SCHEV Assessment Report
Written Communication & Scientific Reasoning
2022-23

Submitted April 2024

Background

SCHEV's policy on Student Learning Assessment and Quality in Undergraduate Education (June 8, 2017) mandates that (applicable) institutions assess student achievement in at least six competency areas. Four core competencies must be assessed by all institutions:

1. Civic Engagement
2. Critical Thinking
3. Quantitative Reasoning
4. Written Communication

Two additional competencies that reflect ongoing institutional priorities for student learning and development shall be selected by individual institutions. For VMI, these are:

5. Oral Communication
6. Scientific Reasoning

Data Collection & Reporting Schedule

Competency	Year
Critical Thinking	2021-2022 (Repeats 2024-2025)
Oral Communication	2021-2022 (Repeats 2024-2025)
Written Communication	2022-2023 (Repeats 2025-2026)
Scientific Reasoning	2022-2023 (Repeats 2025-2026)
Civic Engagement	2023-2024 (Repeats 2026-2027)
Quantitative Reasoning	2023-2024 (Repeats 2026-2027)

VMI Core Curriculum

The VMI Core Curriculum is a common and mutually reinforcing set of courses and experiences designed to cultivate the essential characteristics of the citizen-soldier—a person of character who is able to anticipate, respond, and lead in a complex and changing world.

The VMI Core Curriculum (CC) is thus organized into four components:

A. Key Competencies (e.g., quantitative reasoning)

B. Foundations of Citizenship and Leadership

C. Perspectives on Civilization and Human Achievement

D. Integrative Experiences

All six SCHEV competencies, with the exception of Civic Engagement, are assessed within VMI's Core Curriculum courses.

Written Communication

Written Communication - Overview

What is Written Communication?

Written communication is the ability to employ rhetorical strategies that articulate ideas to an audience to achieve a clear purpose. Written texts can be designed to increase knowledge, foster understanding, or promote change in the listeners' attitudes, values, beliefs, or behaviors.

In a Core Curriculum two-course sequence, Writing and Rhetoric I & II (ERH 101, ERH 102), cadets receive formal instruction in the principles of rhetoric and written communication by reading, composing, and revising both expository and research-informed essays. Beyond these 100-level courses, cadets have opportunities in two required writing-intensive courses (one of which must be in the cadet's major) to build on this knowledge and continue to strengthen their abilities in written communication.

By emphasizing training and practice in written communication, VMI seeks to equip cadets for both academic success and participation in the full range of rhetorical occasions they will encounter in their lives as citizens and professionals.

Written Communication
Student Learning Outcomes (SLOs)

After completing Writing and Rhetoric I & II (ERH 101 and 102), cadets will be able to…

- Analyze the audience, occasion, and purpose of a rhetorical situation in order to formulate a response to an idea or problem.
- Generate ideas through both discovery and consultation of a variety of sources.
- Develop ideas fully, offering compelling support and evidence for assertions or conclusions.
- Organize ideas coherently, integrating sources effectively and documenting them appropriately.
- Edit writing for clarity, precision, and stylistic effectiveness.
- Proofread writing to ensure grammatical and mechanical correctness.

SLOs Measurement & Results

Measurement

- The culminating assignment in all sections of Writing and Rhetoric II (ERH 102) is a common reflective essay.

- A random sample (30%) of these essays are rated independently by two faculty members who have been trained in holistic assessment.

- Using a standard 5-point scale on a holistic scoring rubric, a rating of 3 reflects the standard by which a student demonstrates competency in written communication.

- The target proficiency rate for this assessment is 75%.

Results

- In the 2022-23 assessment, 73.33% of cadets demonstrated proficiency in written communication.

Discussion & Future Actions

Discussion

- The results in the 2022-23 assessment rating of written communication was slightly below the target (73.33% actual vs 75% target).
- Each year assessment results are shared and discussed with instructors. The ensuing conversations generate topics for developmental workshops offered to those who teach the course.
- As well, effective reflective essays are drawn from the 2022-23 rated sample and added to the archive to be used as examples in class.

Future Actions

- Develop and offer faculty development workshops focus on teaching strategies for the reflective essay assignment, using benchmark essays and the holistic rubric.

Scientific Reasonsing

Scientific Reasoning - Overview

What is Scientific Reasoning?

Scientific Reasoning is a form of reasoning which includes the formation of hypotheses and the validation through scientific method of those hypotheses.

In an effort to understand the fundamental principles in science, VMI cadets engage with science in an active learning environment in which they conduct experiments and apply scientific knowledge, theory, and models.

Cadets gain foundational knowledge in Scientific Reasoning within the Core Curriculum by taking two semesters of laboratory-based science courses. Cadets can choose to take these courses among three disciplines including Chemistry (CH111-112 [non-majors] or CH131-132 [majors]), Biology (BI101 -102 [non-majors] or BI112-113 [majors]), and Physics (PY156 & Lab250A)

By emphasizing Scientific Reasoning in a variety of disciplines, VMI provides cadets with the opportunity to engage with science in a discipline of their choosing, while focusing the knowledge and skills learned on common SLOs. This commonality ensures cadets have similar experiences that target the overall purpose of this competency within the Core Curriculum.

Scientific Reasoning Learning Outcomes

After completing their two-course lab sequence, cadets will be able to…

- Demonstrate an understanding of scientific principles through the use of theories or models.
- Employ appropriate scientific equipment to conduct experiments.
- Collect, analyze, and interpret data.
- Demonstrate an understanding of science in our everyday world.

Methods/Measures

Measurement

- The Biology Department uses an end of year lab report in BI 102 and 113 as an additional assessment instrument for the scientific reasoning learning outcomes. Class activities, exercises, homework assignments, and laboratory exercises have been embedded in the course to instruct and reinforce the learning outcomes during BI 101 and BI 102 (non-majors) and BI 111, 112, and 113 (majors).

- Chemistry utilizes two multiple-choice knowledge tests (one at the end of first semester and one at the end of second semester), two laboratory reports (one during CH-111 and one during CH-112), and two laboratory quizzes (one during CH-111 and one during CH-112) to assess scientific reasoning.

- Physics uses two specific laboratory exercises to assess scientific reasoning. In PY 155 the lab selected is on the Work-Energy Theorem and in PY 156 the lab focused on resistivity of metals. In both labs, specific questions/exercises relating to the collection, analysis, and interpretation of data are graded.

Methods/Measures
Biology

Biology

Biology Methods/Measures/Targets			
	Student Learning Outcome	***Method***	***Target***
1	Scientific principles through theories and models	Lab report rubric score for LO 1	60% achieve 3/6
2	Employ appropriate equipment for experiments	Lab report rubric score for LO 2	60% achieve 3/6
3	Collect, analyze, and interpret data	Lab report rubric score for LO 3	60% achieve 3/6
4	Science in our everyday world	Lab report rubric score for LO 4	60% achieve 3/6

Methods/Measures
Chemistry

Chemistry

Chemistry Methods/Measures/Targets			
	Student Learning Outcome	***Method/Measure***	***Target***
1	Scientific principles through theories and models	MC exam questions	60% or greater correct
2	Employ appropriate equipment for experiments	Lab quizzes	60% or greater correct
3	Collect, analyze, and interpret data	Lab report	60% or greater correct
4	Science in our everyday world	MC exam questions	60% or greater correct

Methods/Measures
Physics

Physics

Physics Methods/Measures/Targets			
	Student Learning Outcome	***Method/Measure***	***Target***
1	Scientific principles through theories and models	Lab report	70% achieve 70% correct
2	Employ appropriate equipment for experiments	Lab report	70% achieve 70% correct
3	Collect, analyze, and interpret data	Lab report	70% achieve 70% correct
4	Science in our everyday world	Lab report	70% achieve 70% correct

Results

Results

The data in the table are presented based on the targets for each SLO within each discipline.

Results by Discipline 2022-23				
	Student Learning Outcome	***Biology***	***Chemistry***	***Physics***
1	Scientific principles through theories and models	Majors: 82% Non-majors: 50%	73.1%	92.1%
2	Employ appropriate equipment for experiments	Majors: 100% Non-majors: 82%	82.6%	82.1%
3	Collect, analyze, and interpret data	Majors: 86% Non-majors: 64%	88.4%	97.7%
4	Science in our everyday world	Majors: 82% Non-majors: 54%	75.5%	95.1%

Discussion & Future Actions

Discussion

- All but one (non-majors in Biology for SLO1; 50% vs. 60% target) of the results in the 2022-23 met the established target for each discipline.

- Each year, assessment results are shared and discussed with instructors for each course and lab among the disciplines. The ensuing conversations generate topics for developmental workshops offered to those who teach these labs and courses.

Future Actions/Previous Improvements

Biology

SLO 1 and 4 scores both dropped for non-majors following COVID pandemic. We have reworked some of our lesson plans to better address missing skills and are seeing increasing scores. We also suspect that students are prioritizing effort in studying for the final exam over the lab report. Thus, we are adding an assessment tool comparing pretest questions to posttest questions embedded in the final exams.

Discussion & Future Actions

Future Actions/Previous Improvements

Chemistry

Chemistry instructors meet every semester to discuss the results of the core curriculum assessments. If some SLO scores are lower than others, the instructors are encouraged to give increased emphasis on corresponding topics via homework and/or in-class assignments.

Notably, although SLO scores typically meet target thresholds, we nonetheless would prefer them to consistently exceed our expectations.

To this end, in response to students' difficulties using linear regression to complete lab assignments, faculty created a new, more detailed, step-by-step instructional guide (with screenshots) for making the computations in Excel. Future assessments will be used to determine the impact of this improvement.

Discussion & Future Actions

Future Actions/Previous Improvements

Physics

Given lower than desired lab scores (pre-pandemic), lab instructors devoted more instructional time to lab activities the following year. Subsequent assessments showed an uptick in student performance. Specifically, SLO scores moved from 62.8% (SLO1) and 57.4% (SLO2) to 67% (SLO1) and 68.8% (SLO2) in 2019-2020. In the 2020-2021 assessment, these scores further increased to 72.7% (SLO1) and 83.7% (SLO2).

In 2020 and 2021 we believe the COVID pandemic affected student learning and corresponding SLOs performance. Specifically, in Fall 2021, no targets were met, yet in the following year three of the four learning outcomes were met. Most recently, as shown previously in this report, all SLO targets were met.

Going forward, we will monitor data closely in future assessment cycles to ensure that scores have stabilized and that future improvements are not driven by (likely) pandemic-induced aberrations.