General Education Assessment: Scientific Literacy Results 2020

What do we mean by Scientific Literacy?

Virginia Western describes Scientific Literacy as the ability to apply the scientific method and related concepts and principles to make informed decisions and engage with issues related to the natural, physical, and social world.

A person who is competent in scientific literacy adheres to a self-correcting system of inquiry (the scientific methods) and relies on empirical evident to describe, understand, predict and control natural phenomena. A student is scientifically literate can:

- o formulate a hypothesis
- o collect data
- o analyze data
- o draw accurate conclusions based on data

How did we assess Scientific Literacy?

We assessed students' scientific literacy through evaluation of selected classwork.

How was student work selected?

Fall 2019

- At the beginning of the fall 2019 semester, program heads discussed the general education competencies that would be assessed that year with the faculty in their area. For 2019-20, these competencies were Critical Thinking and Scientific Literacy.
- Faculty identified what assignments in their courses might be appropriate to serve as "artifacts" for the assessment process, and submitted a list of these to the Institutional Effectiveness Office. Such assignments might include homework, lab assignments, test questions, projects, or other student work.
- The Institutional Effectiveness Office (IEO) reviewed the lists and worked with program heads and faculty as needed to ensure that an appropriate array of course sections was included.

Spring 2020 – Fall 2020

- By the end of the spring semester (spring 2020), faculty sent the Institutional Effectiveness Office the student work (artifacts) from all of the students in their class for the selected assignments. Because of COVID-19 disruptions, not all of the planned assignments were conducted. The collection period was then extended through summer 2020 and fall 2020.
- The faculty submissions were not graded and included the student names and student IDs for demographic analysis. All student and faculty information was redacted from the artifacts by the IEO prior to assessment. Starting in 2020, the IEO maintained a cross-reference system to allow the redacted artifacts to later be summarized by demographic attributes.

Spring 2021

- The Institutional Effectiveness Office selected a random sample of 150 redacted scientific literacy artifacts to be assessed.
- Student artifacts from 2020 were assessed from the following classes, which include a range of subjects, instructor types, student levels, and course modalities:

Subject	Instructor Type	Course Level	Mode of Instruction
BIO	Full Time	1xx	Day (converted to Zoom due to COVID)
BIO	Full Time	1xx	Online
BIO	Full Time	2xx	Day (converted to Zoom due to COVID)
GOL	Adjunct	1xx	Evening
PHY	Full Time	2xx	Day (converted to Zoom due to COVID)
SDV	Adjunct	1xx	Hybrid (converted to Zoom due to COVID)
SDV	Full Time	1xx	Online

Who assessed the student work?

- Through the governance process, some faculty chose to serve on the General Education Workgroup for 2020-21. This workgroup was charged with:
    - Assessing the artifacts for the selected general education competencies
    - Analyzing prior general education assessment results and developing a plan for improving student learning for these outcomes
    - Revising the assessment rubrics as needed
- The members of the workgroup were divided into teams, each assessing an equitable set of artifacts from 2020. The team members evaluated and scored each artifact based on criteria in the appropriate rubric.
- Each team then provided the IEO with a list of reconciled scores as well as summary information regarding the process, the rubric, student strengths and student weaknesses.
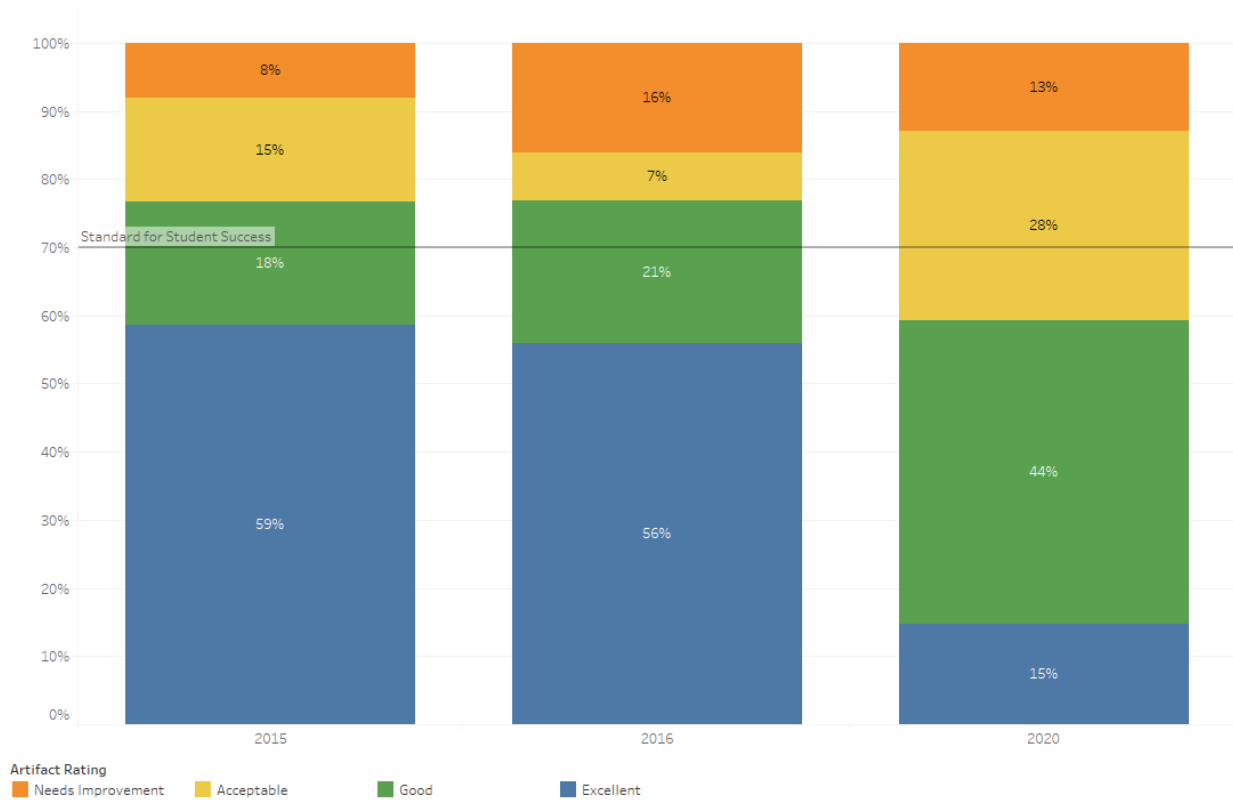
The IEO analyzed the results, with comparison against a target for student achievement of the competency. This target was established by the Vice President of Academic and Student Affairs based on prior results, and approved by Faculty Senate. The results will be discussed with faculty at the beginning of the fall 2021 semester.

What were the standards for assessment?

The rubric used in evaluating the scientific literacy artifacts is included at the end of this report.

What were our results?

Scientific Literacy Assessment
Overall Artifact Rating Trends

	2015	2016	2020
Needs Improvement	8%	16%	13%
Acceptable	15%	7%	28%
Good	18%	21%	44%
Excellent	59%	56%	15%

Artifact Rating: Needs Improvement, Acceptable, Good, Excellent

Note: The standard for student success is that at least 70% of examined artifacts receive a rating of "Good" or "Excellent".

The assessment teams noted the following overall student strengths:

- Most students were able to effectively graph using Excel.

The assessment teams noted the following overall student weaknesses:

- Students demonstrated difficulties in their ability to draw meaningful conclusions from the data.

<u>Have results changed since the last time this outcome was assessed?</u>

Prior to 2016, all general education competencies were evaluated each year. This resulted in an overload of information that made it difficult to implement meaningful change. It also meant that Virginia Western had several assessment teams, which led to turnover and potential discrepancies in assessment over time. Starting in 2016, the college shifted to focusing on two general education competencies each year. Faculty were encouraged to remain with the assessment teams from year to year and assess different competencies each year. This led to reduced turnover and a deeper cohesiveness within the assessment teams.

Year	% of Artifacts assessed as Excellent or Good
2020	59%
2016	77%
2015	77%
2014	71%

The percentage of artifacts assessed as Excellent or Good declined markedly in 2020, and for the first time fell below the standard for success set at 70%. Possible factors affecting these results include:

- COVID effects (most likely)
- Changes in the rubrics over time
- A more experienced assessment team
- Changes in the assignments used for assessment

Breakdown of current results

The following demographics were not analyzed due to an insufficient number of artifacts in these categories:
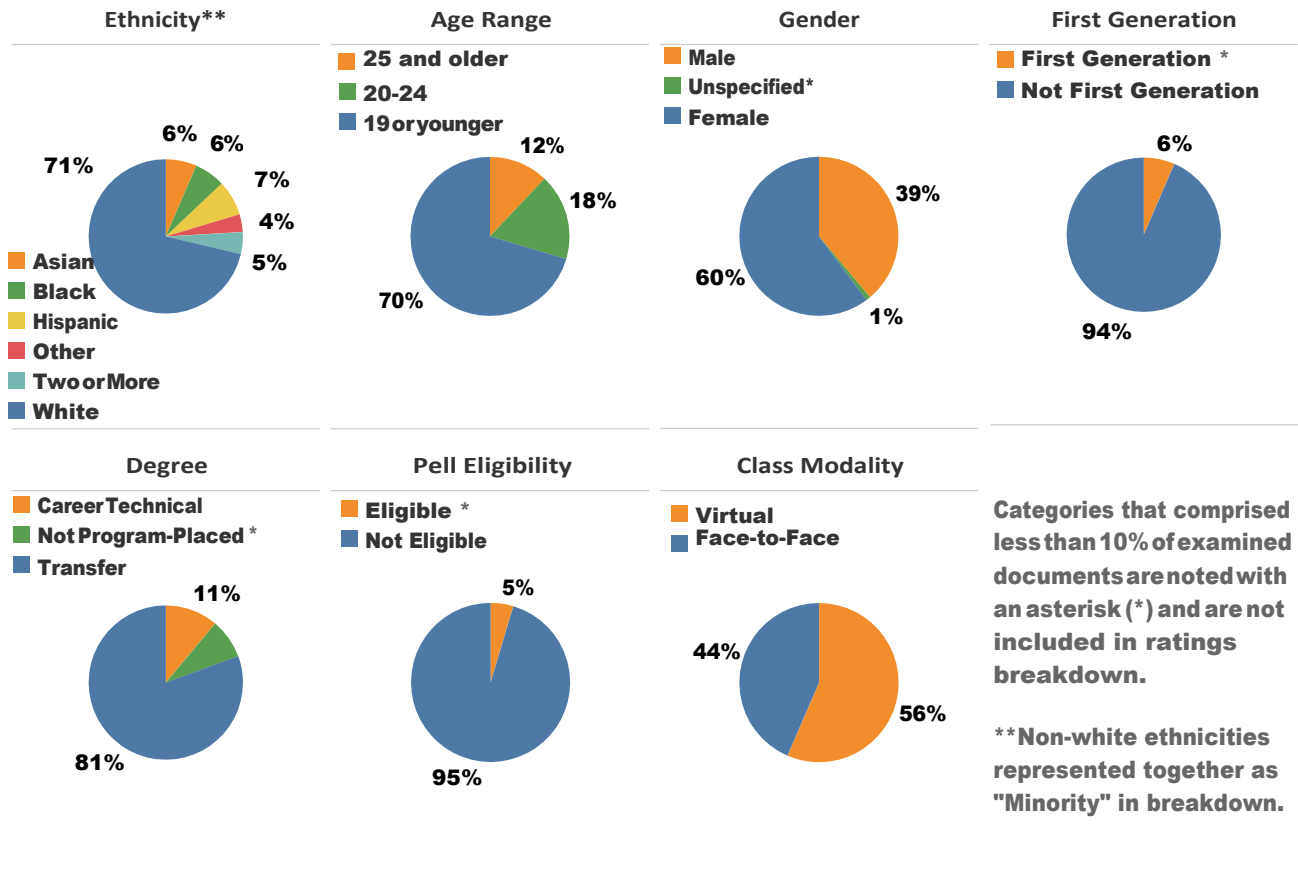
- Gender unspecified
- First generation
- Not program-placed
- Pell eligible

Within the remaining demographic categories, the largest differences were by degree level and by age range.

- Degree level: Among artifacts from Career Technical (AAS and certificate) students, 25% earned an assessment of Excellent or Good, versus 63% of artifacts from Transfer (AA and AS) students.
- Age Range: By age range, 69% of artifacts from students age 20-24 were judged as Excellent or Good, versus 46% from students 25 or older.

Scientific Literacy Assessment
Percentage of Artifacts Examined by Demographic Category

Ethnicity**

71% 6% 6% 7% 4% 5%

- Asian
- Black
- Hispanic
- Other
- Two or More
- White

Age Range

- 25 and older
- 20-24
- 19 or younger

12% 18% 70%

Gender

- Male
- Unspecified*
- Female

39% 60% 1%

First Generation

- First Generation *
- Not First Generation

6% 94%

Degree

- Career Technical
- Not Program-Placed *
- Transfer

11% 81%

Pell Eligibility

- Eligible *
- Not Eligible

5% 95%

Class Modality

- Virtual
- Face-to-Face

44% 56%

Categories that comprised less than 10% of examined documents are noted with an asterisk (*) and are not included in ratings breakdown.

**Non-white ethnicities represented together as "Minority" in breakdown.

Scientific Literacy Assessment
Artifact Ratings by Demographic Category

Note: The standard for student success is that at least 70% of examined artifacts receive a rating of "Good" or "Excellent".

What changes are we making to improve student learning for Scientific Literacy?

Recommendations for changes will be made after faculty have the opportunity to review the results at the beginning of the fall 2021 semester.

Because this competency was assessed at the height of Covid, there were many unknowns for the campus community. Faculty were primarily focused on transitioning their courses to Zoom and making the necessary changes to course materials to accommodate the online modality and offer extra support to students. The faculty decided that the improvements for the scientific literacy competency will be to increase the number of students assessed as well as assess a more diverse population of students, which will include assessments from all schools at the College. This will allow for more meaningful data to be collected and will provide a more accurate representation of whether or not the target was met.

Scientific Literacy Rubric

Revised 3/13/19

A person who is competent in scientific literacy has the ability to apply the scientific method and related concepts and principles to make informed decisions and engage with issues related to the natural, physical, and social world. Scientific literate individuals can recognize and know how to use the scientific method, and to evaluate empirical information.

	Excellent-4	Good-3	Acceptable-2	Needs Improvement-1
Formulate a hypothesis	Formulates a testable hypothesis related to the problem.	Hypothesis is established but is not testable OR is unrelated to the problem.	Hypothesis is established but is not testable AND is unrelated to the problem.	Hypothesis is missing.
Collect data	Relevant data is collected with few or no errors.	Relevant data is collected with minor errors.	Relevant data is collected with a significant number of errors.	No relevant data is collected.
Analyze data	Data is analyzed with few or no errors.	Data is analyzed with minor errors.	Data is analyzed with a significant number of errors.	Data is not analyzed.
Draw accurate conclusions based on data	Conclusion drawn fully supports the scientific argument.	Conclusion drawn partially supports the scientific argument.	Conclusion drawn does not support the scientific argument.	Conclusion is missing.