry.ucsc.edu/academics/graduate/grad-plo.html