

#2. 2017 – 18 Executive Summary: Undergraduate Program Assessment: Student Outcomes

To be completed by Departments and submitted by the Department Chair to the Assessment Blackboard Site.

Department: Natural & Computer Sciences

Date: 5/11/18

Members involved with analysis of artifacts: Kent Einspahr, Kregg Einspahr, Kyle Johnson, Jen Freund, Connie Callahan, Kristy Jurchen, John Jurchen, Marcus Gubanyi, Tim Huntington, Rob Hermann

See #1 Undergraduate Program Assessment Plan: Student Outcomes for: a) *Student Outcome*; b) *Background*; c) *Question(s)*; d) *Methodology*

Analysis of artifacts:

1). **PERFORMANCE CRITERIA*** - *How was data analyzed? (attach rubrics/scoring tools if used).*
Artifacts were analyzed according to the attached rubric. Rubrics were sent to the faculty beforehand for review, and the departmental faculty met together and scored the artifacts through discussion and consensus.

Summary of RESULTS*:

1). *Restate the assessment question(s) (from the Assessment plan):*

Are students able to use appropriate methods to verify the accuracy and robustness of their results?

2). *Summarize the assessment results. A narrative summary is required. Charts, tables or graphs are encouraged but optional.*

A total of 29 artifacts were analyzed from the following courses: Bio 271, Chem 345, CS 231, Phys 381.

Course	Scores					Comments
	1	2	3	4	5	
Bio 271	0	0	3	4	1	Not clear on use of paired vs unpaired test and why.
Chem 345	0	4	1	3	0	Some sloppy use of language.
CS 231	2	3	2	1	0	Can error analysis can be performed if program fails.
Phys 382	0	0	2	2	1	Work standard deviation versus percent difference
Total	2	7	8	10	2	
Total %	7%	24%	28%	34%	7%	

Overall, 20 of the 29 artifacts met the 3 or above criteria, 69%.

3). **INTERPRETATION*** - *Discuss how the results answer the assessment question(s).*

We fell short of our standard for success of 80% scoring a 3 or above. Part of this was due to the very wide range of types of artifacts assessed, and the resulting inability to have completely consistent methods of scoring every artifact. But even with that difficulty, we see that our students are still unable to consistently apply proper analysis to determine the robustness of their results, and to correctly describe what they did.

Overall, there seems to be better success at applying the tools than in describing what they did and what the results meant. For instance in Bio 271 the students did not reliably say whether they had applied a paired or an unpaired t-test, and did not show that they understood the distinction or why it mattered. In Chem 345, even when the statistical tools were applied correctly, students were often unable to correctly describe the result, even confusing what the null result was and whether a particular statistic excluded it or not. In CS 231 there was difficulty because several students were unable to make their program run, and so naturally had difficulty applying tools to analyze the results. (Though there were instances where students said what they would have done with the results had they produced them, which was a good outcome.) Finally in Phys 382, students were again able to apply statistics properly, but were often unable to discuss the statistics in any meaningful way.

4). *Observations made that were not directly related to the question(s). (i.e. interrater reliability of the scoring tool was low)* Chem 115 had instituted a series of "mini lectures" before each lab to introduce students to the methods of science. This included discussions of funding, reading journal articles, and

introductory statistics. Pre- and Post-test results showed marked improvement in most areas of student understanding of science, though their understanding of statistics did not improve due to the instruction.

Sharing of Results:

When were results shared? Date: 5/11/18 and 5/15/18

How were the results shared? (i.e. met as a department) Met as department to score and then analyze the results; the completed form was then shared electronically.

Who were results shared with? (List names): Kent Einspahr, Gregg Einspahr, Kyle Johnson, Jen Freund, Connie Callahan, Kristy Jurchen, John Jurchen, Marcus Gubanyi, Tim Huntington, Brent Royuk, Rob Hermann

Discussion of Results –Summarize your conclusions including:

1. **ACTION***- *How will what the department learned from the assessment impact:*

a. *Teaching:* We need to make statistical analysis a more integrated part of our science teaching. Bio 111 plans to add a unit on introductory statistics, and plans to introduce students to the use of Excel to facilitate the analysis of data. Chem 345 plans to include a "Statistical Boot Camp" on the first day to remind students of what they're supposed to know, and will also add more formal instruction on the use of statistics throughout the course. Phys 382 will add another assignment on the use of statistics and on describing results in a meaningful way in light of statistics.

b. *Assignment/course:* The assignment for CS 231 may be modified to be completed in smaller parts, so that more students are able to successfully complete it.

c. *Program:* Statistics is often the least sexy part of science, and so is the easiest part to skip due to time constraints or other issues. We need a way to integrate it and make students see that the analysis of their results can be the most interesting part of science. We have also been kicking around the idea of a Statistics for Science course; we will wait on this to see if any of the actions above can improve the results.

d. *Assessment:* None for now; the assessment was meaningful as it was.

2. **IMPACT***- *What is the anticipated impact of the ACTION* on student achievement of the learning outcome in the next academic year?*

It is hoped that as statistics is better integrated throughout the curriculum, that students will naturally use its tools and see it as a normal part of data analysis rather than something extra added in. Ideally, science students will become proficient at the use of statistical tools to analyze their results.

3. **BUDGET IMPLICATIONS** – *Indicate budget requirements necessary for the successful implementation of the ACTION* (i.e. an additional staff person, new equipment, additional sections of a course).* There will be no immediate budget implications. If it is determined that a statistics course is needed, then there will be a cost for paying an adjunct or overload.

If action is taken – it is recommended that the same learning outcome and assessment plan be used for a second assessment cycle.

What assessment questions related to the learning outcome would the program like to investigate in the future? We will assess the same question for another year, in order to see the results of actions taken over the past few years.

Submitted by: Rob Hermann
6/18/18

Reviewed by the Assessment Committee (date):

Department Chair notified/additional action needed: na

BUDGET IMPLICATIONS – Assessment Committee Chair notified appropriate Dean: na

Approved & Posted to Assessment site: 7/1/18