EWU Programmatic SLO Assessment
AY 2014-15 and "Closing the Loop" for AY 2013-14

Introduction:

Assessment of student learning is an important and integrated part of faculty and programs. As part of ongoing program assessment at Eastern Washington University, each department is asked to report on assessment results for *each* program and *each* certificate for *at least one* Student Learning Outcome (SLO) this year. To comply with accreditation standards, the programs must also demonstrate efforts to "close the loop" in improving student learning and/or the learning environment. Thus, this template has been revised into two parts.

Resources:

Check this site for sample reports (created with the previous year's template) by EWU programs and other assessment resources: http://access.ewu.edu/graduate-education/academic-planning/faculty-support/student-learning-assessment/sample-program-slo-assessment-reports

Additional resources and support are available to:

1) Determine whether students can do, know or value program goals upon graduation and to what extent;
2) Determine students' progress through the program, while locating potential bottlenecks, curricular redundancies, and more; and
3) Embed assessments in sequenced and meaningful ways that save time.

Contact Dr. Helen Bergland for assistance with assessment in support of student learning and pedagogical approaches: hbergland@ewu.edu or 509.359.4305.

Use this template to report on your program assessment. **Reports are due to your Dean and to Dr. Helen Bergland (hbergland@ewu.edu), Office of Academic Planning, by Nov. 2, 2015.** (Some Deans have elected to move the deadline up.

Degree/Certificate: BAE

Major/Option: Secondary Mathematics
Submitted by: Mathematics Education Committee, with leads Carlos Castillo-Garsow and Jackie Coomes
Date: November 3, 2015

Part I – Program SLO Assessment Report for 2014-15

Part I – for the 2014-15 academic year: Because Deans have been asked to create College-Level Synthesis Reports annually, the template has been slightly modified for a) clarity for Chairs and Directors, and b) a closer fit with what the Deans and Associate Deans are being asked to report.

1. **Student Learning Outcome**: The student performance or learning outcome as published either in the catalog or elsewhere in your department literature.

Applications of Pedagogical Content Knowledge for Learning and Teaching

2. **Overall evaluation of progress on outcome:** Indicate whether or not the SLO has been met, and if met, to what level.

   __x___*SLO is met after changes resulting from ongoing assessments, referencing assessment results from the previous year to highlight revisions;*
   _____*SLO is met, but with changes forthcoming;*
   _____*SLO is met without change required*

3. **Strategies and methods:** Description of assessment method and choices, why they were used and how they were implemented.

Students were given the task:

Explain the basic idea behind the "linear interpolation" approach to teaching compound interest. In what ways is the "linear interpolation" approach useful for teaching exponentials? In what ways is it problematic?

It addresses the SLO by:

• Addressing student prior experience with linear functions, preferably connecting to point-slope form.

•Addressing the financial applications of the model, preferably also including weaknesses

•Addressing the high cognitive load and heavy algebraic manipulation involved in this approach

•Addressing reliance on limits

4. **Observations gathered from data:** Include findings and analyses based on the strategies and methods identified in item #3.

   a. Findings:

	Developing	Proficient	Exemplary
Quantitative Reasoning	4 (40%)	1 (10%)	5 (50%)
Pedagogical Content Knowledge	4 (40%)	4 (40%)	2* (20%)

*An exemplary response to this task is at the end of this report.

   b. Analysis of findings:

•Most prototeachers successfully identified the key idea and were able to give some discussion of advantages and disadvantages of teaching this idea.

•Overall the quality of response and level of detail (both mathematical and PCK) has improved over the previous year, when the majority of students had to revise and resubmit this assignment

•Two prototeachers in the "Developing" category did not turn in the assignment.

•The two prototeachers in the developing category QR did not describe the problem mathematically, instead describing the problem graphically ("turning curves into lines") or experientially ("cheating the system") without any mathematical detail.

•The same two prototeachers did not meet PCK. They both described the approach as "easier" than working with a curve, and did not attend to the high demands that this approach has of students, and had only briefly mentioned connections between topics.

•The proficient PCK prototeachers did not have student cognition present in their responses: They discussed applications ("real world"), and did not address student prior knowledge. In disadvantages, these prototeachers addressed problems common to all teaching of exponential function ("reliance on limits") and not the cognitive load or algebraic demands on students.

5. **What program changes will be made based on the assessment results?**

   a) Describe plans to improve student learning based on assessment findings (e.g., course content, course sequencing, curriculum revision, learning environment or student advising).

   •Students need more specific feedback and clearer instructions on the level of mathematical detail expected in a response.

   •Faculty teaching methods need to make student cognition present in all lessons, so that methods students learn how to address the student experience with the task, and not just the task itself.

   • In this task, we attribute the improvement in writing quality and detail in large part to the peer review component that was added to the class.

   b) Provide a broad timeline of how and when identified changes will be addressed in the upcoming year.

Methods faculty have discussed the implications and are addressing them in all methods classes in 2015-16. (Fall 2015: MTED 493, Winter 2016 MTED 392, Spring MTED 393)

6. Description of revisions to the assessment process the results suggest are needed and an evaluation of the assessment plan/process itself.

No revisions necessary since the assessment provided valuable information.

Sample (Exemplary) Student response:

The basic idea behind the piecewise linear approach to compound interest is to use linear rates (by which the amount of money in the account increases over time) adjusted at a set interval to calculate the amount earned via a set interest rate and compounding that amount at certain intervals...

This means starting with some amount in the account, *a0*, and an interest rate (a percent or a decimal), *r*, and setting the linear rate at which we earn money from the start equal to *a0* * *r*. Then, at each interval (for instance, "every quarter of a year"), the interest rate is reevaluated by taking the amount in the account at interval number *k* (interval number *k* being the number of completed quarters), *ak*, and the same interest rate, and setting our linear rate at which we earn money from interval number *k* to be *ak * r*. [Having the students graph this is also a good idea to get students to make connections with the patterns that are emerging.]...

It's also important to note that in the end, our piecewise linear approach will look like an approximation of an exponential function. So, beyond simply teaching the concept of compound interest, we can move into the idea of exponentials.

After this, we can generalize from the actions and operations we are taking to calculate the amount in the account at the start of each interval *k*, *ak*, that is:

$$a_0 = a_0$$
$$a_1 = a_0 + r*t*(a_0)$$
$$a_2 = a_0 + r*t*(a_0) + r*t*(a_0 + r*t*(a_0))$$
$$a_3 = a_0 + r*t*(a_0) + r*t*(a_0 + r*t*(a_0)) + r*t*(a_0 + r*t*(a_0) + r*t*(a_0 + r*t*(a_0)))$$

Then, after factoring out an *a0* from every term, distributing all of the *r*t* coefficients, and combining like terms, we get:

$$a_3 = a_0 * (1 + 3r*t + 3(rt)^2 + (rt)^3)$$

This can be factored, and we get an end result of:

$a_3 = a_0 * (1+rt) * (1+rt) * (1+rt)$ or $a_3 = a_0 * (1+rt)^3$

And after doing the same with a few other terms, and noticing the pattern, we can then find the total amount earned by the start of interval letter *k* with the formula:

$$a_k = a_0 * (1+rt)^k$$

That's the basic idea behind the piecewise linear approach to teaching compound interest. (Maybe taken a couple steps forward.)

combining like terms, we get:This can be factored, and we get an end result of:
a =*a* ∗(1+*rt*)∗(1+*rt*)∗(1+*rt*) or *a* =*a* ∗(1+*rt*)3 30 30
And after doing the same with a few other terms, and noticing the pattern, we can then find the total amount earned by the start of interval letter *k* with the formula:
a =*a* ∗(1+*rt*)*k k*0
That's the basic idea behind the piecewise linear approach to teaching compound interest. (Maybe taken a couple steps forward.)

This piecewise linear approach is useful for teaching exponentials because it's fairly mathematically simple. It doesn't require logarithms, or knowledge of exponents really at all beyond the idea that “some number squared” is the same as saying “some number times itself,” and by this point, students should be able to at least follow the factoring involved in coming up with the formula. Instead, this approach simply utilizes students knowledge of linear functions, slope, and (kind of) sequences. With this lesson, students understand a little better not only what an exponential should look like graphically, but how an exponential increases based on prior values and that it does not increase at a constant rate.

This method is problematic though, as the piecewise linear function does not match the exponential model at the “in-between” points. That is, at the half-way point of our first interval, our piecewise linear function says we've earned a different amount of interest than our exponential model implies that we've earned at that point. Additionally, in order for this exercise to work, we need to “connect the dots” - something that's been an issue with students for a while now, and we need them to not always do. If we made our piecewise linear function more like how the bank generates interest, we would likely have a step function (as normally, you just get a payout at the end of one interval/the start of another and your account doesn't increase in the meantime). However, if we had students analyze a step function like this, they are a little less likely to accept the approximation that emerges.

NEW: Part II – Closing the Loop
Follow-up from the 2013-14 Program Assessment Report

In response to the university's accrediting body, the Northwest Commission on Colleges and Universities, this section has been added. This should be viewed as a follow up to the previous year's findings. In other words, begin with findings from 2013-14, and then describe actions taken during 2014-15 to improve student learning along, provide a brief summary of findings, and describe possible next steps.

PLEASE NOTE: The College-Level Synthesis report includes a section asking Deans to summarize which programs/certificates have demonstrated "closing-the-loop" assessments and findings based on the previous year's assessment report.

> ***Working definition for closing the loop**: Using assessment results to improve student learning as well as pedagogical practices. This is an essential step in the continuous cycle of assessing student learning. It is the collaborative process through which programs use evidence of student learning to gauge the efficacy of collective educational practices, and to identify and implement strategies for improving student learning." Adapted 8.21.13 from http://www.hamline.edu/learning-outcomes/closing-loop.html.*

1. **Student Learning Outcome(s)** assessed for 2013-14

Demonstrate computational proficiency using various strategies, including a conceptual understanding of numbers, relationships among number and number systems and meanings of operations with all real numbers.

2. **Strategies implemented** during 2014-15 to improve student learning, based on findings of the 2013-14 assessment activities.

The strategies we identified on the 13-14 report are: We are revising our program so that secondary mathematics educators work with majors earlier in their program to help them develop dispositions to develop conceptual understanding and procedural fluency together. We are also changing the courses so that we are replacing a History of Mathematics course with an additional methods course that focuses on understanding and teaching algebra and functions.
We submitted forms and were approved to change our program as described above. The changes are going into effect in the 2015-16 academic year. However, the two secondary methods faculty have continued to share ways that we can target students' conceptual understanding and have created an assessment plan targeting specific assignments to measure students' development of conceptual understanding. We have also shared ways to help students understand these expectations, including creating rubrics that span the courses, being explicit, sharing student work in class, and providing specific feedback.

3. **Summary of results** (may include comparative data or narrative; description of changes made to curriculum, pedagogy, mode of delivery, etc.): Describe the effect of the changes towards improving student learning and/or the learning environment.

   Anecdotal: students have voiced appreciation for the clarity in expectations and the chances to improve their work. Seeing another student's exemplary work has helped some students improve their understanding of the expectations. We expect to provide more specific measures and details in our 2015-16 report.

4. What **further changes to curriculum, pedagogy, mode of delivery,** etc. are projected based on closing-the-loop data, findings and analysis?

We are offering an experimental elective course in the Winter of 2016 that provides teacher candidates opportunities to teach math to students earlier in their program and receive guidance from faculty to support their learning while teaching.

Definitions:

1. **Student Learning Outcome**: The student performance or learning objective as published either in the catalog or elsewhere in your department literature.
2. **Overall evaluation of progress on outcome:** This checklist informs the reader whether or not the SLO has been met, and if met, to what level.
3. **Strategies and methods used to gather student performance data,** including assessment instruments used, and a description of how and when the assessments were conducted. Examples of strategies/methods: embedded test questions in a course or courses, portfolios, in-class activities, standardized test scores, case studies, analysis of written projects, etc. Additional information could describe the use of rubrics, etc. as part of the assessment process.
4. **Observations gathered from data**: This section includes findings and analyses based on the above strategies and methods, and provides data to substantiate the distinction made in #2. For that reason this section has been divided into parts (a) and (b) to provide space for both the findings and the analysis of findings.
5. **Program changes based on the assessment results:** This section is where the program lists plans to improve student learning, based on assessment findings, and provides a broad timeline of how and when identified changes will be addressed in the upcoming year. Programs often find assessment is part of an ongoing process of continual improvement.

6. **Description of revisions to the assessment process the results suggest are needed.**

   Evaluation of the assessment plan and process itself: what worked in the assessment planning and process, what did not, and why.

Some elements of this document have been drawn or adapted from the University of Massachusetts' assessment handbook, "Program-Based Review and Assessment: Tools and Techniques for Program Improvement" (2001). Retrieved from http://www.umass.edu/oapa/oapa/publications/online_handbooks/program_based.pdf