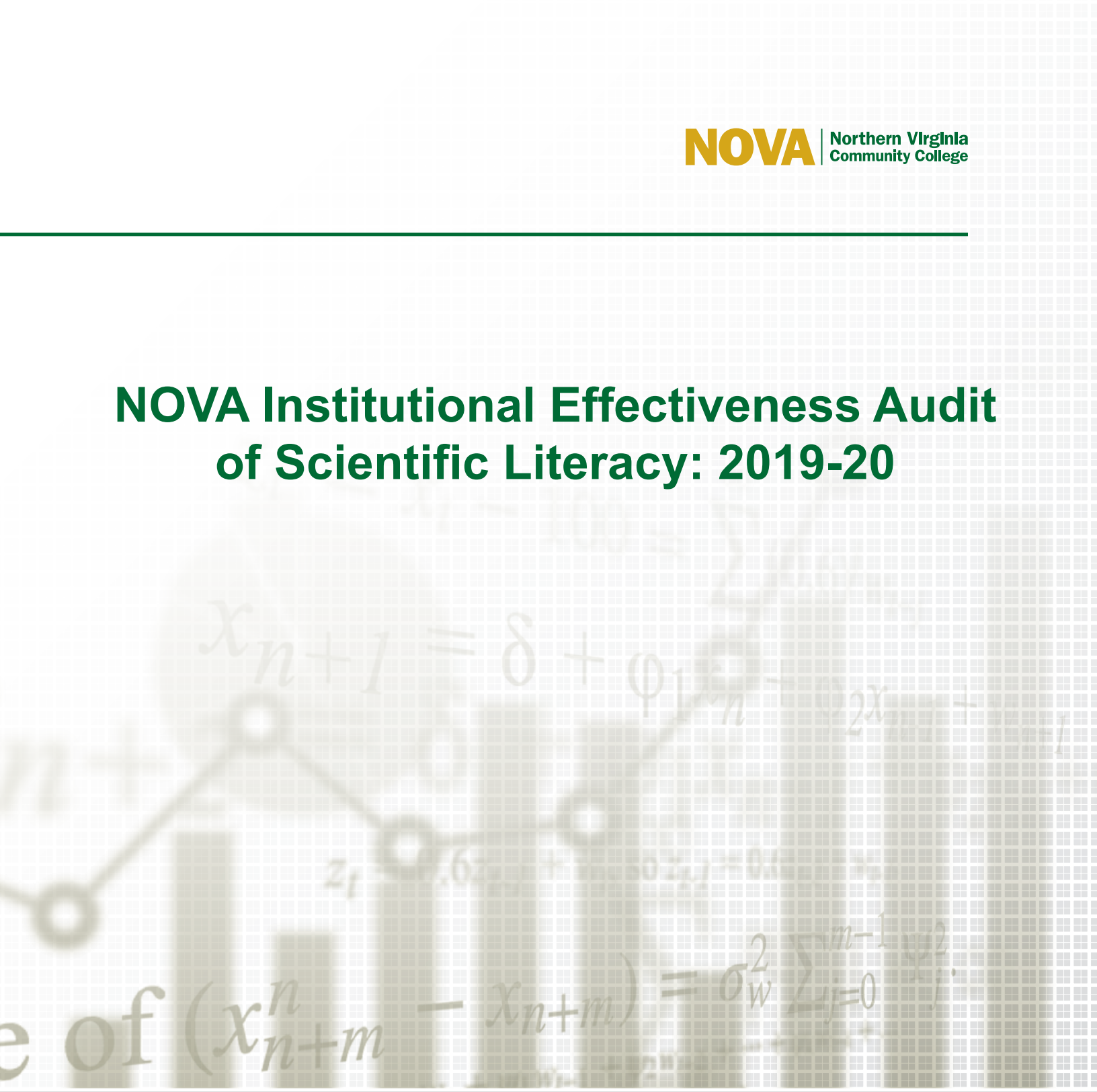
NOVA | Northern Virginia Community College

NOVA Institutional Effectiveness Audit of Scientific Literacy: 2019-20



Research Report No. 20-22

Office of Strategic Insights

July 2022

NORTHERN VIRGINIA COMMUNITY COLLEGE

Office of Strategic Insights

The Office of Strategic Insights (OSI) conducts analytical studies and provides information to support institutional planning, policy formulation, and decision-making. Additionally, OSI provides leadership and support in research-related activities to NOVA community members who are engaged in planning and evaluating the institution's success in accomplishing its mission.

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Institutional Effectiveness Audit of Scientific Literacy: 2019-2020

Executive Summary

This section summarizes key findings from the Office of Strategic Insights' 2019-2020 *Institutional Effectiveness Audit of Scientific Literacy.* The audit examines data gathered from all programs and disciplines performing scientific literacy (SL) assessments. This audit is used to summarize the college-wide assessment process and provide evidence of student learning in scientific literacy. *VCCS General Education Policy (5.0.2)* defines 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. Degree graduates will recognize and know how to use the scientific method, and to evaluate empirical information."

1. Submission and Quality of Professional Assessments:
   - In 2019-2020, nine educational programs and seven disciplines without degrees assessed scientific literacy.
   - The overall quality of 2019-2020 scientific literacy assessment reports written by programs and disciplines was excellent. On average, programs and disciplines average score on the analytic rubric was a 94.6 percent, which meets expectations (90-100 percent).
2. Course Embedded Scientific Literacy Assessments:
   - In 2019-2020, six educational programs and six disciplines used an SLO to operationalize scientific literacy.
3. Sample Size:
   - 7,367 students were involved in the 2019-2020 assessment of scientific literacy at NOVA. Approximately 46 percent of those students were assessed in their educational programs and about 55 percent of students assessed in a discipline course.
4. Measuring Student Achievement in Scientific Literacy:
   - The Office of Strategic Insights coded 16 SL rubrics and exams. Seventy-two percent of exams and 80 percent of rubrics were operationalized to align with the VCCS definition of scientific literacy.
5. Actions to Improve Student Learning:
   - In 2019-2020, the 16 programs and disciplines assessing scientific literacy created 126 actions to improve student learning and the assessment process. This averages to 7.8 actions for improvement per program and discipline.
   - 69 percent of the disciplines' changes were made to their assessment process.
   - 50 percent of programs' actions were curricular specific.

Introduction

The State Council of Higher Education for Virginia (SCHEV) and the Virginia Community College System (VCCS) define general education as a core set of knowledge, abilities, and skills essential to the undergraduate curriculum to optimize student success for work and life. The six general education content areas prescribed by the VCCS for all system college curricula are: civic engagement, critical thinking, professional readiness, quantitative literacy, scientific literacy, and written communication. At NOVA, these crucial skills and knowledge are called core learning outcomes (CLOs). Core learning outcomes are developed in general education courses and practiced and honed in individual fields of study. The teaching and assessment of these skills and knowledge are dispersed across the curriculum. Educational degree programs and disciplines without degrees at NOVA assess general education core learning competencies.

Prior to 2017-2018, VCCS required NOVA to assess general education core competencies using standardized assessment measures chosen by the VCCS. In 2017-18, NOVA implemented course embedded assessments, a direct measure using students' actual coursework, for CLO assessments. This decision was based on recommendations from NOVA's Ad Hoc Committee on General Education Assessment, established in 2016, and the SCHEV *Policy on Student Learning Assessment and Quality in Undergraduate Education* adopted in July 2017.

This report analyzes how well NOVA students learn the scientific literacy core learning outcome. The VCCS General Educational Policy (5.0.2) defines scientific literacy (SL) 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. Degree graduates will recognize and know how to use the scientific method and to evaluate empirical information." Scientific literacy is essential to 21st century living, though students and our educational system in the United States are finding the path to proficiency difficult to navigate.[1]

This CLO assessment is part of a larger three-year cycle assessing NOVA's six core learning outcomes. The goal is determining students' level of mastery of the general education competencies (Table 1). Each year, the College's programs and disciplines assess at least one of two scheduled CLOs for college-wide reporting. NOVA initiated the three-year assessment cycle in 2017-2018, and that year assessed critical thinking and quantitative literacy. Professional readiness and scientific literacy were assessed in 2019-2020.[2]

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[1] The National Academies of Science, Engineering, and Medicine wrote the book on scientific literacy in 1996, *The National Science Education Standards*. It posits, "scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity." The National Academy understands scientific literacy as the ability to identify important scientific content as well as key abilities. They write, "Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena."

[2] Information on the professional readiness assessment may be found in the *Institutional Effectiveness Audit of Professional Readiness: 2019-2020.*

Table 1. Core Learning Outcome Assessment Schedule 2017-2018 to 2022-2023

Core Learning Outcome	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Assessment Phase →	**Complete**	**Complete**	**Complete**	**Data Collection**	**Preparing**	**Not Started**
Civic Engagement		X			X	
Critical Thinking	X			X		
Professional Readiness			X			X
Quantitative Literacy	X			X		
Scientific Literacy			X			X
Written Communication		X			X	

All educational programs and disciplines report on the assessment of each CLO in four broad areas: how the learning outcome is assessed; the assessment method; the assessment results; and how the results will be used to continuously improve student learning (Table 2).

Table 2. Reporting Areas for *Annual Planning and Evaluation Report*

SLOs, CLOs, Program Goals	Assessment Methods	Assessment Results	Use of Results
What did we assess?	*How did we assess? Who was assessed?*	*When did we assess? What were the results? Have results improved over time? What areas need improvement?*	*What have we been doing to improve student learning? What are we doing (or will we do) to improve student learning based on the results of the assessment?*

This *Institutional Effectiveness Audit of Scientific Literacy: 2019-2020 Report* describes and analyzes the assessment reports provided to the Office of Strategic Insights by NOVA's educational programs and disciplines without degrees. It is divided into five sections:

- Section I discusses educational programs' and disciplines' participation in the 2019-2020 scientific literacy assessment and the quality of assessment reporting;
- Section II reviews examples of how educational programs, standalone certificates, and disciplines operationalized scientific literacy and analyzes the impact of sample sizes;
- Section III describes how programs and disciplines met achievement targets;
- Section IV highlights the changes made to improve assessment and student learning;
- Section V concludes the report.

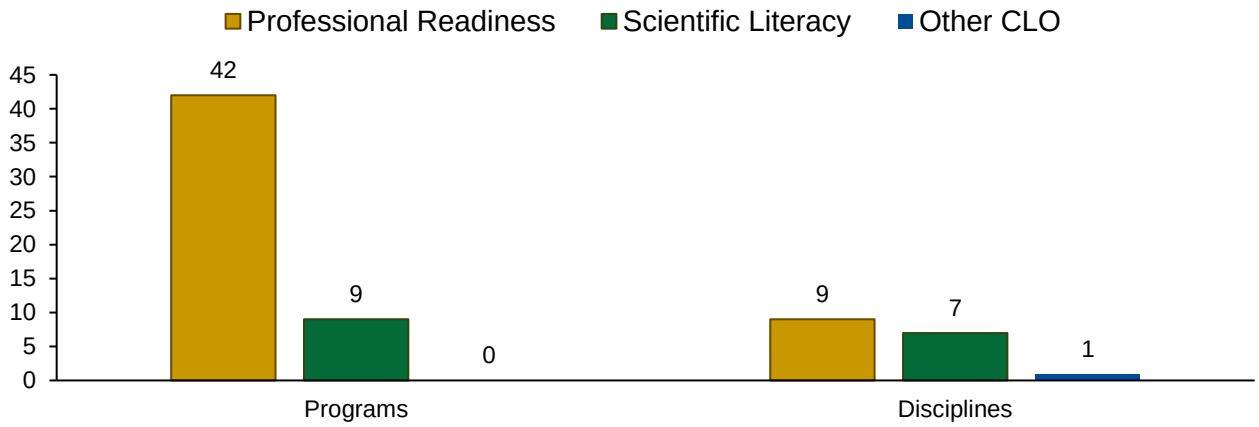
Section I: Submission and Quality of Scientific Literacy Assessments

A. Submission of Reports

In 2019-2020, nine educational programs and seven disciplines without degrees assessed scientific literacy (Figure 2). All college bound programs/disciplines, trade programs/disciplines, and the Medical Education Campus participated in the assessment of scientific literacy. The compiled *Scientific Literacy Core Learning Competency Assessment Report: 2019-2020* containing these assessment documents can be found on the Office of Strategic Insights' webpage.

Figure 1 illustrates the number of programs and disciplines assessing professional readiness and scientific literacy in 2019-2020. One discipline conducted an additional CLO assessments for the multidisciplinary degrees. For more information about the professional readiness assessment, see the *Professional Readiness Core Learning Competency Assessment Report: 2019-2020*.

Figure 1. Programs and Disciplines Assessing Core Learning Outcomes: 2019-2020



B. Quality of Assessment Reporting by Programs and Disciplines

The Office of Strategic Insights evaluated the quality of the 16 scientific literacy assessment reports using a rubric to score each section of the report: (1) the operationalization of the core learning outcome, (2) the assessment method used, (3) the assessment results, and (4) how the results are used to improve student learning and/or the assessment process.[3] The rubric awards points for the quality of reporting in each of these four sections. The sections are broken down into several sub-sections, to create clarity for the program or discipline receiving the report. Points are awarded for addressing the variety of components of the report: two points for meeting the requirement, one point for partially meeting it, and zero points for not meeting the requirement. Based on the total points and resulting overall percentage score, reports are

[3] This data set includes the four multidisciplinary degree reports (Liberal Arts, Social Sciences, General Studies, and Science). To avoid counting data twice, some tables and figures do not include the multidisciplinary degree data, as they are a composite of discipline reports already in evidence. This is noted with the relevant tables and figures.

classified by performance: meeting expectations, mostly meeting expectations, partially meeting expectations, and not meeting expectations (Table 3).

Table 3. Quality of Reporting in the *Core Learning Outcome Report*: Rubric Scale

Score on Rubric	Color	Performance Level
90%-100%	Dark Green	Meeting expectations
80-89%	Light Green	Mostly meeting expectations
70%-79%	Yellow	Partially meeting expectations
Below 70%	Red	Not meeting expectations

For the 2019-2020 assessments, programs and disciplines scored exclusively in the top two performance levels on their scientific literacy assessment reports: meeting expectations and mostly meeting expectations (Table 4). These numbers indicate a high level of success in this third year of CLO assessment at NOVA as well as a commitment to useful data collection, analysis, and subsequently, improving the assessment culture.

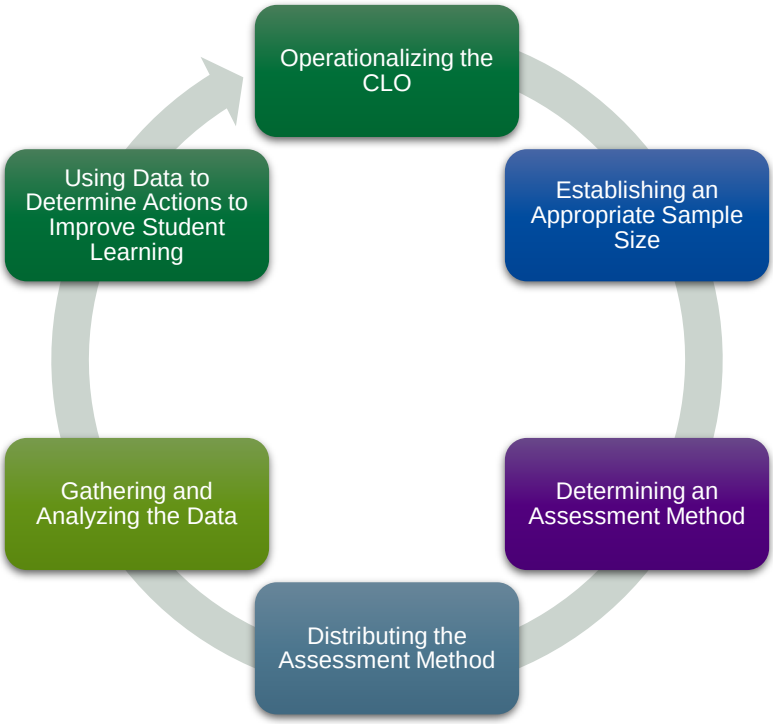
Table 4. Scientific Literacy Assessment Rubric Results: 2019-2020

Area of the Report	Educational Programs	Disciplines Without Degrees	Programs and Disciplines
CLO Criteria	100.0%	92.9%	96.4%
Assessment Methods	96.0%	91.3%	93.7%
Results	97.2%	96.4%	96.8%
Use of Results	96.1%	89.8%	93.0%
TOTAL	**97.1%**	**92.1%**	**94.6%**

Section II: Course Embedded Assessments

An effective CLO assessment cycle includes: operationalizing the CLO; establishing an appropriate sample size across courses, campuses, and modalities (i.e., on campus, online, hybrid, or off-site dual enrollment); determining the assessment method; distributing the assessment to faculty teaching the selected course sections; gathering and analyzing data; making decisions about actions to take to improve student learning and the assessment process based on the assessment results; writing the report; and disseminating this information to the program/discipline faculty (Figure 2). To implement this cycle of assessment, discipline Chairs and Assessment Leads rely on their full-time and part-time faculty, deans, and other administrators.

Figure 2. The Assessment Process Cycle



Examining core learning outcomes using course embedded assessment relies on educational programs' and disciplines' ability to align the VCCS definitions of the core learning outcomes with an appropriate course assignment and effectively operationalizing the CLO. Some programs and disciplines use existing SLOs to assess the core learning outcomes in question (Figure 3). Faculty consult their curriculum map, which indicates the courses most appropriately addressing the SLOs and CLOs being assessed each year. The curriculum map also indicates how each SLO is assessed and at what level of proficiency (introduced, practiced, and mastered). After determining the course most closely aligning with the CLO being assessed, faculty operationalize the CLO, so it best reflects the skills or abilities expected in the selected course(s).

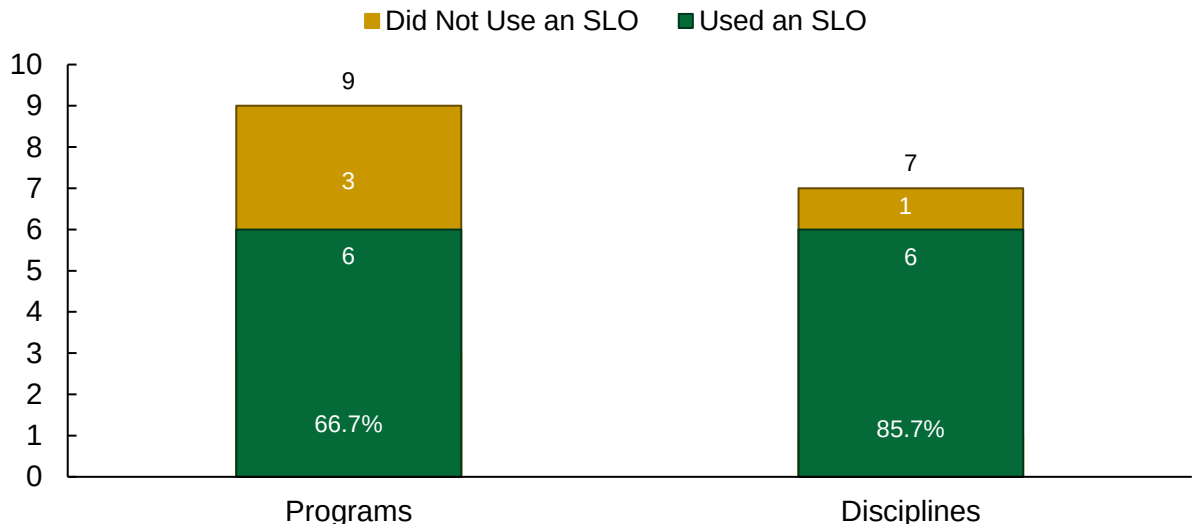
A. Operationalizing Scientific Literacy

Programs and disciplines begin with the VCCS definition of scientific literacy then operationalize the CLO to reflect the skills and competencies taught in their courses. Programs and disciplines may consult the Office of Strategic Insights to ensure that the operational definitions appropriately align with the VCCS definitions (see Appendix B, Tables A and B). What follows are examples of operational definitions of scientific literacy:

1. **Social Sciences, Health Sciences Specialization, A.S.:** "Students will demonstrate the ability to apply the scientific method and to evaluate empirical information."
2. **Computer Science, A.S.:** "Demonstrate techniques for problem analysis and algorithm design."
3. **Chemistry:** "Students will be able to use quantitative reasoning coupled with scientific knowledge to draw logical conclusions and make well-reasoned decisions."
4. **Economics:** "Students will be able to identify the impact of science and technology on economic outcomes."

As the examples above indicate, programs and disciplines sometimes operationalize core learning outcomes using their pre-existing student learning outcomes. At NOVA, 78 program and discipline student learning outcomes can be used to operationalize the VCCS scientific literacy general education core learning competency. In 2019-2020, 6 educational programs and 6 disciplines used a previously developed SLO to operationalize scientific literacy (Figure 3). These student learning outcomes have been assessed in the past, and/or will be assessed in the future. The widespread existence of SLOs used to operationalize scientific literacy indicates a high degree of integration of college-wide learning goals at the program and discipline level.

Figure 3. Scientific Literacy Assessments Operationalized Using Student Learning Outcomes



B. Sample Sizes

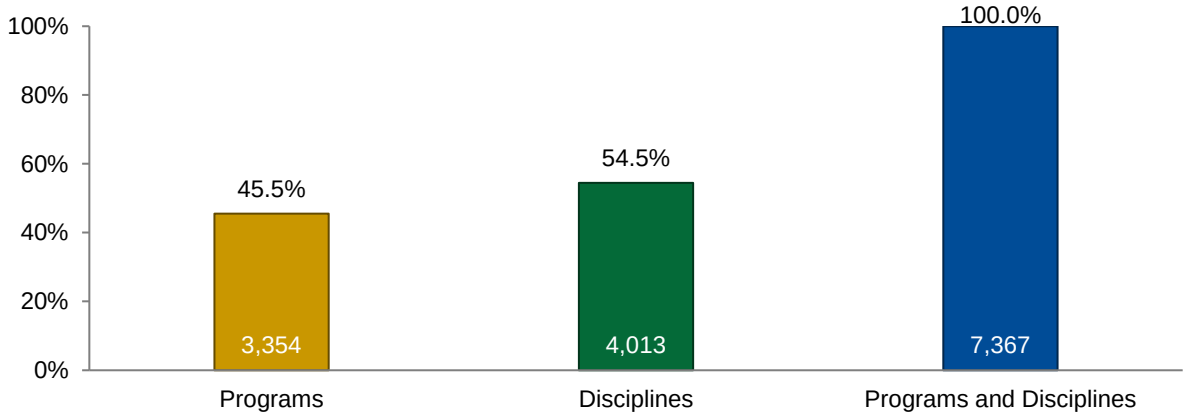
At NOVA, the faculty choose appropriate course(s) to assess each core learning outcome. If a program or discipline chooses a course with a small number of class sections, it is customary to assess all sections. If the course has multiple sections (10+), programs and disciplines ask the Office of Strategic Insights to create a sample from a representative sub-set of courses offered

across all campuses/modalities of the College; this sample typically equates to approximately one third of the total sections offered.

Sample Size by Program and Discipline

Despite the disruptions caused by COVID in 2019-2020, NOVA successfully assessed student ability regarding scientific literacy. Sixteen programs and disciplines participated in the assessment of scientific literacy, which translates to over 7,000 students. As Figure 4 below indicates, **7,367 students were involved in the 2019-2020 assessment of scientific literacy at NOVA.** Approximately 46 percent of these students were assessed in their educational programs and about 55 percent of students assessed in a discipline course. In Spring 2020, 46,419 students were enrolled at NOVA.[4] The Office of Strategic Insights estimates 16 percent of NOVA students participated in scientific literacy assessment.

Figure 4. Scientific Literacy Student Sample Size by Programs and Disciplines: 2019-2020

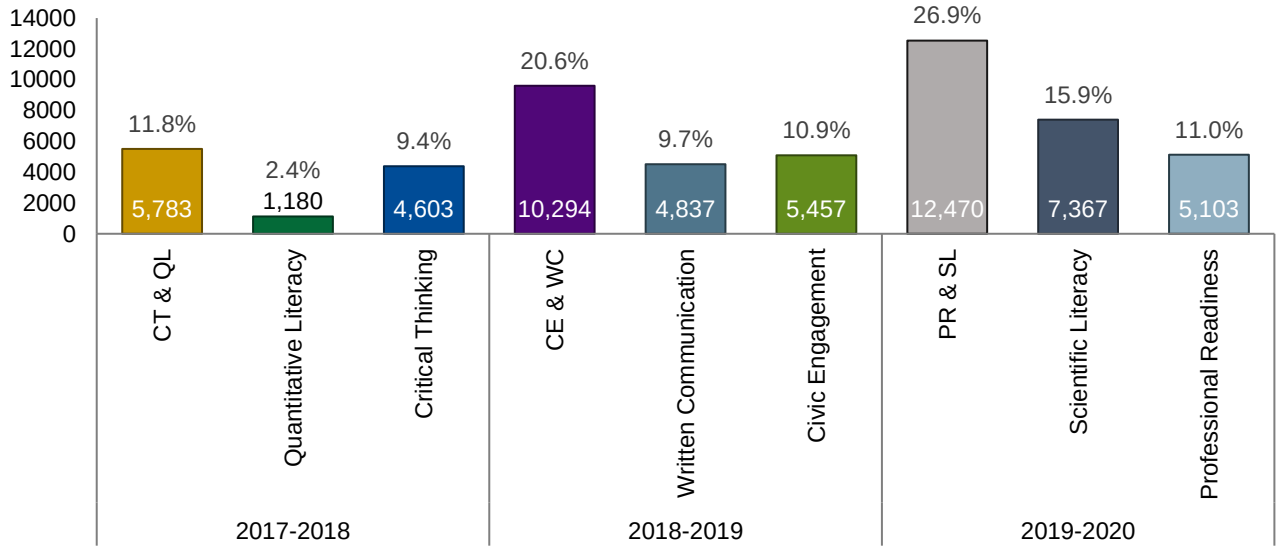


Sample Size by Core Learning Outcome

NOVA just completed its third year of CLO assessments. This means that all six core learning outcomes have been assessed in this three-year period. Figure 5 displays the increase in the number and percentage of NOVA students captured during the first three years of core learning outcome assessment. The 2019-2020 core learning outcomes assessment included 12,770 students; of this group, 7,367 participated in the assessment of scientific literacy.[5] This is a total increase of 2,476 students from the year before. The 2017-2018 assessment of CLOs assessed 13 percent of the student population, while 2018-2019 assessment of CLOs captured just over 20 percent of the student population (Figure 5). The 2019-2020 CLO student sample size increased to just over 28 percent of the student population (Figure 5).

[4] Data on student enrollment can be found in the NOVA Fact Book.
[5] The Office of Strategic Insights recognizes that there may be some overlap between assessments; specifically, we may occasionally assess the same student in two different PR, or SL (etc.) assignments. As we don't ask for student identification numbers from most programs and disciplines, we cannot determine the exact level of overlap, but we assume it is small.

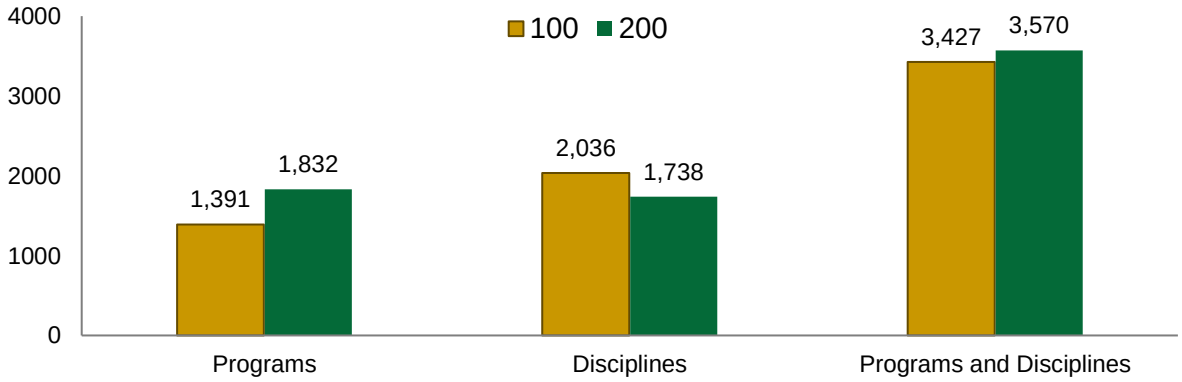
Figure 5. Student Sample Size by Core Learning Outcome: 2017-2018 to 2019-2020



Total Sample Size by Course Level

In the first two years of tracking core learning outcome sample sizes, more students were assessed at the 100-level than at the 200-Level (see the previous audits for details written communication, quantitative literacy, civic engagement, critical thinking). But the assessment of scientific literacy there is a notable change, the number of students assessed at the 100 and 200-level are about even, with 3,427 assessed at the 100-level and 3,570 assessed at the 200-level; Figure 6). It is notable that in 2019-2020, Biology assessed over 1,300 students at the 200-level, and Psychology assessed over 700 students at the 200-level.

Figure 6. *Student Sample Size* by Course Level by Program and Discipline[6]



[6] Physical Therapy and Philosophy assessed students in 100 and 200-level classes. They did not separate these students in their sample. Therefore, their students are not considered when discussing data aggregated by 100- and 200-level classes. Thus, the sample size is smaller in these graphs.

Average Sample Size by Course Level

The previous section gave figures for the total number of students assessed in 100- and 200-level courses. This section discusses the average number of students assessed in 100- and 200-level courses, which offers insight into current assessment practices. The average number of students assessed in 100- and 200-level courses is interesting this year because the differences arise between disciplines and programs and not between the course level. Historically, it is the course level that is the primary determining factor. Disciplines' 100-level courses tend to assess the largest number of students, as those classes typically fulfill general education requirements.

The 2019-2020 average sample size of students who were assessed on scientific literacy diverges from many of the sample size trends of the last two years of CLO assessment at NOVA. As has been typical, more students are assessed in 100-level *discipline* courses than in 100-level *program* courses, and more programs assess students at the 200-level than disciplines. However, there are two notable changes this year. First, the gap between the number of students assessed by programs and disciplines at the 100-level is much more narrow than usual. At the 100-level, disciplines assessed 679 students (on average) and programs assessed 464, a difference of only 215 students (Figure 7). Second, at the 200-level, the gap continues to narrow between disciplines and programs, with disciplines assessing 279 more students (Figure 7). What has typically been the case for CLO assessments is that at the 200-level, programs assess more students than the disciplines. However, this year disciplines assessed more 200-level students (579) than programs (300).

An average of 300 students were assessed by programs at the 200-level. Programs assessed a more significant 464 students at the 100-level (Figure 7). This creates a difference of only 164 students. Disciplines assessed 679 students at the 100-level and 579 at the 200-level. This creates a difference of 100 students (Figure 7).

Figure 7. Average Sample Size by Course Level by Program and Discipline

Section III: Measuring Student Achievement in Scientific Literacy

Course embedded assessment requires a minimum threshold of success to demonstrate student learning. At NOVA, this minimum threshold, or target goal, is determined by the faculty of each educational program and discipline using a variety of measures: national certification exams; standards determined by state licensing agencies or accrediting bodies; criteria designed by the discipline's national association body (e.g., The American Chemical Society's Guidelines for Lab Safety for Chemistry); or by faculty using their professional expertise.

Target goal thresholds are commonly set at a student performance level of 70 percent or better on an assignment or exam. Success regarding target goals signals student achievement of the competencies being assessed. For CLO assessments, it also signals college-wide student learning in the general education competencies outlined by VCCS. The College aggregates program and discipline student data, across all campuses and learning modalities, to examine student performance on a given CLO. The target goal data is shared with faculty and the public via NOVA's website, campus TV monitors, working groups, and various infographics shared at high school events. The information detailed in this audit is shared with faculty via the campus-wide Daily Flyer, working groups, workshops, email distribution, and discussion in their program and discipline meetings.

Section III focuses on: (a) the methodologies used to assess scientific literacy (e.g., how programs/disciplines assessed this CLO and the effectiveness of their assessment method) and (b) how, and to what degree, programs, disciplines, and students met the target goals.

A. Methods for Assessing Scientific Literacy

Major Categories of Scientific Literacy

Programs and disciplines use a variety of definitions and methods to assess students' scientific literacy (SL) skills. In order to analyze scientific literacy assessments college-wide, the Office of Strategic Insights collated the data from all the assessment measures of SL (assignment descriptions, exams, and rubrics), noting key terms used. Then, these key terms were organized into lists of like-minded terms, which were refined into two broad components of scientific readiness: understanding the scientific method and applying the scientific method (Table 5). Applying the scientific method has five sub-categories.

Table 5. Major Categories Used to Operationalize Scientific Literacy

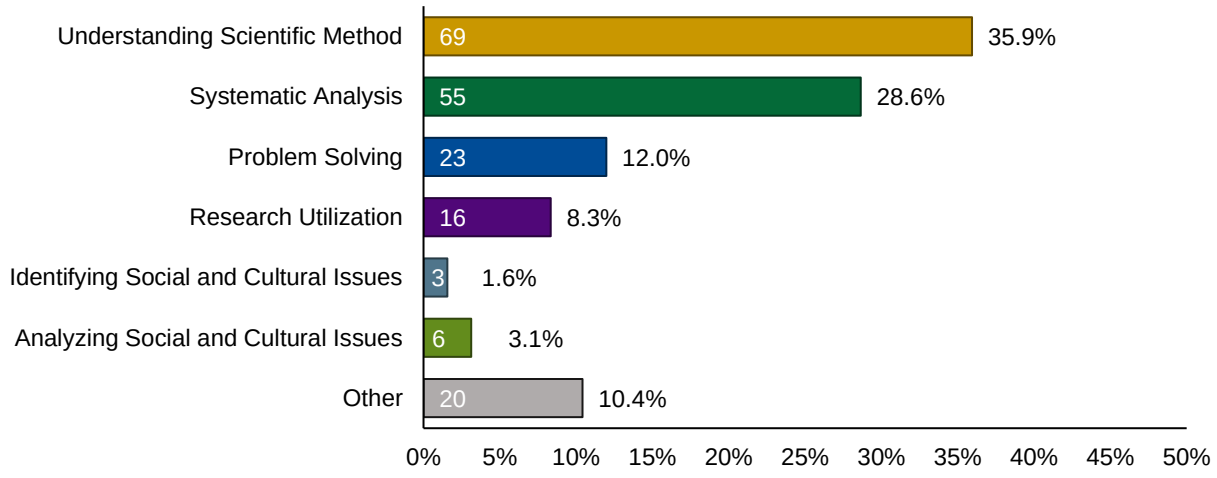
Category	Description
Understanding the Scientific Method	Students must identify concepts related to the scientific method or perform similar ideas.
Applying the Scientific Method	*Systematic Analysis* Students must apply a form of evaluative logic correctly, while using evidence consistent with the logic to support the claim being made.
	Problem Solving Students must analyze a scientific concept/issue and • provide credible evidence to either support or deny the scientific claim • provide potential solutions to solve the issue.
	Research Utilization Students must find credible sources and combine facts from the sources to build a strong argument.

	Identifying Social and Cultural Issues Students must identify social and/or cultural issues in the scientific community and understand its impact on society, culture, and the world.
	Analyzing Social and Cultural Issues Students must analyze all aspects of the social and/or cultural issue in the scientific community. This may include asking students to consider all perspectives, understand and describe the implications behind the issue and provide any solutions/concluding remarks.
Other	

The scientific readiness assessments employed by programs and disciplines were coded using the categories of components listed above. Coders noted, by category, each item requiring an element of scientific literacy on every exam and rubric. Therefore, the number of items categorized as scientific literacy is greater than the number of assessment methods used to assess SL. For instance, Occupational Therapy students must engage their scientific literacy skills and knowledge 29 times to satisfy their SL assessment. The rubric used to assess Occupational Therapy students includes the following elements of SL: understanding the scientific method (8 items); use systematic analysis (9 items), problem solving (3 items), research utilization (6 items), identify social and cultural issues (one item), and analyzing social and cultural issues (two items; see Appendix C).

Across all rubrics and exams, 192 instances of scientific readiness were coded (Figure 8; see Appendix A Table I). When disaggregating the data by sub-component, interesting trends emerge (Figure 8). The most common components of scientific literacy assessed at NOVA in 2019-2020 were understanding the scientific method (assessed 69 times) and systematic analysis (assessed 55 times). Problem solving (assessed 23 times) and research utilization (assessed 16 times) are the third and fourth top skills assessed in 2019-2020 (Figure 8).

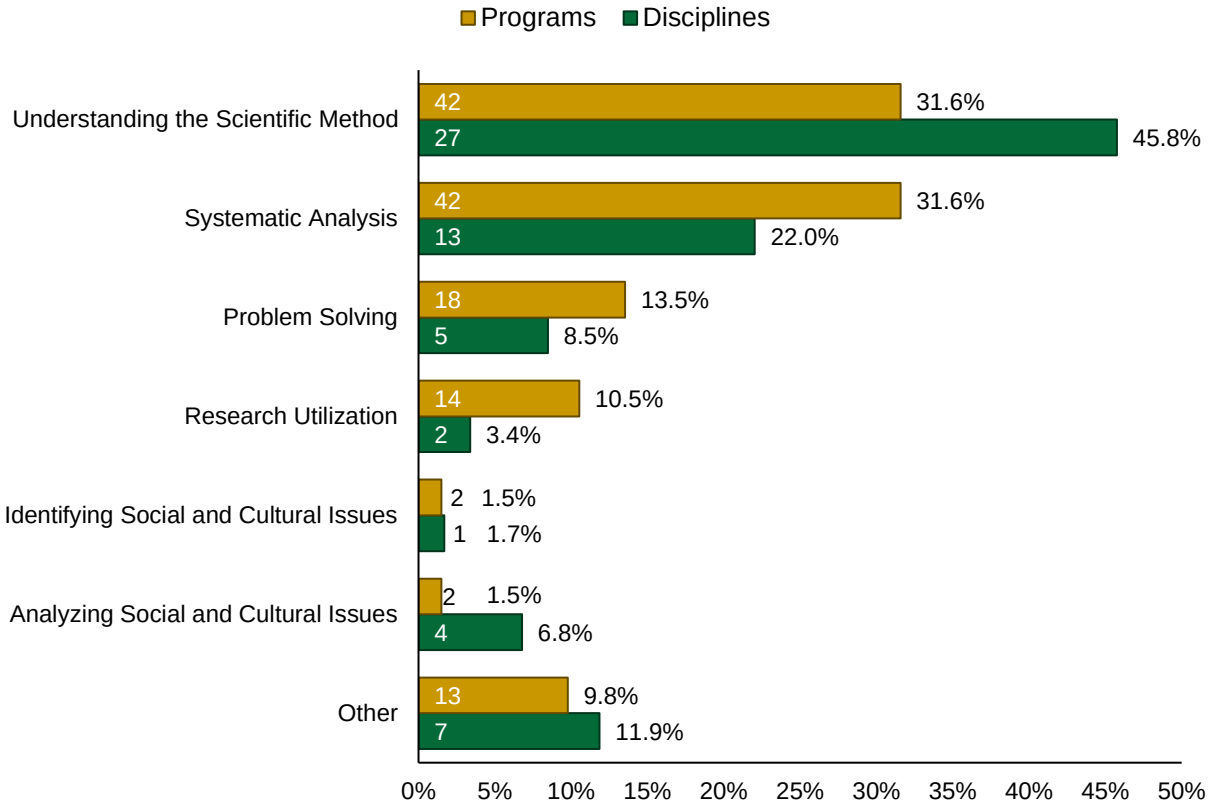
Figure 8. Types of Scientific Literacy Assessed



As Figure 9 indicates, programs most often assessed scientific literacy using two components of SL: understanding the scientific method (42 items) and systematic analysis (42 items). Problem solving is the third most frequently assessed component of SL (18 items). Disciplines most often assessed SL as either understanding the scientific method (27 items) or systematic analysis (13 items). While programs assessed understanding the scientific method and systematic analysis

at the same rate (42 items each), disciplines assessed SL as understanding the scientific method twice as often as using systematic analysis (Figure 9).

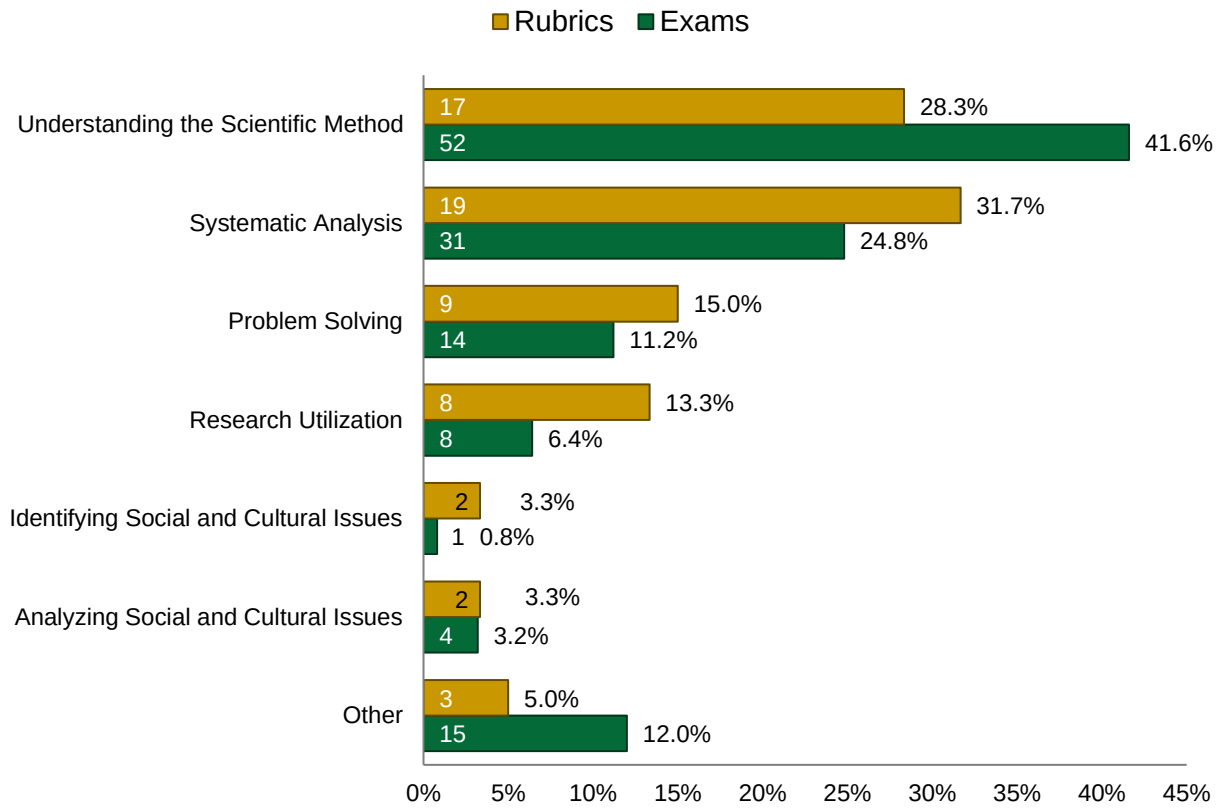
Figure 9. Scientific Literacy Components Measured by Programs and Disciplines



When reviewing the difference between rubrics and exams that assessed SL, the instructions/grading criteria on scientific literacy rubrics fell across all six subcategories. Scientific literacy was most frequently operationalized on rubrics through activities that required systematic analysis: 32 percent of rubrics assessed SL as systematic analysis (Figure 10). The second most frequently used SL component on rubrics is understanding the scientific method, at 28 percent. Rubrics also assessed problem solving (15 percent) and research utilization (13 percent; Figure 10) to operationalize scientific literacy.

Exams most frequently operationalized scientific literacy using understanding the scientific method (44 percent; Figure 10). Systematic analysis was utilized on 25 percent of exams, and other forms of operationalizing SL were utilized on 12 percent of exams.

Figure 10. Scientific Literacy Categories by Assessment Method



Assessment Measures' Alignment with the Scientific Literacy Competency

The Office of Strategic Insights analyzed program and discipline SL assessment asking how well NOVA assessment measures aligned with the VCCS definition of scientific literacy (Table 6). Assessment methods were examined for their alignment with relevant operational definitions of professional readiness. The clarity of the operational definitions of scientific literacy used on rubrics and exams was also examined (Table 6). Sample sizes were categorized (small, medium, or large). Finally, student achievement on the assessment was compared to the target goal set by the faculty.

Table 6. Categorizing Assessment Methods and Target Data

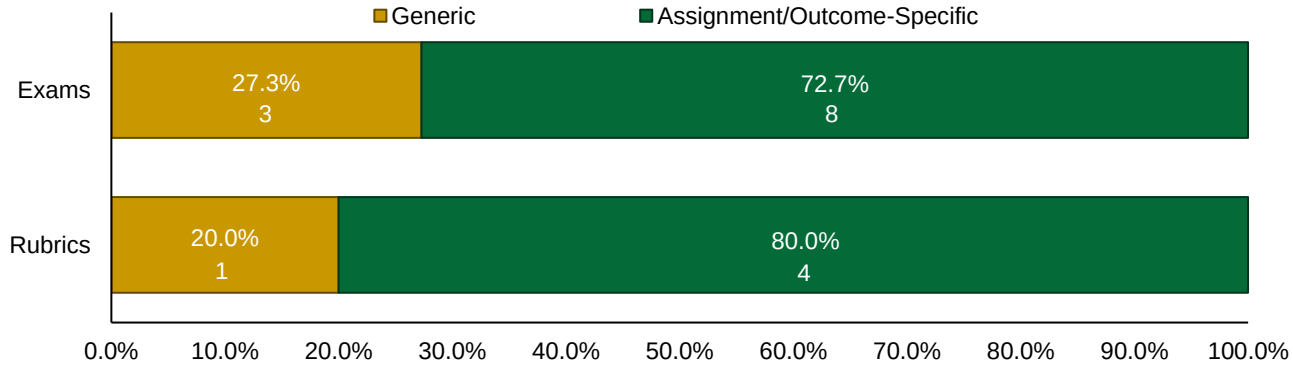
Category	Description
Operationalized definition	Program/discipline provided an operationalized definition of the CLO that is clear, measurable, and relates to the VCCS definition of the CLO; includes actions students will take to demonstrate learning of this outcome (e.g., demonstrate proficiency in certain areas, analyze data, interpret information, etc.)
Sample Size	*Small Sample Size:* Samples with 33 students or fewer.
	Medium Sample Size: Samples between 34 and 69 students.
	*Large Sample Size: S*amples over 70 students.
Outcome-Method Alignment	Method/assignment used clearly measures the operationalized CLO.
Rubric/Measure	*Rubric in APER:* Separate Rubric/assessment measure and/or grading scale was not provided but was explained in the *APER*.

	No Rubric Provided: No rubric was provided either with the *APER* submission email or in the *APER*.
	Assignment-Specific Rubric: Rubric evaluates the CLO being assessed and provides at least one of the following: a. Clear description of grading criteria/grading scale and/or b. a clear description of the pedagogical purpose of assignment.
	Generic Rubric: A rubric contains two or more of the following problems: • it uses a generic rubric that does not directly address the assignment (for example, using a CT rubric that does not address the particulars of the paper/presentation being assessed); • a rubric which does not address the specifics of the assignment; the grading scale is not provided; and/or no pedagogical purpose is presented.
	Misaligned Rubric: The rubric does not directly evaluate the CLO being assessed
Examination	*Outcome-Specific Examination:* The exam questions evaluate the assessed CLO by addressing 3 or more aspects of the CLO
	Generic Examination: The exam questions touch on the CLO in general terms, or only tangentially relate to the CLO. Only assessed 2 or fewer of the concepts and/or is unrelated to the CLO.
	Misaligned Exam: The exam does not test for knowledge, skills, or abilities related to the CLO.
Other	

Using the categories in Table 6, the Office of Strategic Insights coded 16 SL rubrics and exams. Seventy-two percent of coded exams aligned with the VCCS definition of scientific literacy (Figure 11). As a result of this analysis, NOVA will continue working with faculty to align rubrics and exams measuring SL with the NOVA definition of scientific literacy for the next assessment in 2022-23.

As Figure 11 indicates, 80 percent of rubrics are considered assignment specific. As well, almost 73 percent of exams were operationalized to effectively test students' SL skills. This means the rubrics and exams effectively assessed the components and/or subcomponents of scientific literacy delineated by NOVA. The rubrics are clear regarding grading criteria and the purpose of the assignment. This specificity makes the assignment more easily understood by students. Extensive research suggests that clear guidelines for content and assessment on an assignment improves student success on an assignment.[7]

Figure 11. Operationalizing Rubric Criteria and Exam Questions



[7] Almarode, J., & Vandas, K. (2018). *Clarity for Learning: Five Essential Practices that Empower Students and Teachers.* New York: Corwin.

Assignment-Specific Rubrics

Chemistry students were assessed on their ability to read the volume on glassware to the correct number of significant figures, with correct units based on the glassware; make an informed decisions in selecting the best glassware to perform the density measurement and calculation; and evaluate empirical data via a pre-staged density measurement set up. Students were expected to use the scientific process to collect and calculate the density of water. The rubric assessed student performance based on the following three criteria: applying the scientific method, evaluating empirical data, and making informed decisions.

Personal Therapist Assistant students were asked to identify and integrate appropriate evidence-based resources to support clinical decision-making in patient care. The required performance criteria on which students were evaluated included: (1) whether they were capable of completing tasks, clinical problem solving, and interventions/data collection for patients with simple or complex conditions under general supervision of the physical therapist; (2) whether they were consistently proficient and skilled in simple and complex tasks, clinical problem solving, and interventions/data collection; and (3) whether they were capable of maintaining 100% of a full-time PTA's patient care workload in a cost effective manner with direction and supervision from the physical therapist (Appendix D).

Outcome-Specific Exams

Geology students engaged in a seismic wave analysis exercise. This required students to create a graph using seismic wave data and then use the graph to determine distances of various recording stations from earthquake epicenters. From this information, students were then asked to triangulate an earthquake epicenter and indicate its location on a map.

Sociology students responded to ten exam questions to assess students' scientific literacy. These questions focused on: positivism; interpretive frameworks, peer review, blind/double blind research, sampling, validity, mathematical mean, primary vs. secondary research, types of primary and secondary research, and ethics in science.

B. Achieving Scientific Literacy Target Goals

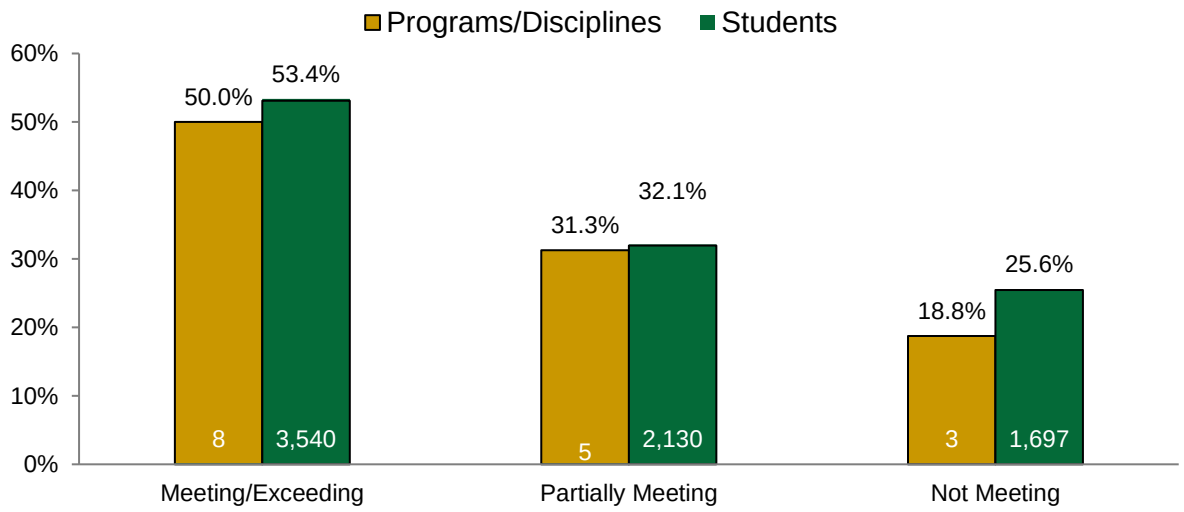
Target goals are set by programs and disciplines to measure student success in scientific literacy. They allow programs and disciplines to investigate the success of the curriculum in preparing students in this area and the extent to which students mastered the required skills and material. Programs and disciplines then analyze the assessment results and take actions to improve student learning.

The Office of Strategic Insights compiles the program and discipline data to analyze how well individual programs and disciplines are meeting their target goals. As well, the Office of Strategic Insights aggregates the student data to create a college-wide student sample. Therefore, the data discussed below operates as two samples in concert: student data and program/discipline data. Target goal success is rated in one of four categories: exceeded target (i.e., results are 10 percent or more than the set target); met target; partially met target; or did not meet target.

Overall, 7,367 students were involved in the 2019-2020 assessment of scientific literacy at NOVA. As indicated by Figure 13 below, 53 percent, or 3,540 students, met or exceeded their

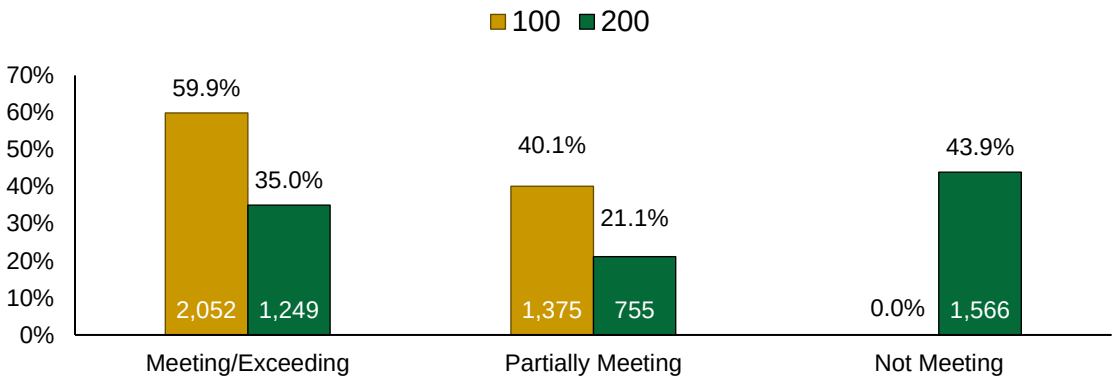
program/discipline's SL target goal. Another 32 percent, or 2,130 students assessed partially met their target goals. Therefore, regarding scientific literacy, over 86 percent of students exceeded, met, or partially met the target goals set for them by their program or discipline. Programs' and disciplines' success rates are very close to the student success rates, with 50 percent of programs and disciplines meeting or exceeding their target goals. Another 31 percent of programs and disciplines partially met their target goals (Figure 12), resulting in over 80 percent of programs and disciplines exceeding, meeting, and partially meeting their targets.

Figure 12. Scientific Literacy Target Scores



Disaggregating students' performance in scientific literacy at the 100 and 200-level indicates room for improvement. At the 100-level, 52 percent of students were meeting/exceeding the target goals (Figure 13), and at the 200-level, 44 percent of students met or exceeded their target goals. Another 34 percent of students assessed at the 100-level partially met their goals, and 27 percent of students partially met the target goals set by their program/discipline. Thus, all students assessed in 100-level courses met the targets set out by the program/discipline, while only half of students at the 200-level met target goals. Another 44 percent did not meet targets in SL. As a College, NOVA is in the process of refining assessment and teaching techniques, including initiatives involving authentic assessments and equity minded teaching and assessment. As this was the first SL assessment conducted at NOVA, the data provided in this report provide the benchmarks against which we can compare future data. NOVA will monitor students' SL skills, and it is the hope that the initiatives discussed above will improve teaching and learning at NOVA.

Figure 13. Student Achievement by Scientific Literacy Target Scores by 100- and 200-Level Courses[8]



[8] Physical Therapy and Philosophy assessed students in 100 and 200-level classes. They did not separate these students in their sample. Therefore, their students are not considered when discussing data aggregated by 100- and 200-level classes. Thus, the sample size is smaller in these graphs.

Section IV: Actions to Improve Student Learning

Using assessment results to improve the assessment process and the learning process is essential to continually improving student learning. Therefore, closing the loop, or presenting the assessment findings to the faculty is the last step (before the cycle begins again). The faculty use the assessment results, making alterations to the processes to improve assessment and/or learning. This section of the audit examines the changes presented in the Use of Results section of the APERs and *CLO Reports.*[9] These annual reports detail the assessment methods and results for each program and discipline. The changes outlined in the Use of Results discussion are coded into 5 major categories: curriculum specific changes, changes regarding program resources, changes regarding co-curricular resources, changes in the assessment process, and changes made at the college-level (Table 7; See Table P in Appendix A for Descriptions and Examples of Major and Subcategories. See Table R in Appendix A for Use of Results by Subcategory in Descending Order of use). Each category has sub-categories. The aggregation of this data allows for the assessment of the college-wide changes used to improve the assessment process and student learning.

Table 7. Use of Results Codes: Major and Subcategories

Major Category	Subcategories
Curriculum-Specific	Curricular Change
	Course Revision
	Pedagogy
	Subject-Matter Expert Feedback
Program Resources	Financial
	Human Resources
	General Resources
Co-Curricular Resources	Co-Curricular Opportunities
	Academic Support/Advising
SLO Assessment Process	SLO Assessment Change
	Data Analysis Method Change
	Student Learning Outcome Change
	Target Increased
	Target Decreased
	Target Clarified
	Sample Size
	Communication on the Assessment Process
College Level Changes	Dual Enrollment
	Articulation Agreement
	Recruitment/Marketing

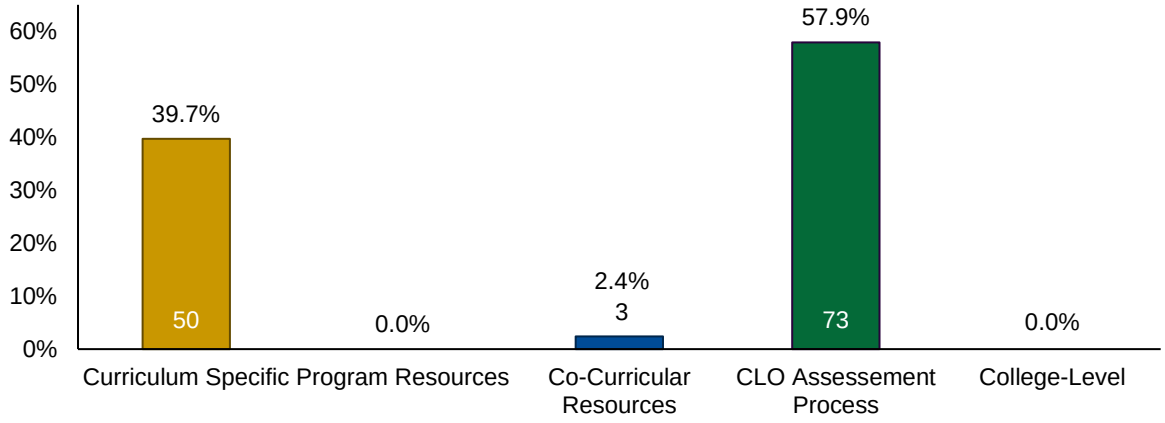
A. Analysis of Actions for Improvement by Major Category

In 2019-2020, the 16 programs and disciplines assessing scientific literacy created 126 actions to improve student learning and the assessment process. This averages to 7.9 actions for improvement per program and discipline (see Appendix A, Table O). This demonstrates that programs and disciplines use their assessment data to plan and seek improvements.

[9] As a reminder, degree-granting programs report on assessments using the Annual Planning and Evaluation Report (APER) for Instructional Programs. They report on their SLO, CLO, and program goal assessments. The disciplines without degrees submit an attenuated report, which focuses on the core learning outcomes assessments for the college.

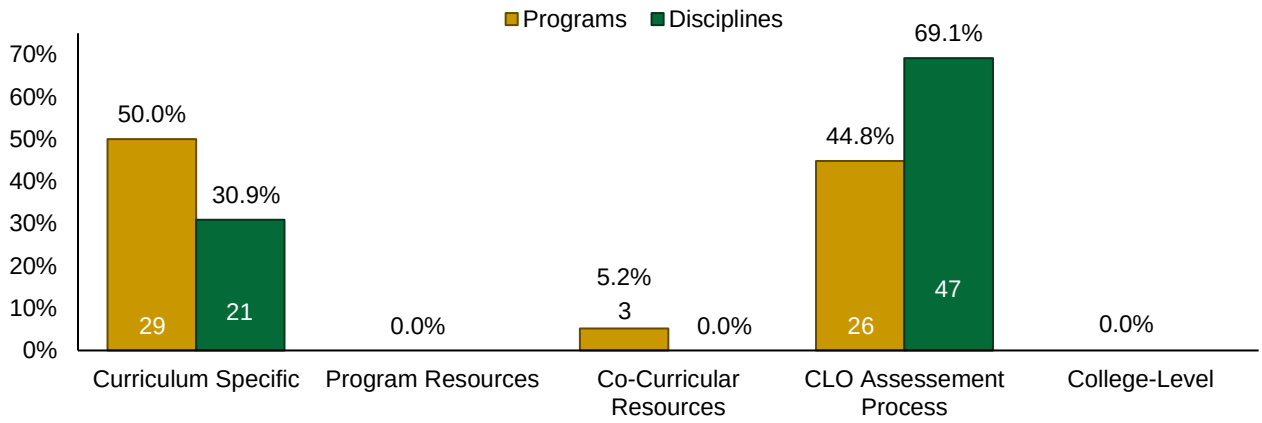
Almost 58 percent of the actions taken, or planned, relate to improving the core learning outcome assessment process (Figure 14). This is the most frequently used category of actions in 2019-2020. At almost 40 percent changes to the curriculum are the second most frequently mentioned by programs and disciplines. Programs and disciplines tend to make, or plan for, changes in areas over which they have control. Therefore, there are few attempts to: improve resources (new faculty, facilities, etc.) or make college-level changes (Figure 14).

Figure 14. Actions for Improvement Mentioned in the Uses of Results



Data disaggregated by program and discipline reveals that programs and disciplines are at different stages in the assessment process (Figure 15). Changes to the curriculum and assessment process are the two most frequently noted changes made to improve assessment and student learning. It is best practice to refine data collection and analysis techniques prior to making curricular changes. As mentioned previously, 2017-2018 was the first-year non-degree granting disciplines reported on their assessment process. In line with best practice, 69 percent of the disciplines' actions involve changes to their assessment process. Meanwhile, degree-granting programs tend to have more developed assessment processes because they have been reporting assessment data for many years; thus, most of their actions (50 percent) are curricular specific. Programs continue to improve the assessment process, with almost 45 percent of their actions being assessment oriented.

Figure 15. Actions for Improvement Mentioned by Programs and Disciplines



B. Key Actions to Improve Program and Discipline *Assessment Processes*

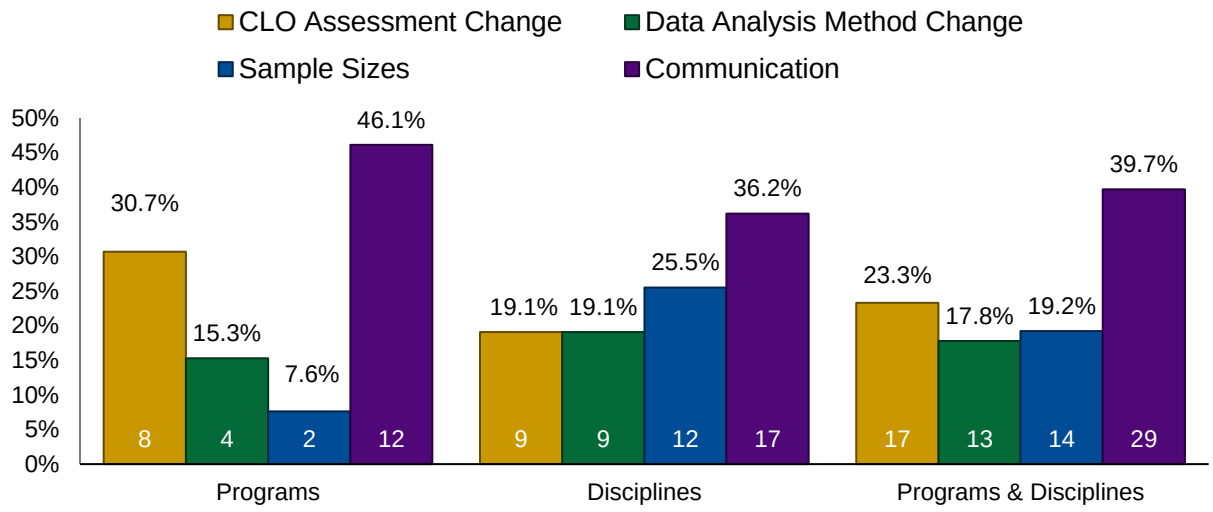
In 2019-2020, programs and disciplines made 73 changes to their scientific literacy assessment process. The most frequent changes to the assessment process concerned improving the communication between the assessment lead (or steering committee), and the program or discipline faculty. Communication with NOVA administrators count in this category as well. Assessment leads (or steering committees) are creating best practices for helping faculty administer the assessment measure, communicating the need to spend more time on a topic in class, and communicating assessment results, which are all forms of interactions coded as changes in communication. Changes in communication accounted for almost 40 percent of all changes made by programs and disciplines in the assessment process (Figure 16). Just over 46 percent of the changes made by programs to improve assessment were made in the area of communication and disciplines made 36 percent of their changes in communication (Figure 16). This attention to improving the movement of information to the faculty (full-time and part-time) and administrators notes an appreciation for closing the loop. Closing the loop ensures all faculty can use the assessment data to improve student learning.

The category CLO Assessment Change refers to a change in how the core learning outcome (often a program or discipline SLO) is measured. It includes implementing a new assessment or changing items on an existing assessment. It also refers to the addition of break-out data for the CLO, allowing the program or discipline to learn more detailed information on student achievement of the subcomponents of scientific literacy. Disciplines made approximately 19 percent of their assessment related changes in this area (Figure 16), while programs made just over 30 percent of their assessment related changes in this area.

The category Data Analysis Method Change refers to a change or modification in the collection or analysis of data, such as modifying or creating a new rubric or implementing new methods for collecting data. Disciplines and programs made 18 percent of their assessment changes in this area (Figure 16). For disciplines, these changes accounted for nearly 19 percent of the changes that they made, and programs made approximately 15 percent of their assessment related changes in this area (Figure 16).

The category Sample Size refers to decisions and/or attempts to include more students in the assessment process. Adding off-site dual enrollment students to the sample and/or working with NOVA Online to assess those students are a part of changes in sample size, as are attempts to bring in more participation from the various campus sites. Disciplines and programs made 14 percent of their changes in this area (Figure 16). Disciplines made more changes in this area. They made just over 25 percent of their changes to improve the assessment of scientific literacy around sample size. Programs only made 8 percent of their changes to assessment in this area.

Figure 16. Actions to Improve the Assessment Process by Programs and Disciplines



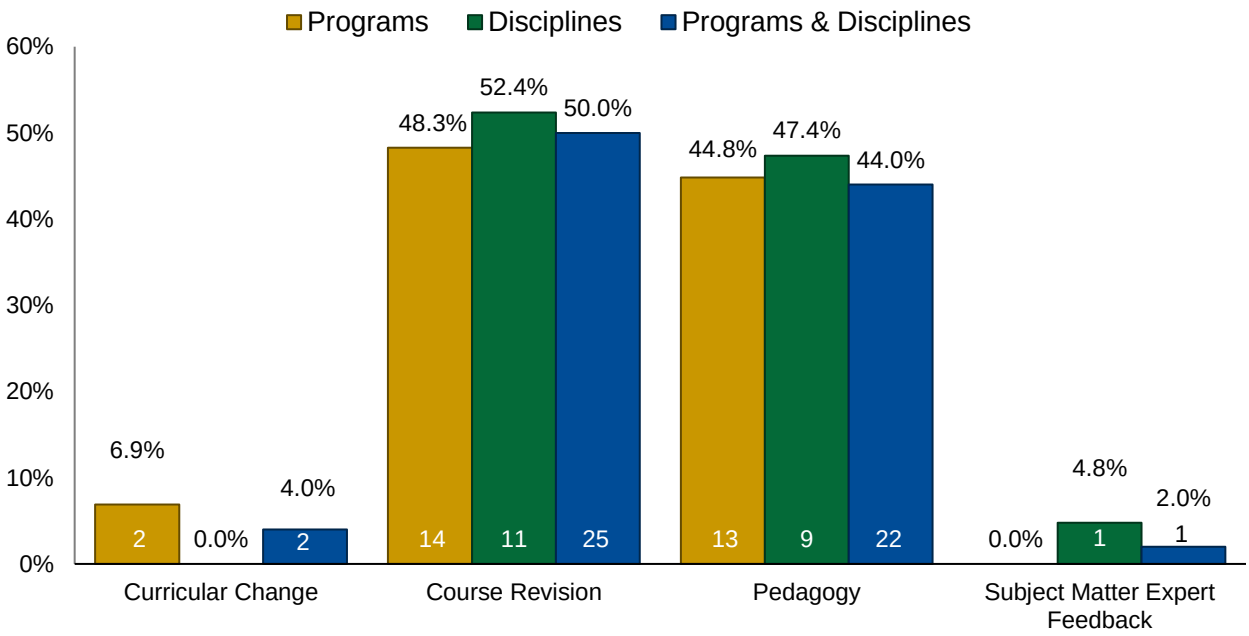
C. Key Actions to Improve the Curriculum by Programs and Disciplines

Actions mentioned in the Use of Results section of the annual assessment results meant to improve course content and forms of instruction to improve student learning are categorized as curriculum specific changes. Curriculum Specific changes fall into the following subcategories: curricular change (change to the degree requirements); course revision (modifying course content, adding review sessions, or modifying assignments); pedagogical changes (revising the means of delivering course content, such as adding more discussion, new technology); and subject matter expert feedback (seeking recommendations from employers, experts in the field, or an accreditation body).Sixteen programs and disciplines made 50 curriculum specific changes (Figure 17).

Programs made most of their curriculum specific changes to improves student learning in scientific literacy in the areas of course revision and pedagogy. As Figure 17 indicates, programs made 14 course revisions, or 48 percent of all curriculum specific changes, and 13 pedagogy changes (45 percent) to improve scientific literacy among students.

Like programs, disciplines made most of their curriculum specific changes to improves student learning in scientific literacy in the areas of course revision and pedagogy. As Figure 18 indicates, disciplines made 11 course revisions, or 52 percent of all their curriculum specific changes. They also made 9 changes to pedagogy, or 47 percent of their changes to improve scientific literacy education.

Figure 17. Key Actions to Improve the Curriculum by Programs and Disciplines



Section V: Conclusion

This year's assessment of PR and SL included 12,470 students. This is an increase of 2,176 students from the prior year (2018-2019), which assessed 10,294 students. Based on the current sample size data, the Office of Strategic Insights suspects that NOVA is slowly becoming a culture of assessment as student sample sizes rise. However, the Office will continue to monitor the data as we approach a new cycle of CLO assessments to solidify this is the case. 7,367 NOVA students, across modalities, took part in the scientific literacy assessment process. The students were assessed in courses from nine educational programs and seven disciplines without degrees.

Of those 17 programs and disciplines, 71 percent used their existing student learning outcomes to assess scientific literacy. Additionally, 73 percent of programs' and disciplines' rubrics and 80 percent of their exams clearly aligned with the VCCS definition of scientific literacy. Approximately 36 percent of questions, or items on a rubric, used to operationalize scientific literacy assessed it as understanding the scientific method (used 69 times by programs and disciplines). Systematic analysis (29 percent; 55 uses), problem solving (12 percent; 23 uses), and research utilization (8 percent; 16 uses) were the next three components used to assess scientific literacy.

Each year the Office of Strategic Insights rates the quality of assessment reporting by programs and disciplines. The overall quality of the 2019-2020 scientific literacy assessment reports by programs and disciplines is excellent. On average, 94% of program and discipline reports reached the meeting expectations scoring range (90-100 percent).

According to the 2019-2020 assessment reports, programs and disciplines created 126 actions to improve scientific literacy and its assessment. Fifty percent of actions established by *programs* were curricular in nature. Sixty-nine percent of actions established by *disciplines* were focused on improving the assessment process.

Appendix A: Data Tables for Professional Readiness Audit

Table A1. Programs and Disciplines Assessing Core Learning Outcomes: 2019-2020

	Core Learning Outcome: Scientific Literacy
Program	9
Discipline	7
Total	**16**

Table A2. Scientific Literacy Assessments Operationalized Using Student Learning Outcomes

	# of Reports	# Using SLOs	Percentage
Program	9	6	66.7
Discipline	7	6	74.7
Programs and Disciplines	**16**	**12**	**75.0**

Table A3. Overall Student Sample Size

	#	%
Programs	3354	45.5
Disciplines	4013	54.5
Total	**7367**	**100**

Table A4. Comparison of Sample Sizes and Population Percentage: 2017-2018 to 2019-2020

	2017-2018 (49,011 Students Enrolled in Spring 2018)			2018-2019 (50,011 Students Enrolled in Spring 2019)			2019-2020 (46,419 Students Enrolled in Spring 2020)		
CLO Assessed	**CT**	**QL**	**CT & QL**	**CE**	**WC**	**CE & WC**	**PR**	**SL**	**PR & SL**
Sample Size	4603	1180	5783	5457	4837	10297	5103	7367	12470
% of Population	9.4	2.4	11.8	10.9	9.7	20.6	11.0	15.9	26.9

Note: CT = Critical Thinking; QL = Quantitative Literacy; CE = Civic Engagement; WC = Written Communication; PR = Professional Readiness; SL = Scientific Literacy

Table A5. Scientific Literacy Sample Sizes by Course Level and by Program and Discipline

	100-Level	200-Level
Programs	1391	1832
Disciplines	2036	1738
Total	**3427**	**3570**

Table A6. Average Scientific Literacy Student Sample Size by 100 and 200-Level Courses by Programs and Disciplines

	Average Sample Size	
	100-Level	**200-Level**
Programs	464	300
Disciplines	679	579
Programs and Disciplines	**571**	**397**

Table A7. Types of Scientific Literacy Assessed by Subcategory

	#	%
Understanding Scientific Method	69	35.9
Systematic Analysis	55	28.6
Problem Solving	23	12.0
Research Utilization	16	8.3
Identifying Social and Cultural Issues	3	1.6
Analyzing Social and Cultural Issues	6	3.1
Other	20	10.4
Total	**192**	**100**

Table A8. Scientific Literacy Components Assessed by Programs and Disciplines

	Programs		Disciplines	
	#	%	#	%
Understanding Scientific Method	42	31.6	27	45.8
Systematic Analysis	42	31.6	13	22.0
Problem Solving	18	13.5	5	8.5
Research Utilization	14	10.5	2	3.4
Identifying Social and Cultural Issues	2	1.5	1	1.7
Analyzing Social and Cultural Issues	2	1.5	4	6.8
Other	13	9.8	7	11.9
Total	**133**	**100**	**59**	**100**

Table A9. Scientific Literacy Categories Used in Assessment Measures

	Rubrics		Exams	
	#	%	#	%
Understanding Scientific Method	17	28.3	52	41.6
Systematic Analysis	19	31.7	31	24.8
Problem Solving	9	15.0	14	11.2
Research Utilization	8	13.3	8	6.4
Identifying Social and Cultural Issues	2	3.3	1	0.8
Analyzing Social and Cultural Issues	2	3.3	4	3.2
Other	3	5.0	15	12.0
Total	**60**	**100**	**125**	**100**

Table A10. Effectivity of Rubrics and Exams by Discipline Group

	Rubrics					Exams				
	# of Rubrics	Assignment-Specific		Generic		# of Exams	Outcome-Specific		Generic	
		#	%	#	%		#	%	#	%
Program	3	2	50.0	1	100	6	6	75.0	0	0.0
Discipline	2	2	50.0	0	0.0	5	2	25.0	3	100
Total	**5**	**4**	**100**	**1**	**100**	**11**	**8**	**100**	**3**	**100**

Table A11. Scientific Literacy Target Scores by Programs and Disciplines

	Programs		Disciplines		Overall	
	#	%	#	%	#	%
Exceeded	3	30.0	4	57.1	7	41.2
Met	0	0.0	1	14.3	1	5.9
Partially Met	4	40.0	1	14.3	5	29.4
Did Not Meet	3	30.0	1	14.3	4	23.5
Total	**10**	**100**	**7**	**100**	**17**	**100**

Table A12. Programs' and Disciplines' Achievement of Scientific Literacy Targets by 100-Level and 200-Level Courses

	100-Level Courses						200-Level courses					
	Programs		Disciplines		Overall		Programs		Disciplines		Overall	
	#	%	#	%	#	%	#	%	#	%	#	%
Exceeded	1	33.3	2	66.7	3	50.0	2	33.3	1	33.3	3	33.3
Met	0	0.0	1	33.3	1	16.7	0	0.0	0	0.0	0	0.0
Partially Met	2	66.7	0	0.0	2	33.3	2	33.3	1	33.3	3	33.3
Did Not Meet	0	0.0	0	0.0	0	0.0	2	33.3	1	33.3	3	33.3
Total	**3**	**100**	**3**	**100**	**6**	**100**	**6**	**100**	**3**	**100**	**9**	**100**

Table A13. Scientific Literacy Target Achievement by Sample Size: All Level Courses

	Number of Students	
	#	%
Exceeded	3000	40.7
Met	540	7.3
Partially Met	2130	28.9
Did Not Meet	1679	22.8
Total	**7367**	**100**

Table A14. Scientific Literacy Target Achievement by Sample Size: 100-Level and 200-Level Courses

	100-Level Courses						200-Level courses					
	Programs		Disciplines		Overall		Programs		Disciplines		Overall	
	#	%	#	%	#	%	#	%	#	%	#	%
Exceeded	16	1.2	1496	73.5	1512	44.1	633	34.6	616	35.4	1249	34.9
Met	0	0.0	540	26.5	540	15.8	0	0.0	0	0.0	0	0.0
Partially Met	1375	98.8	0	0.0	1375	40.1	382	20.9	373	21.5	755	21.1
Did Not Meet	0	0.0	0	0.0	0	0.0	817	44.6	749	43.1	1566	43.9
Total	**1391**	**100**	**2036**	**100**	**3427**	**100**	**1832**	**100**	**1738**	**100**	**3570**	**100**

Table A15. Average Number of Use of Results per Discipline Group: 2019-2020

	Annual Reports Submitted	Total # of Use of Results	Average # of Use of Results
Program	9	58	6.4
Discipline	7	68	9.7
Total	**16**	**126**	**7.9**

Table A16. Descriptions and Examples of Changes by Major Categories and Subcategories

Major Category	Subcategory	Description
Curriculum Specific	Curricular Change (CC)	Curricular change to degree program, e.g., added a course or other requirement; changed sequence of courses, paradigm shift—i.e., change in program focus based on industry standards and evolving technology; change in time schedule (when classes are offered); added courses online or in hybrid format; added/increased number of sections of a course to accommodate more students; coordinated course scheduling with other campuses, designing a common course syllabus, competitive admission, designing a common course curriculum; changed entrance requirements/prerequisites to program, e.g., require completion of MTH 151 or ENG 111 before entering program, changed GPA requirement; requirement of computer competency test before program placed.
	Course Revision (CR)	Revised existing course or courses; added or revised assignment, tests, readings, projects; modified assignment; modified course content, changed textbook; added or modified study guides, checklists, or other course handouts; revisited course topics for greater comprehension; emphasized/improved content; posted material online; added rubric; added review session or practice test; revised time spent on topic, remediation.
	Pedagogy (P)	Revised methodology of delivering course material, e.g., less lecture, more student involvement, more interactive or experiential activities (lab); integrated learning technology (video, Blackboard), smaller class size, added or replaced some in person courses with on-line or hybrid courses (differs from offering entire degree program on-line); added peer learning methods.
	Subject Matter Expert Feedback (SMEF)	Sought recommendations from external and internal stakeholders, e.g., employers, on-site clinical coordinator/supervisor, program advisory board/committee, accreditation body, faculty cluster, program review.
Program Resources	Financial (F)	Requested additional fiscal resources; allocated funds from other budget area to focus on achieving SLO.
	Human Resources (HR)	Provided faculty or adjuncts with development or training, e.g., faculty attend teaching workshops or conference to keep current with industry changes; hired new faculty.
	General Resources (GR)	Utilized external partners as guest speakers or resources for students; physical resources, e.g., new software, computers, open lab time, expansion of physical space.
Co-Curricular Resources	Co-Curricular (Co-C) Opportunities	Coordinated opportunities to engage in learning outside classroom: e.g., faculty and students interaction outside classroom; optional field trips; internships (if not a part of course), social gatherings, career fairs, speakers, study sessions, participation in professional or student organizations.
	Academic Support/ Advising (AS)	Connected students with peer tutors; referred to NOVA Academic Support Resources like Writing Center, Science Lab, Math Lab; referred student to see academic advisor, counselor; improved or increased faculty advising and guiding students on degree related topics; program placement, transfer info sessions for 4 year colleges; orientation activities.
College Level	Dual Enrollment (DE)	Allowed students to take program courses during high school.
	Articulation Agreement (AA)	Increased number of transferrable credits to specific 4 year institutions; Agreement with 4 year institution to accept NOVA graduates; change/update transfer requirements with transfer partners.
	Recruitment/ Marketing (R/M)	Efforts to increase access, e.g., outreach to high schools, non-traditional students, non-declared students.
CLO Assessment Process	CLO Assessment Change (AC)	Changed or added to the assessment method for the SLO; broke out SLO components and assessed those individually.
	Data Analysis Method Change (DAC)	Changed or modified data analysis method, e.g., developed a new rubric; added indirect measures such as surveys or student self-assessment.
	Core Learning Outcome Change (CLO)	Refined or modified student learning outcome(s).
	Target Increased (TI)	Increased target for success, e.g., increased the target number of students achieving a certain score on an assessment from 70% to 80%; increased the target assessment score from 60% to 70%.

	Target Decreased (TD)	Decreased target, e.g., decreased the target number of students achieving a certain score on an assessment from 90% to 80%; decreased the target assessment score from 100% to 90%.
	Target Change (TC)	Target was created/determined; target was revised or modified to be more clear or specific; target was changed (e.g., changing graduation target from percent/number increase per year to a percent of program placed students each year).
	Sample Size (SS)	Improved/increased sample size, e.g., assessed more sections of a course; assessed more courses for the same SLO; increased faculty/campus participation in assessment.
	Communication on Assessment Process (C)	Communicated with faculty to clarify or revise the assessment process; discussions/training about implementing the assessment (e.g., standardizing processes and procedures).
Other	Other (O)	Please specify

Table A17. Use of Results by Major Category: 2019-2020

Use of Results Major Categories												
	Curriculum-Specific		Program Resources		Co-Curricular Resources		Assessment Process		College-Level		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Program	29	50.0	0	0.0	3	5.2	26	44.8	0	0.0	58	100
Discipline	21	30.9	0	0.0	0	0.0	47	69.1	0	0.0	68	100
Total	**50**	**39.7**	**0**	**0.0**	**3**	**2.4**	**73**	**57.9**	**0**	**0.0**	**126**	**100**

Table A18. Use of Results by Subcategory in Descending Order: 2019-2020

Subcategory	Number of Changes	% of Total
Communication on Assessment Process	29	23.0
Course Revision	25	19.8
Pedagogy	22	17.5
CLO Assessment Change	17	13.5
Sample Size	14	11.1
Data Analysis Method Change	13	10.3
Academic Support/Advising	3	2.4
Curricular Change	2	1.6
Subject Matter Expert Feedback	1	0.8
General Resources	0	0.0
Co-Curricular Opportunities	0	0.0
Target Increased	0	0.0
Human Resources	0	0.0
Financial	0	0.0
Recruitment/Marketing	0	0.0
Core Learning Outcomes Change	0	0.0
Target Decreased	0	0.0
Dual Enrollment	0	0.0
Articulation Agreement	0	0.0
Target Change	0	0.0
Other	0	0.0
Total	**126**	**100**

Table A19. Use of Results by Subcategory: Curriculum-Specific

Use of Results Sub- Category: Curriculum-Specific Scientific Literacy [2019-2020]								
	Curricular Change		Course Revision		Pedagogy		Subject-Matter Expert Feedback	
	#	%	#	%	#	%	#	%
Program	2	100	14	56.0	13	59.1	0	0.0
Discipline	0	0.0	11	44.0	9	40.9	1	100
Total	**2**	**100**	**25**	**100**	**22**	**100**	**1**	**100**

Table A20. Use of Results by Subcategory: Program Resources

Use of Results Sub- Category: Program Resources Scientific Literacy [2019-2020]						
	Financial		Human Resources		General Resources	
	#	%	#	%	#	%
Program	0	0.0	0	0.0	0	0.0
Discipline	0	0.0	0	0.0	0	0.0
Total	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**

Table A21. Use of Results by Subcategory: Co-Curricular Resources

Use of Results Sub- Category: Co-Curricular Resources Scientific Literacy [2019-2020]				
	Co-Curricular Opportunities		Academic Support/Advising	
	#	%	#	%
Program	0	0.0	3	100
Discipline	0	0.0	0	0.0
Total	**0**	**0.0**	**3**	**100**

Table A22. Use of Results by Subcategory: Assessment Process

Use of Results Sub- Category: Assessment Process Scientific Literacy [2019-2020]																
	CLO Assessment Change		Data Analysis Method Change		CLO Change		Target Increased		Target Decreased		Target Clarified		Sample Size		Communication	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Program	8	47.1	4	30.8	0	0.0	0	0.0	0	0.0	0	0.0	2	14.3	12	41.4
Discipline	9	52.9	9	69.2	0	0.0	0	0.0	0	0.0	0	0.0	12	85.7	17	58.6
Total	**17**	**100**	**13**	**100**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**14**	**100**	**29**	**100**

Table A23. Use of Results by Subcategory: College-Level

Use of Results Sub- Category: College-Level Scientific Literacy [2019-2020]						
	Dual Enrollment		Articulation Agreement		Recruiting/ Marketing	
	#	%	#	%	#	%
Program	0	0.0	0	0.0	0	0.0
Discipline	0	0.0	0	0.0	0	0.0
Total	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**

Appendix B: Operational Definitions of Professional Readiness

Table B1. Scientific Literacy Operationalized Definitions by Programs

Program Name	Operationalized Definition
100-Level Courses	
Occupational Therapy Assistant	Implement evidence-based practice skills when working with clientele across the life span.
Radiography	Determine proper exposure to achieve optimum images of anatomical structures.
General Studies: Health Sciences, A.S.	Students will demonstrate the ability to apply the scientific method and to evaluate empirical information.
200-Level Courses	
Business Management, A.S.	Students will recognize and know how to use the scientific method, and to evaluate empirical information.
Engineering	Student will apply and demonstrate engineering problem solving methodology .
Computer Science	Demonstrate techniques for problem analysis and algorithm design.
Science, A.S.: Math Specialization	Interpret mathematical results, state conclusions using statistics and accept or reject the null hypothesis.
Science, A.S.	Students will recognize and know how to use the scientific method, and to evaluate empirical information.
Psychology	Students will correctly identify the steps of the scientific method and display knowledge about the evaluation of empirical information.
Both 100- and 200-Level Courses	
Physical Therapist Assistant	Identify and integrate appropriate evidence-based resources to support clinical decision-making in patient care.

Table B2. Scientific Literacy Operationalized Definitions by Disciplines

Discipline Name	Operationalization
100-Level Courses	
Biology	Students will understand the scientific method and identify methods of inquiry that lead to scientific knowledge.
Chemistry	Students will be able to use quantitative reasoning coupled with scientific knowledge to draw logical conclusions and make well-reasoned decisions.
Geology	Describe the basic parts of the process of evolution.
200-Level Courses	
Economics	Students will be able to identify the impact of science and technology on economic outcomes.

Sociology	Students will identify the main methods of data collection and analysis in sociology
Physics	Students will recognize and know how to use the scientific method, and to evaluate empirical information.

Appendix C: Occupational Therapy Assistant Rubric

CRITICALLY APPRAISED TOPIC (CAT) PAPER Grading Rubric 2020

GRADING CATEGORY	POINTS AVAILABLE	POINTS EARNED	COMMENTS
TITLE	2		
NAME of AUTHORS	2		
CLINICAL SCENARIO	5		
FOCUSED CLINICAL QUESTION	4		
SUMMARY OF SEARCH	5		
CLINICAL BOTTOM LINE	5		
SEARCH SUMMARY USING PICO	6		
INCLUSION CRITERIA	2		
EXCLUSION CRITERIA	2		
SUMMARY OF STUDY DESIGNS OF ARTICLES RETRIEVED	15		
SUMMARY OF BEST EVIDENCE	15		
IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH	5		
REFERENCES/ CITATIONS (APA Style)	3		
DISSEMINATION PLAN	5		
GROUP/SELF-FEEDBACK FORM AVERAGE FOR PAPER	5		
ORGANIZATION	4		
GRAMMAR/SPELLING	10		
TOTAL	***100***		

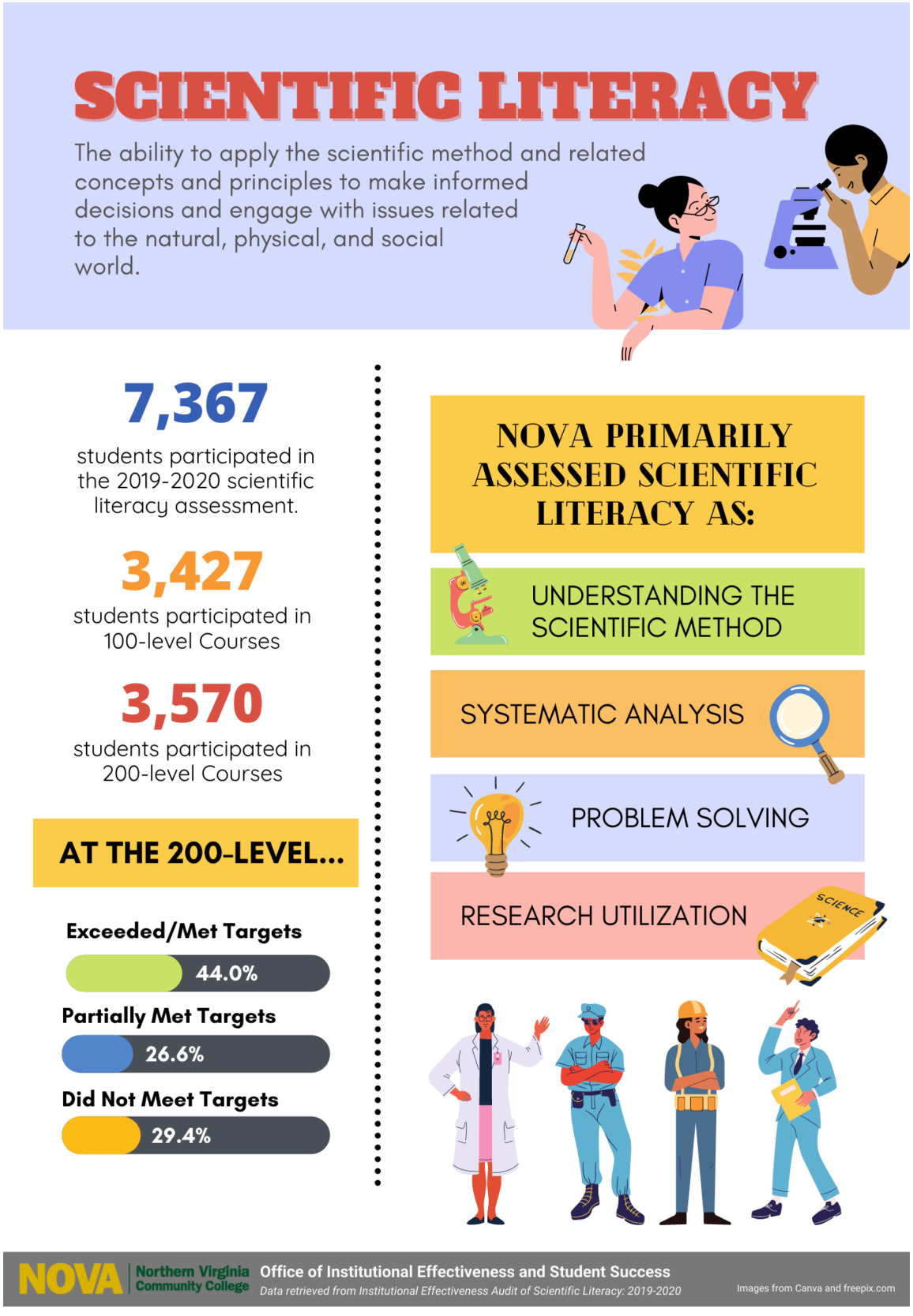
Appendix D: Personal Therapist Assistant Rubric

PTH 245 – Research Paper Rubric

	Excellent	**Satisfactory**	**Less than satisfactory**		Total
CONTENT	categories with 10 pts max: 7-10 categories with 5 pts max: 4-5	categories with 10 pts max: 3-6 categories with 5 pts max: 2-3	categories with 10 pts max: 0-2 categories with 5 pts max: 0-1	Comments	**MAX: 75 points**
Introduction					
Part I	Begins with an introduction that presents background information on the topic. The introduction leads clearly and logically to the PICO question. Interesting, makes the reader want to keep reading!	Begins with an introduction that presents background information on the topic. The introduction leads to the PICO question, but it is very basic and may be missing important points about the background of the topic.	Introduction is vague and does include relevant information.		**10**
Part 2-PICO	The PICO question is included. The PICO question includes the 4 appropriate parts (P-I-C-O). It is a narrowly focused question.	The PICO question is included. The PICO question includes the 4 appropriate parts (P-I-C-O). It is not quite as narrowly focused a question.	The PICO question does not include all 4 appropriate parts (P-I-C-O) OR no PICO question included		**5**
Article Description					
Type of study	Type of study and blinding described correctly.	Type of study included, but poorly written description about blinding.	Vaguely written. Description about blinding is incorrect.		**5**
Background and Purpose	Excellent description about the background and purpose of the study.	Good description about the background and purpose of the study.	Poorly written description about the background and purpose of the study.		**5**
Methods	Includes sample size, explains groups, interventions and length of trial period. Written well and described accurately.	Leaves out 1-2 portions of this section or is not written accurately.	Leaves out major portions of this section or not accurately written.		**10**
Outcome Measures	Includes all primary and secondary outcome measures.	Includes the majority of primary and secondary outcome measures.	Leaves out major portions of this section or not accurately written		**5**
Results	All results explained in detail. *P* values given for all primary outcome measures. May include one or more secondary outcome measures.	Some results explained, not detailed, or partially inaccurate.	Leaves out major portions of this section or not accurately written		**10**
Limitations	Includes 2 limitations and described well.	Includes 2 limitations, but not described well or only includes 1 limitation.	Leaves out major portions of this section or not accurately written		**5**
Article Conclusions	Includes 2 conclusions and described well.	Includes 2 conclusions, but not described well or only includes 1 conclusion.	Leaves out major portions of this section or not accurately written		**5**

Discussion	Excellent, Insightful and well written discussion which demonstrates the relationship between the PICO question and the article. Strong review of key conclusions with integration of the PICO question, purpose of the report and applicability to practice	Basic discussion demonstrates the relationship between the PICO questions and the article, but is mainly a repeat of article descriptions. Somewhat reviews key conclusions with integration of the PICO question and purpose of the report. May or may not show some applicability to practice	Poorly written discussion. Only repeats information from article description and doesn't provide a review of conclusions or tie to PICO question or relate to practice.		**10**
Conclusion Paragraph	Provides a concise closing summary that effectively closes the paper.	Provides a concise closing summary, but it is a repeat of other statements.	Does not provide a closing summary or it is too long or off topic.		**5**
FORMAT	4-5	2-3	0-1		**MAX: 25 points**
Mechanics of Writing	The paper is free of grammatical, spelling and punctuation errors.	Spelling and grammatical errors are throughout paper but do not detract from the paper.	Repeated mistakes in spelling, grammar or punctuation. These mistakes detract from the overall paper.		**5**
Language Use (sentence construction, style and word choice)	Writing is flowing and easy to follow, without errors in style that detract from paper. Word choice- Written in proper medical terminology.	Some errors in language use, but writing is clear and sentence construction and word choice is good. Word choice- Some incorrect use of medical terminology or use of layman's terms.	Errors in style detract substantially from paper, word choice is informal in tone. Writing is choppy with many unclear passages. Use of medical terminology is poor.		**5**
APA – in text citations	The paper is free from any APA in text errors.	The paper has up to 3 APA in text errors.	The paper has more than 3 APA in text errors.		**5**
APA References at end of paper	The references are free from APA style reference mistakes.	The references have up to 3 APA style reference mistakes.	The references have 3 or more APA style reference mistakes.		**5**
Other	Paper stapled, article stapled and attached with a paper clip, complete title page attached, printing only on one side of paper.		Any mistakes in this row will drop score to this column.		**5**
BONUS					
Results section of paper	Includes an accurate description of clinical significance				**5 point bonus**
DEDUCTIONS					
Citations	Sections of the paper are in quotes or not paraphrased well				**-10 points**

Appendix E: 2019-2020 Scientific Literacy Target Data Infographic



PATHWAY TO THE AMERICAN DREAM—NOVA'S STRATEGIC PLAN 2017-2023

THE NOVA COMMITMENT

As its primary contributions to meeting the needs of the Commonwealth of Virginia, Northern Virginia Community College pledges to advance the social and economic mobility of its students while producing an educated citizenry for the 21st Century.

THE STRATEGIC PLAN GOALS AND OBJECTIVES[10]

To deliver on this commitment, NOVA will focus its creativity and talent, its effort and energy, and its resources and persistence, on achieving three overarching goals—success, achievement, and prosperity. It will strive to enable **Every Student to Succeed, Every Program to Achieve,** and **Every Community to Prosper.** These strategic goals are grounded in our college's commitment to equity, excellence, empathy, evidence, and economic and social mobility (NOVA's 5Es).

GOAL 1: Every Student Succeeds

- **Objective 1:** Adopt a college-wide approach to advising
- **Objective 2:** Achieve equity in student outcomes

GOAL 2: Every Program Achieves

- **Objective 3:** Establish comprehensive, fully-integrated, Informed Pathways (high school to NOVA to four-year college/university) for every program
- **Objective 4:** Sustain and, where needed, establish effective, equity-minded NOVA collegewide processes, protocols, policies, and accountabilities for services and programs
- **Objective 5:** Align NOVA's culture, structure, and talent management/development with its access and equity mission and commitment to inclusive excellence
- **Objective 6:** Stabilize, grow, and sustain resources required to support mission and innovation

GOAL 3: Every Community Prospers

- **Objective 7:** Elevate and empower NOVA as the region's leading workforce provider across all essential and high demand industry sectors

[10] Strategic Plan Objectives were revised in Fall 2020.

NOVA

Northern Virginia
Community College

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