UofL **General Education Curriculum Committee** **Strickler Hall 236**
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General Education Assessment of Natural Sciences (Spring 2017)

History of the Assessment Program

Assessment of student learning outcomes is a national expectation in higher education, and the expectation calls for increased accountability. Section 2.7.3 of the Southern Association of Colleges and Schools' (SACS) accreditation standards requires in each undergraduate program the successful completion of a general education component that:

1) is a substantial component of each undergraduate degree,
2) ensures breadth of knowledge, and
3) is based on a coherent rationale.

Section 3.5.1 of the SACS accreditation standards also requires that "the institution identifies college-level competencies within the general education core and provides evidence that graduates have attained those competencies."

Based on these standards, in 2005, the Provost charged the General Education Curriculum Committee (GECC) with developing and implementing an assessment program. To accomplish this directive, the committee developed and modified rubrics to measure student performance in the competencies stated in the preamble of the General Education Plan: "The General Education Program at the University of Louisville fosters active learning by asking students to:

1) think critically,
2) to communicate effectively, and
3) understand and appreciate cultural diversity."

The GECC initiated the first General Education Assessment in fall of 2005. The university adopted LiveText© as the platform for electronic assessment of General Education artifacts in the fall of 2010. The process, results, and findings from each assessment iteration are presented to the GECC to drive continuous improvement of the university's general education program.

Assessment Administration

The General Education Program at the University of Louisville advances three over-arching competencies: critical thinking, effective communication, and cultural diversity. In addition, the university has defined additional learning outcomes for the following content areas: Arts and Humanities, Mathematics, Natural Sciences, Oral Communication, Social and Behavioral Sciences, and Written Communication, and the Cultural Diversity competency area. The University of Louisville Student Learning Outcomes are closely aligned with the Statewide General Education Student Learning Outcomes.

The spring 2017 assessment was focused on courses in the Natural Sciences content area. A crosswalk of the outcomes and assessment measures for Natural Sciences is provided in

Appendix A to demonstrate alignment between the assessment measures, the UofL content area outcomes, and the statewide content area outcomes.

University of Louisville Natural Sciences Learning Outcomes

Natural Sciences are concerned with understanding the physical world through the scientific method. Students who satisfy this requirement will demonstrate that they are able to do all of the following:

1. Relate everyday observations of the world to physical principles;
2. Apply scientific principles to construct explanations of natural phenomena;
3. Communicate an understanding of scientific explanations of natural phenomena.

Statewide Natural Sciences Student Learning Outcomes

1. Demonstrate an understanding of the methods of science inquiry.
2. Explain basic concepts and principles in one or more of the sciences.
3. Apply scientific principles to interpret and make predictions in one or more of the sciences.
4. Explain how scientific principles relate to issues of personal and/or public importance.

University of Louisville General Education Rubric Measures

The measures for the Natural Science Critical Thinking Rubric are as follows:

(NS1) Demonstrate an Understanding of Methods of Science
(NS2) Construct Scientific Understanding of Natural Phenomena
(NS3) Apply Scientific Principles to Everyday and Lab-based Phenomena
(NS4) Communicate an Understanding of Vocabulary, Materials, and Technique Used

The University of Louisville General Education Rubrics use a four-point scale, with *4* indicating performance of the measure as "clearly evident," *3* indicating performance as "usually evident," *2* indicating "minimally evident," and *1* indicating performance as "not evident." In addition, a score of "not requested" could be assigned for assignments that did not provide an opportunity for the student to demonstrate the criterion within the rubric measure.

Assessment Process

For the spring 2017 assessment of student work from the Natural Sciences (NS) content area, the Office of General Education contacted department chairs for each department offering Natural Science courses in the spring semester to give departments adequate time to communicate the upcoming assessment and identify assignments for the assessment sample. A formal memo outlining the project and process was also distributed to all faculty teaching Natural Sciences

General Education courses prior to the start of the semester to ensure a mutual understanding of project expectations.

The initial communication to faculty requested faculty to (a) post syllabi to Blackboard in compliance with the university's SACS data requirements, (b) select an assignment for the assessment, (c) collect student work and the assignment prompt, and (d) submit files to the Office of General Education. Prior to the start of the semester, all faculty teaching General Education courses are notified that the syllabi should explicitly list General Education Learning Outcomes and the manner in which the outcomes will be assessed.

After the deadline for dropping and adding a course passed, the Office of General Education requested the class rosters for all General Education courses in the Natural Sciences from the Office of the Registrar and systematically selected every fifth student for assessment. Course instructors were sent assessment rosters along with detailed instructions requesting that they provide a copy of the assignment prompt along with the ungraded responses for the selected students to be sent via email to the Assessment Coordinator.

Student artifacts were collected and stored in an electronic repository and uploaded into the LiveText© assessment management system. A panel of 20 faculty (tenured and tenure-track faculty, term faculty, and adjunct faculty) and graduate teaching assistants assessed student artifacts. Assessors applied the university's Natural Sciences rubric to all artifacts. Prior to the assessment reading, assessors were brought together for a four-hour training session coordinated by the Office of General Education. In response to prior assessment feedback, the background and history of the General Education Assessment, assessment rubrics, and LiveText© instructions were shared in advance to allow for greater focus on practice scoring and discussion during the training session. During the training, faculty engaged in dissection and discussion of rubric criteria, and assessors individually reviewed and scored benchmark sample assignments. Benchmarks were selected assignments that represented a wide range of content and skill development in order to give assessors a baseline for measuring learning expectations and evaluating student performance (Herman, Osmundson, & Dietel, 2010). Assessors then engaged in discussion about the benchmark assessment scores to share their rationales for why particular scores were selected. When discussing the scores that they selected, readers were asked to highlight the rubric language that helped them to determine the score to ensure that assessors were basing their ratings only on the rubric criteria. To highlight the reliability of the training scoring, the results from scoring benchmark samples for the Natural Sciences Rubric are provided in Table 1 and Figure 1.

Table 1

Results of Benchmark Sample Assessments for Natural Sciences

Benchmark Sample 1

	Clearly Evident	Usually Evident	Minimally Evident	Not Evident	Not Requested
NS1	75.0%	10.0%	15.0%		
NS2	55.0%	45.0%			
NS3	20.0%	70.0%	5.0%	5.0%	0.0%
NS4	15.0%	55.0%	25.0%	5.0%	0.0%

Benchmark Sample 2

	Clearly Evident	Usually Evident	Minimally Evident	Not Evident	Not Requested
NS1	30.0%	35.0%	35.0%		
NS2	15.0%	50.0%	35.0%		
NS3		31.6%	63.2%	5.3%	1
NS4		20.0%	65.0%	15.0%	

Benchmark Sample 3

	Clearly Evident	Usually Evident	Minimally Evident	Not Evident	Not Requested
NS1		57.1%	42.9%		2
NS2		62.5%	37.5%		
NS3		50.0%	50.0%		3
NS4		25.0%	75.0%		1

Benchmark Sample 4

	Clearly Evident	Usually Evident	Minimally Evident	Not Evident	Not Requested
NS1	33.3%	55.6%	11.1%		2
NS2		91.7%	8.3%		
NS3	9.1%	54.5%	36.4%		1
NS4	9.1%	81.8%	9.1%		2

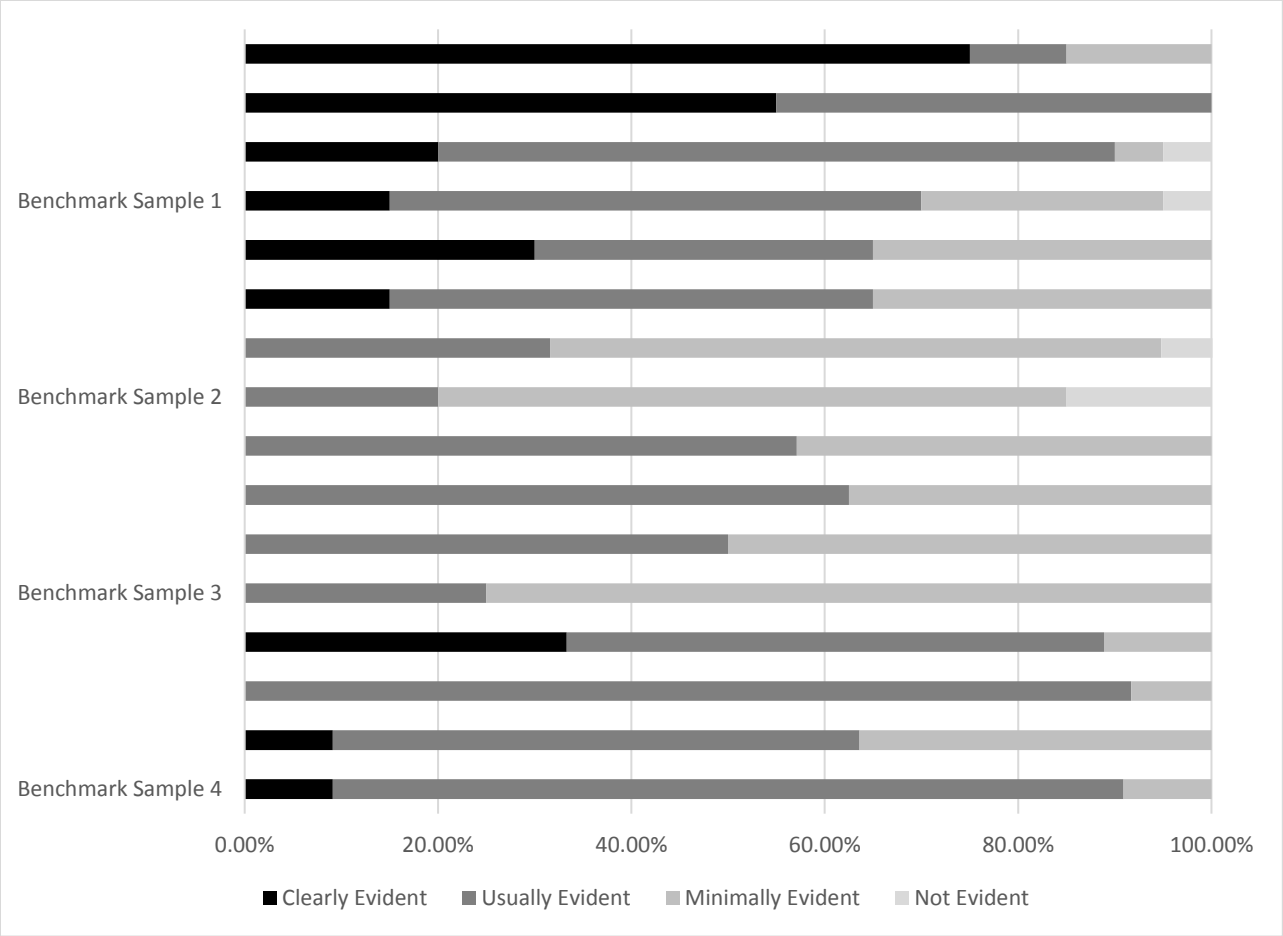

Figure 1. Results of Benchmark Sample Assessments for Natural Sciences

At the start of the assessment reading day, each faculty assessor was assigned a username and password for one of three LiveText© accounts and a list of courses and sections to assess. Three faculty readers assessed each artifact so that scores could be compared across assessors for reliability purposes.

Data Collection Overview

The enrollment for Natural Sciences General Education courses was approximately 8970 students after the drop/add deadline. The Office of General Education received and determined that 400 student artifacts were eligible for review from the Natural Sciences content area. The final sample included artifacts from Biology (198), Chemistry (53), Geography & Geosciences (59), and Physics (90).

Summary of Assessment Data

For the assessment of Natural Science outcomes, 400 student artifacts were assessed by faculty and graduate teaching assistants from the College of Arts & Sciences, School of Dentistry, College of Education and Human Development, and the Speed School of Engineering, using the

Natural Sciences Rubric. A summary of results from the NS assessment is provided in Table 2 and Figure 2.

The target for both the Natural Sciences rubric measures was set by the General Education Assessment Coordinator and the General Education Curriculum Committee Assessment Subcommittee at 60% of artifacts to score at a *3* or *4*, indicating that at least 60% demonstrate performance at either the "usually evident" or "clearly evident" level. The target was met for all NS measures.

Table 2

Summary Results for Natural Sciences Assessment

Natural Sciences

	Clearly Evident	Usually Evident	Minimally Evident	Not Evident	Not Requested	% Above (3 or 4)
NS1	39.0% (468)	40.4% (485)	17.8% (214)	2.8% (33)	*0*	79.4%
NS2	30.9% (371)	43.6% (523)	22.7% (272)	2.8% (34)	*0*	74.5%
NS3	27.5% (330)	41.9% (503)	27.3% (328)	3.3% (39)	*0*	69.4%
NS4	29.0% (348)	42.6% (511)	24.3% (292)	4.1% (49)	*0*	71.6%

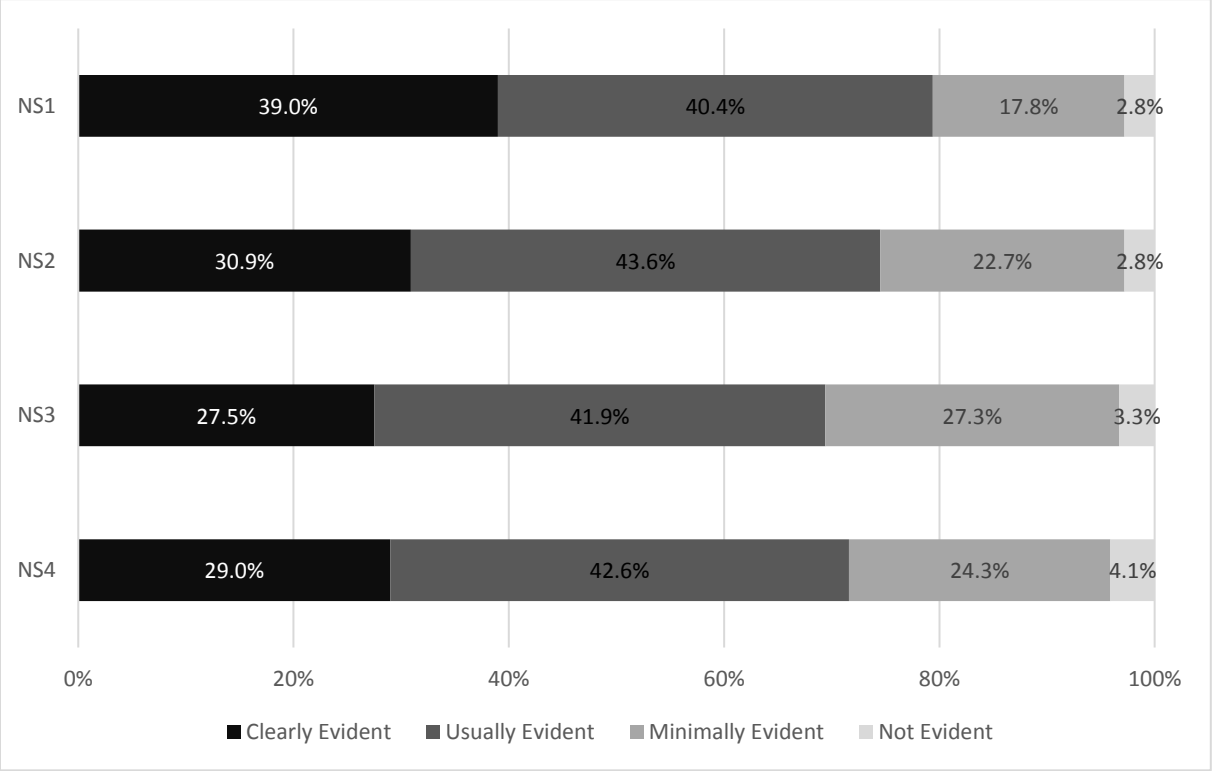

Figure 2. Summary Results for Natural Sciences Assessment

The mean and mode for each rubric measure is provided in Table 3 and Figures 3 and 4. The mode was at the "usually evident" level for all NS measures.

Table 3

Mean and Mode by Rubric for Natural Sciences Assessment
Natural Sciences

	NS1	NS2	NS3	NS4
Mean	3.16	3.03	2.94	2.97
Mode	3	3	3	3

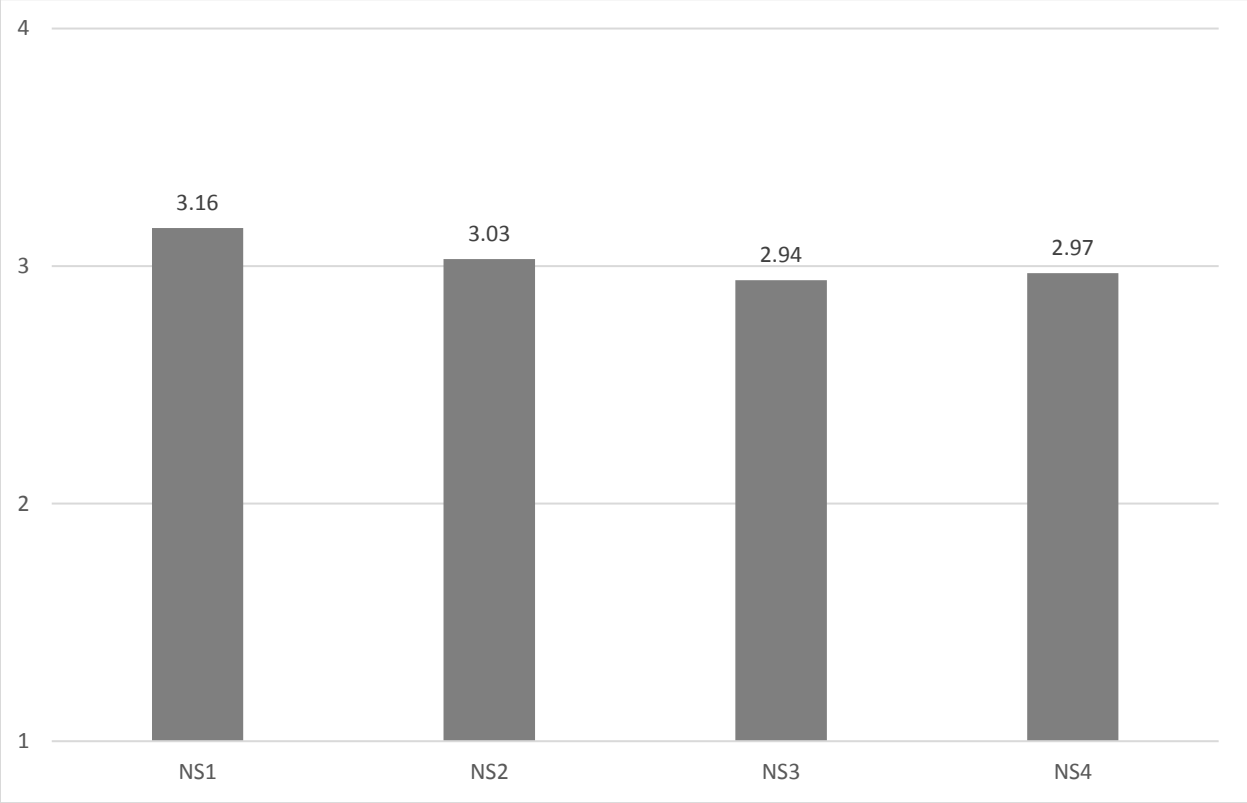

Figure 3. Mean Score by Rubric Measure for Natural Sciences Assessment

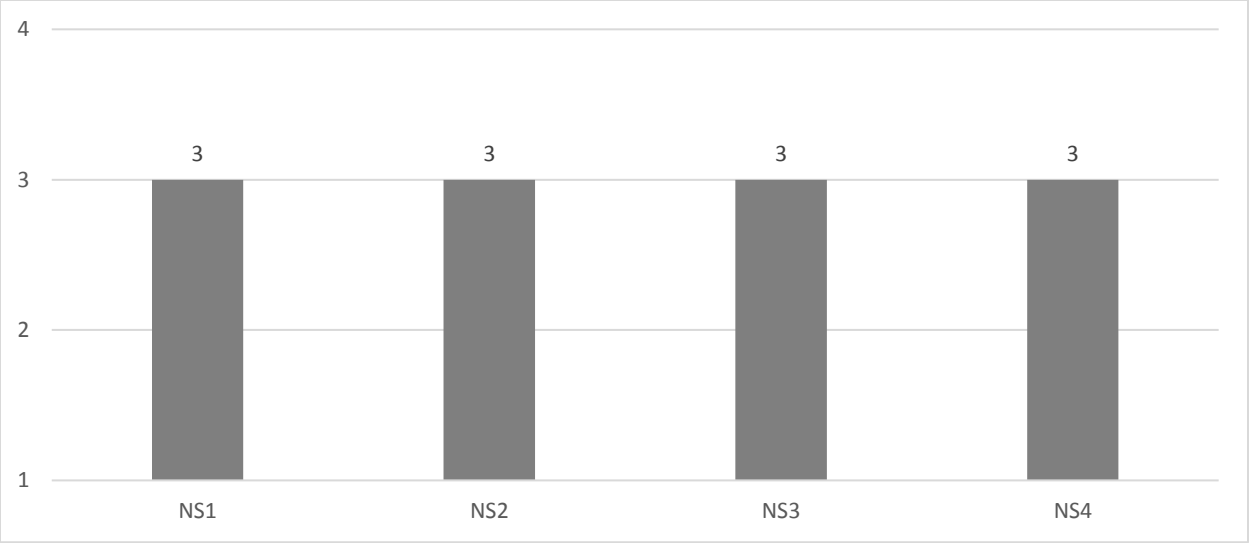

Figure 4. Mode by Rubric Measure for Natural Sciences Assessment

Inter-rater Reliability

Three separate readers assessed each student artifact. Table 4 displays the mean score for the three separate readings of all artifacts.

Table 4

Inter-rater Summary for Natural Sciences Assessment
Natural Sciences

	Assessor 1	Assessor 2	Assessor 3	SD
NS1	3.08	3.14	3.26	.09
NS2	2.97	3.11	3.00	.07
NS3	2.84	3.09	2.88	.14
NS4	2.93	3.01	2.97	.04

In addition to the descriptive statistics, Table 5 provides multiple measures of inter-rater reliability. The percentage agreement value was calculated to determine the percentage of artifacts for which all three assessors scored at the same performance level or within one level. Values for *Total Agreement* provided in Table 5 represent the percentage of artifacts for which all three assessors selected the same score (e.g., Assessors 1, 2, and 3 all selected *3*). *Agreement (within 1 level)* represents the percentage of artifacts for which all three assessors scored the artifact at the same performance level or within one level (e.g., Assessor 1 selected a score of *3*, Assessor 2 selected a score of *2*, and Assessor 3 also selected a score of *2*).

In addition to percentage agreement, a one-way, average-measures intra-class correlation coefficient (ICC) was calculated to assess inter-rater reliability. ICC coefficients between .75 and 1.00 are considered excellent, .60 to .74 considered good, .40 to .59 fair, and below .4 is considered poor (Cicchetti, 1994). Based upon these criteria, inter-rater reliability was acceptable for all measures.

Table 5

Inter-rater Reliability for Natural Sciences Assessment
Natural Sciences

Competency Measure	Total Agreement	Agreement (within 1 level)	ICC	95% Confidence Interval
NS1	18.8%	47.0%	.57	(.50-.64)
NS2	19.0%	81.5%	.62	(.55-.68)
NS3	17.8%	76.0%	.56	(.48-.63)
NS4	19.5%	80.8%	.65	(.59-.71)

Summary and Plan for Improvement

A comparison of results from the 2014 Natural Sciences Assessment with the 2017 assessment demonstrates an improvement in student performance on all rubric measures. Table 6 provides the percentage of artifacts scored at a *3* or *4,* indicating "clearly evident" or "usually evident," for both 2014 and 2017. The percentage of artifacts scored at the "clearly evident" and "usually evident" levels increased for all NS measures from 2014 to 2017.

Table 6

Natural Sciences Assessment Results 2014 and 2017

	% Above (3 or 4) 2014	% Above (3 or 4) 2017
NS1	68.4%	79.4%
NS2	68.9%	74.5%
NS3	68.0%	69.4%
NS4	62.8%	71.6%

Assessment Instrumentation

The university is currently undergoing a General Education program revision. With a pending revision to the program and the assessment of student learning outcomes within the program, the GECC has determined that no further revisions will be made to the existing assessment instruments. The Office of General Education will continue to capture feedback on the assessment instruments to help guide the development of new instruments when the new General Education program goes into effect.

Measures and Targets

For the assessment of the Natural Sciences content area courses, a target was set at 60% of students demonstrating the outcomes at the “clearly evident” or “usually evident” level for the Natural Sciences rubric. The target was met for all rubric measures. The comparison in results from 2014 to 2017 demonstrate departments have been working diligently to incorporate the outcomes in the curriculum and the GECC requests that the academic departments continue these efforts.

References

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*(4), 284-290. doi: 10.1037/1040-3590.6.4.284

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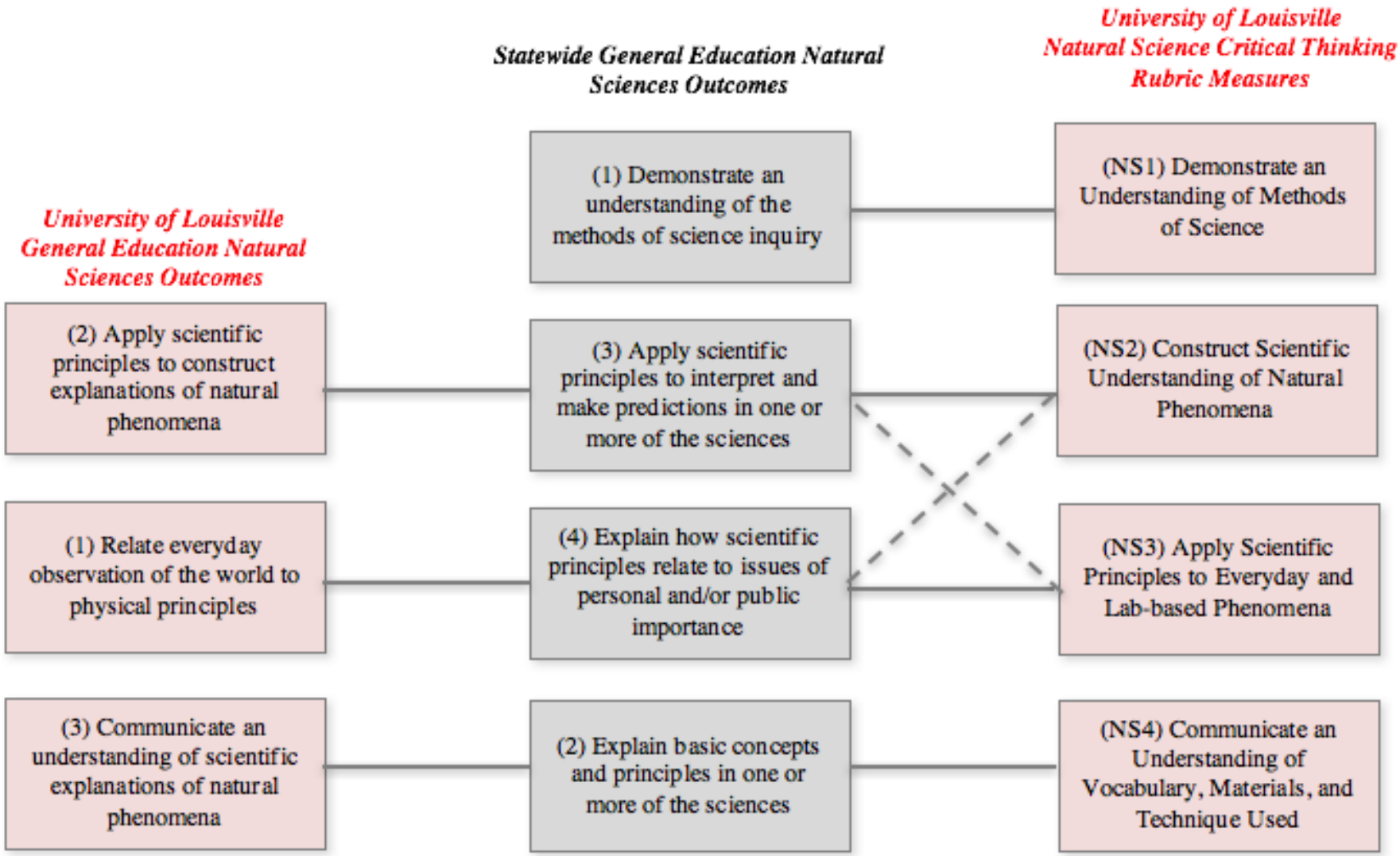
Appendix A: Outcomes and Assessment Measures Crosswalks



Appendix B

General Education Natural Sciences Syllabus Review (Spring 2017)

History of the Syllabus Review

In 2012, the General Education Syllabus Review Project was initiated to evaluate the congruence of general education course syllabi with the approved content-specific general education student learning outcomes. Specifically, it was designed to determine: (a) if the student learning outcomes stated in each course syllabus are congruent with the approved content-specific general education learning outcomes, and (b) if corresponding assessment methods are stated that support the approved content-specific general education learning outcomes.

In the spring of 2015, the GECC Assessment Subcommittee proposed that the Syllabus Review Project be incorporated into the existing General Education Assessment Project. Therefore, the syllabi from each content area will be collected and reviewed by the Office of General Education in alignment with the corresponding assessment cycle.

This report summarizes the review process and the results of the syllabi review for the Natural Sciences content area.

Review Process

The Provost requests that all faculty load their syllabi to Blackboard© each semester. These syllabi are then available through the university's course catalog system. For the purpose of this review, the Office of General Education collected all Natural Sciences syllabi that were loaded to Blackboard in spring 2017.

The review of syllabi sought to answer two questions:

1) Does the syllabus contain the content specific general education learning outcomes approved for the course?

2) Are assessment methods stated that support the content-specific general education learning outcomes approved for the course?

An evaluation of the congruence between the listed assessment methods with the content specific approved general education learning outcomes was not conducted when a reviewer determined that the syllabus does not contain a statement of the approved content specific general education learning outcomes.

Natural Sciences

The syllabus review included syllabi from 127 of the Natural Sciences General Education course sections offered in the Spring of 2017 resulting in an 80.9% sample. Appendix Table 1 provides

a breakdown of the number of General Education syllabi available, the number of syllabi with the outcomes stated, and the number of syllabi that also included the assessment methods.

Table 1.

Natural Sciences Syllabus Review

	Syllabi Available	**Outcomes Listed in Syllabus**	**Assessment Method**
NS Courses	**127 (80.9%)**	**57 (44.9%)**	**3 (5.3%)**

The review of the 127 General Education Natural Sciences syllabi identified 57 syllabi (44.9%) containing the content-specific general education learning outcomes approved for the course. Further review of the 57 syllabi containing the General Education Outcomes revealed that 3 syllabi (5.3%) also listed the assessment methods for the General Education Outcomes.