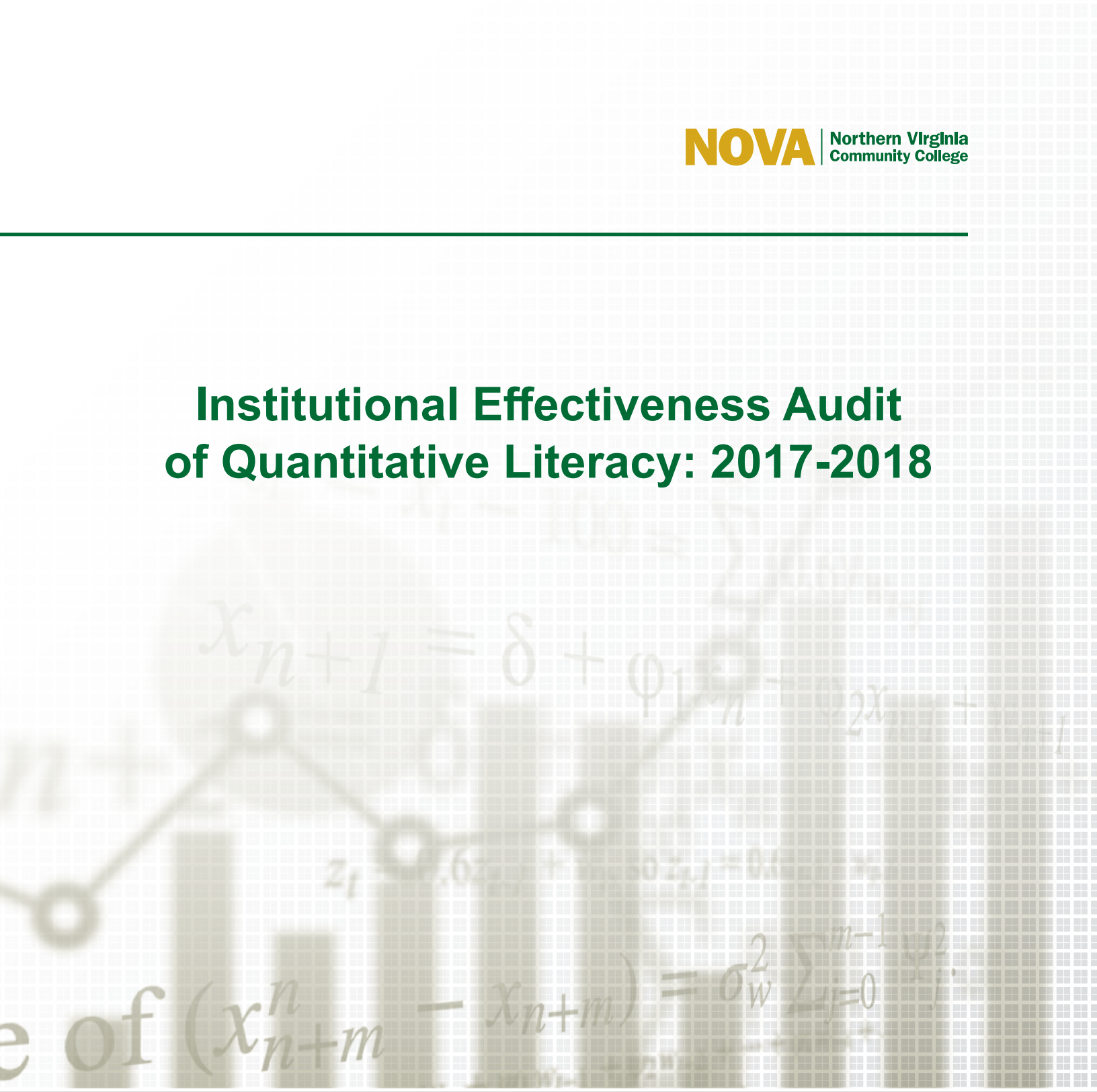
NOVA | Northern Virginia Community College

Institutional Effectiveness Audit of Quantitative Literacy: 2017-2018



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OFFICE OF INSTITUTIONAL EFFECTIVENESS AND STUDENT SUCCESS

The purpose of the Office of Institutional Effectiveness and Student Success is to conduct analytical studies and provide information in support of institutional planning, policy formulation, and decision making. In addition, the office provides leadership and support in research related activities to members of the NOVA community engaged in planning and evaluating the institution's success in accomplishing its mission.

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Institutional Effectiveness Audit of Quantitative Literacy 2017-2018

Executive Summary

This section summarizes key findings from the Office of Academic Assessment's 2017-2018 Quantitative Literacy Core Learning Outcome Audit. The audit considers the assessment data gathered from all programs and disciplines performing quantitative literacy assessments. This data provides insight into the assessment process and student learning.

1. Submission and Quality of Quantitative Literacy Assessments.
    - In 2017-2018, 17 of NOVA's 66 educational programs and standalone certificates and 3 of 12 disciplines without degrees assessed quantitative literacy.
    - Program and discipline Annual Performance Evaluation Reports (APERs) rated above 80% in every category, minus one, when evaluated by the Office of Academic Assessment.
2. Course Embedded Assessments.
    - Approximately 72 percent of educational programs used one of their previously developed SLOs to operationalize QL.
    - 1,880 students, across modalities, took part in the assessment process of quantitative literacy.
3. Measuring Student Achievement in Quantitative Literacy.
    - Programs' and disciplines' definitions of quantitative literacy fell into 1 of 6 categories: data interpretation; presentation of quantitative information; calculation; application/analysis; communication; and other.
    - Most programs and disciplines used calculation and application/analysis to operationalize QL in exam questions and on rubrics.
4. Achieving Target Goals.
    - 70% of programs and disciplines met their QL target goals and 67% of students met the target goals set by the program/discipline in which they were assessed.
5. Actions to Improve Student Learning.
    - Disciplines and programs plan to make, or have made, 158 changes to improve quantitative literacy assessment and student learning.
    - 57% of the changes *programs* made were curricular changes.
    - 86% of the *disciplines'* changes focused on assessment.
6. The Quantitative Literacy Working Group was composed of 13 members, including deans, provosts, and faculty, and represented every physical campus (minus Alexandria).
7. Final Quantitative Literacy Recommendations included:
    a. Increase the number of programs and disciplines assessing QL.
    b. Encourage innovative QL assessment in the Trade, Liberal Arts, and Social Sciences courses.
    c. Encourage faculty to move QL assessments beyond numeracy.
    d. Encourage faculty to "meet students where they live" by creating assignments using social media, gaming, or other Millennial and Gen-Z focused topics/media.

e. Tighten the operationalization of QL to ensure it conforms to the VCCS definition.
f. Let the students know what they are learning: use the language of the SLOs, CLOs, course objectives, and assignment goals when writing-up assignment descriptions/rubrics. Write specific, concise, and clear instructions for every assignment. Include all assignment descriptions/rubrics in the syllabus.
g. Provide adjuncts with assessment resources and program/discipline contact in advance of assessments.

Introduction

The State Council for Higher Education in 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. There are six general education content areas prescribed by the Virginia Community College System (VCCS) for all system colleges' curricula: 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). They are developed in general education courses and practiced and developed in individual fields of study. The teaching and assessment of these skills and knowledge are dispersed across the curriculum. Educational degree programs, select certificates, and disciplines without degrees at NOVA assess general education core learning competencies.

This report examines the extent to which NOVA students achieve the VCCS quantitative literacy general education core competency, or core learning outcome. VCCS *Policy General Education (5.0.2)* defines quantitative literacy (QL) as "the ability to perform accurate calculations, interpret quantitative information, apply and analyze relevant numerical data, and use results to support conclusions." Examples of quantitative literacy include setting a budget, evaluating statistics, or finding the correct apartment for the right price. It allows individuals to not only perform correct and accurate calculations, but also use existing knowledge on a topic to draw logical, valid conclusions and assumptions based on the data presented.

This CLO assessment is part of a larger three-year cycle assessing NOVA's six core learning outcomes. The overarching goal of this process 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 assessing critical thinking and quantitative literacy.

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
Civic Engagement		X			X	
Critical Thinking	X			X		
Professional Readiness			X			X
Quantitative Literacy	X			X		
Scientific Literacy			X			X
Written Communication		X			X	

Prior to 2017-2018, Virginia Community College System (VCCS) required all community colleges, including NOVA, to assess general education core competencies using standardized assessment measures they determined. Shifting course, NOVA implemented course embedded assessment, a direct measure using students' actual coursework, in 2017-2018. This decision was made based on recommendations from NOVA's Ad Hoc Committee on General Education

Assessment established in Spring 2016 and the State Council of Higher Education for Virginia (SCHEV) *Policy on Student Learning Assessment and Quality in Undergraduate Education* adopted in July 2017.

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

Table 2: Content 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?*	*When did we assess? Who was involved? What did we find out?*	*What have we been doing to improve student learning? What are we doing (or will we do) to improve student learning?*

This *Institutional Effectiveness Audit of Quantitative Literacy: 2017-2018 Report* describes and analyzes the assessment reports provided to the Office of Academic Assessment by NOVA's educational programs, select certificates, and disciplines without degrees. It is divided into six sections:

- *Section I* discusses educational programs' and disciplines' participation in the 2017-2018 quantitative literacy assessment and the quality of quantitative literacy assessment reporting;
- *Section II* reviews examples of how educational programs and disciplines operationalized quantitative literacy and analyzes sample sizes;
- *Section III* describes how programs and disciplines set targets and how the Office of Academic Assessment analyzed student achievement of those targets by programs and disciplines as well as student success on the assessment measures;
- *Section IV* highlights the changes made by programs and disciplines in assessment and student learning and;
- *Section V* focuses on changes recommended by the Quantitative Literacy Working Group, comprised of faculty and college staff, to improve the next institutional assessment of quantitative literacy.
- *Section VI* concludes the report.

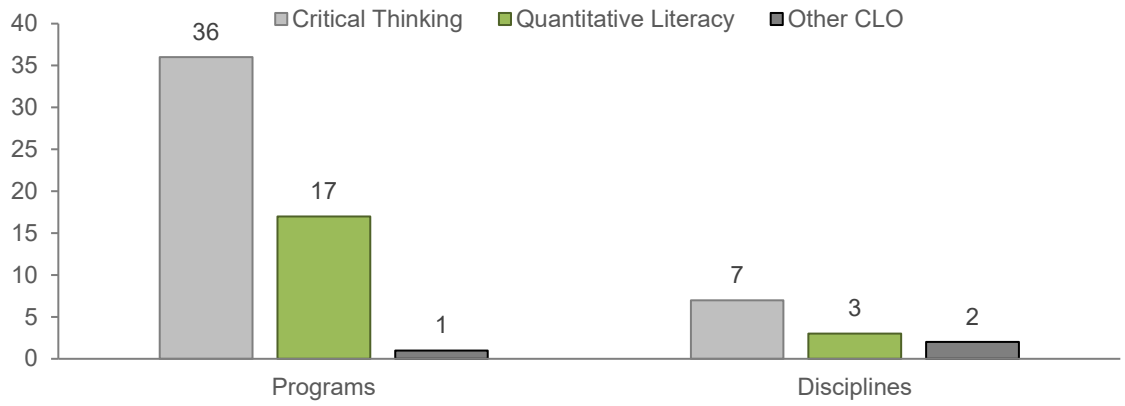
Section I: Submission and Quality of Quantitative Literacy Assessments

A. Submission of Reports

In 2017-2018,17 educational programs and standalone certificates and three disciplines without degrees assessed quantitative literacy (Figure 1).[1] Participation was not limited to the programs and disciplines involved in the General Education curriculum at NOVA. College bound programs/disciplines, trade programs/disciplines, and the Medical Education Campus all participated in the assessment of quantitative literacy. The compiled *Quantitative Literacy Core Learning Competency Assessment Report: 2017-2018* containing these assessment documents can be found on the Office of Academic Assessment's webpage.

Figure 1 illustrates the number of programs and disciplines assessing quantitative literacy and critical thinking in 2017-2018. Two disciplines conducted additional CLO assessments for the multidisciplinary degrees. For more information about the critical thinking assessment, see the *Critical Thinking Core Learning Competency Assessment Report: 2017-2018*.

Figure 1. Submission of Core Learning Outcomes Assessment: 2017-2018



B. Quality of Assessment Reporting by Programs and Disciplines

The Office of Academic Assessment evaluated the quality of 20 educational programs' and disciplines' quantitative literacy assessment reports, or APERs, 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. The rubric awards points for the quality of reporting in each of these four sections of the APER. The Office breaks down each section of the APER into several sub-sections, creating detailed suggestions for the program or discipline receiving the report. Points are awarded for addressing the variety of components of the APER: two points for meeting the requirement, one point for partially meeting it, and zero points for not meeting the requirement. Using the resulting scores, reports are classified by performance: meeting

[1] 66 programs and disciplines submitted reports assessing critical thinking, quantitative literacy, or another CLO. Three of the multi-disciplinary transfer degrees are only counted once, as they submitted aggregated data from disciplines that was unable to be disaggregated by degree. Information Technology and Information Systems Technology submitted aggregated data from both IT and IST students in the same course(s).

expectations, mostly meeting expectations, partially meeting expectations, and not meeting expectations (Table 3).

Table 3. Quality of Reporting in the *APER*: 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

In the 2017-2018 assessment year, programs and disciplines APERs scored almost exclusively in the top two tiers: meeting expectations and mostly meeting expectations (Table 4). Disciplines dropped into the “yellow” category once in the Uses of Results section. Given there are only three disciplines assessing QL, one report scoring below expectations lowers the total score in the category. Overall, these numbers indicate a high level of success in this first year of CLO assessment at NOVA. These scores indicate a commitment to useful data collection and analysis and subsequently, improving the assessment culture.

Table 4. Quantitative Literacy Assessment Rubric Results: 2017-2018

	Programs	Disciplines	Programs and Disciplines
CLO Criteria	100.0%	91.7%	98.8%
Evaluation Methods	96.8%	80.6%	94.3%
Results	95.8%	86.9%	94.4%
Use of Results	94.9%	71.4%	91.4%
TOTAL	**96.9%**	**80.8%**	**94.5%**

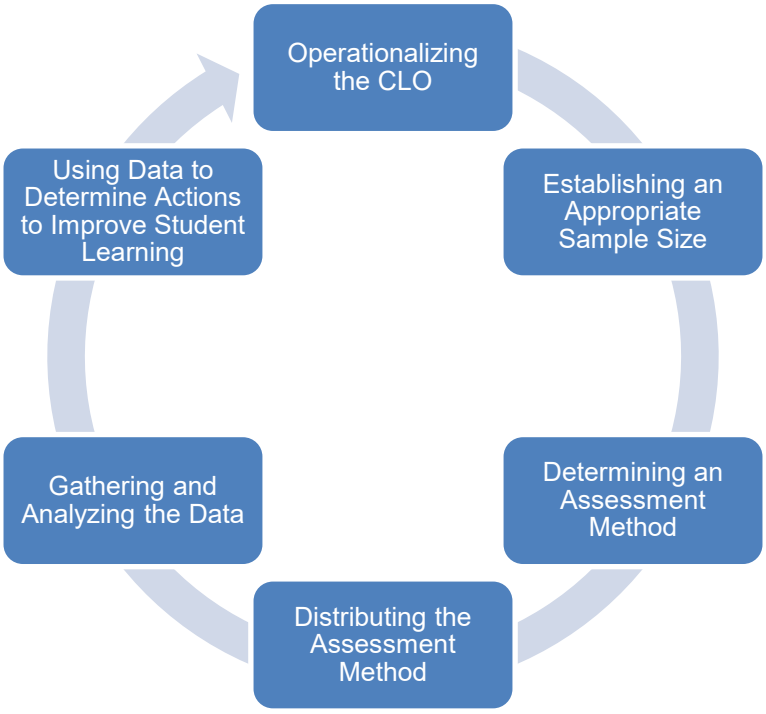
While programs previously assessed student learning, this is the first-year disciplines formally assessed student learning. After disaggregating the scores by programs and disciplines, the benefit of practice becomes clear. Programs consistently outscore disciplines in the quality of reporting (Table 4). Considering programs are more familiar with the assessment process, the Office of Academic Assessment anticipated their rubric results would reflect greater experience. The Office further expects improvement in discipline rubric scores within the next few years, as they fine-tune their assessment methods and become more familiar with the assessment process and report writing.

Section II: Course Embedded Assessments

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 subsequently, operationalizing the CLO. Some programs use existing program SLOs to assess the core learning outcome in question (Figure 2). Faculty consult their program's curriculum map, which indicates: the student learning outcome being taught and assessed in each core course; the method of assessing the SLO, (exam, paper, etc.); and the level of proficiency provided by the course (introduced, practiced, and mastered). After determining which course most closely aligns with the CLO being assessed, faculty operationalize the CLO so it best reflects the skills or abilities expected in the selected course(s).

An effective CLO assessment cycle includes: operationalizing the CLO; establishing an appropriate sample size across courses 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 SLO Leads rely on their full-time and part-time faculty, provosts, deans, and other administrators.

Figure 2. The Assessment Process Cycle



A. Operationalizing Quantitative Literacy

Programs and disciplines use the VCCS definition of the CLO as a starting point, then operationalize it to best fit the skills and competencies taught in the program/discipline. Programs and disciplines may consult with the Office of Academic Assessment to ensure that the operational outcomes appropriately align with the VCCS definitions (see Appendix B, Tables A and B). Examples of how programs operationalized quantitative literacy in 2017-2018 include:

1. *Explain numerical information in mathematical forms; convert numerical information into graphic form; draw conclusions based on information and data; and communicate quantitative information persuasively.* **–Chemistry (100-level).**
2. *Students will use graphical methods to organize and interpret quantitative data. –* **Geology (100-level).**
3. *Students will appropriately interpret graphic depictions of ventilator waveforms as it applies to the patient's clinical status. —***Respiratory Therapy (200-level).**
4. *Students will apply and demonstrate engineering problem solving methodology. —* **Engineering A.S. SLO #1 (200-level).**

As the examples above highlight, courses at the 200-level tend to be more differentiated, focusing on the specialized knowledge of a given program. These courses build on 100-level course content, adding to the skills, knowledge and abilities acquired in the 100-level. At the 200-level, faculty tend to build assessment measures that assume students have effectively retained information from previous courses.

Using Engineering's curriculum map as a guide, the skills necessary to achieve the QL assessment above, which is also an Engineering SLO, are introduced in 100-level courses. Building on that knowledge, the SLO/CLO is practiced and mastered at the 200-level.

In practice, about 72 percent of educational programs used one of their SLOs to operationalize QL (Figure 3). Therefore, about 72 percent of the QL assessments completed in 2017-2018 have been completed in the past, and/or will be assessed in the future. The use of SLOs to assess quantitative literacy indicates the degree to which it is integrated into NOVA courses. None of the 3 disciplines assessing QL used an SLO as a CLO. Given only three disciplines assessed QL, this absence is not telling. The Office of Academic Assessment expects disciplines to further integrate their SLOs with the College's CLOs as they become more familiar with CLO assessment.

Figure 3. Quantitative Literacy Assessments Using Program/ Discipline Student Learning Outcomes: 2017-2018

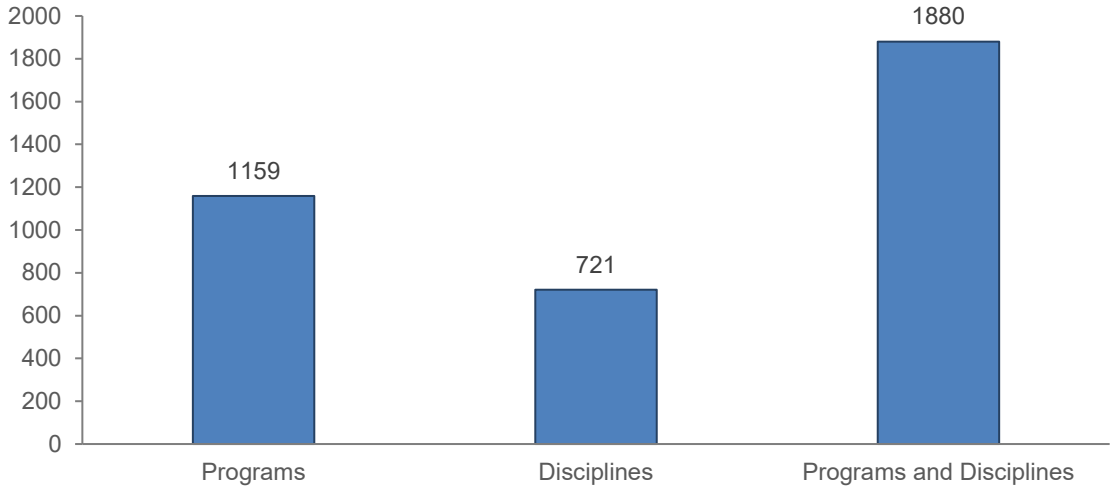
B. Sample Sizes

At NOVA, the faculty determine the appropriate course(s) in which 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+), the programs and disciplines may ask the Office of Academic Assessment 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 1/3 of the total sections offered.

The number of students assessed in 2017-2018 is well beyond the College's expectations. The assessment of quantitative literacy involved 1,880 students (Figure 4). Approximately 62 percent of these students were assessed in their educational program while 38 percent were assessed in a discipline (Figure 4).

In Spring 2018, 36,365 program placed students were enrolled at NOVA.[2] Thus, approximately five percent of NOVA's students participated in the course embedded assessment of QL. It is important to note, this level of student participation is significantly greater than the past VCCS assessment expectation of at least 50 student participants per Virginia Community College.

Figure 4. Quantitative Literacy Sample Sizes Overall: 2017-2018



As Figures 5 and 6 indicate, more *students* were assessed in 100-level courses, while more *courses* were assessed at the 200-level, (1128 students in 100 level courses and 807 in 200-level courses; Figure 5). As more students enroll in 100-level courses, the assessment of more students in 100-level courses is expected. Equally, given faculty want to assess courses where quantitative literacy is practiced or mastered, it follows they will often choose 200-level courses (Figure 6).

[2] Program placed students are enrolled in a degree or certificate program at NOVA. Spring 2018 enrollment numbers were used in this report as the number of program placed students for the 2017-2018. The official number of program placed students in 2017-2018 have not been released at the time of writing.

Figure 5. Quantitative Literacy Student Sample Sizes by Course Level and Program and Discipline: 2017-2018[3]

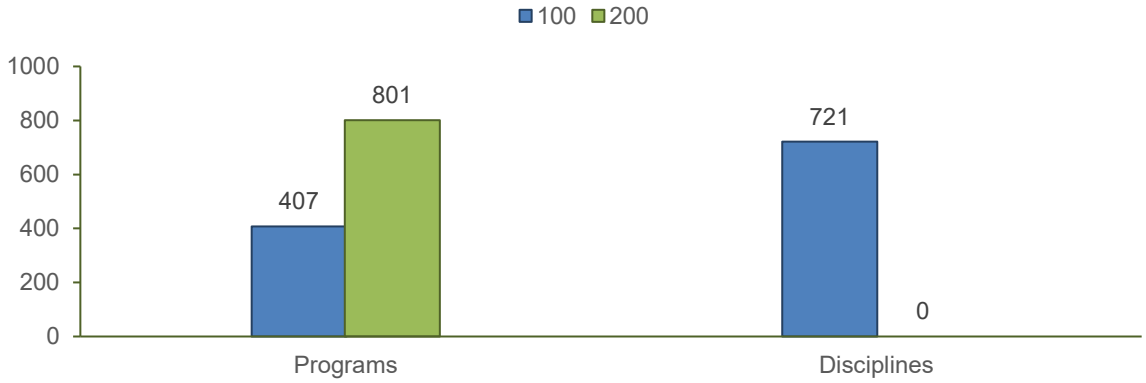
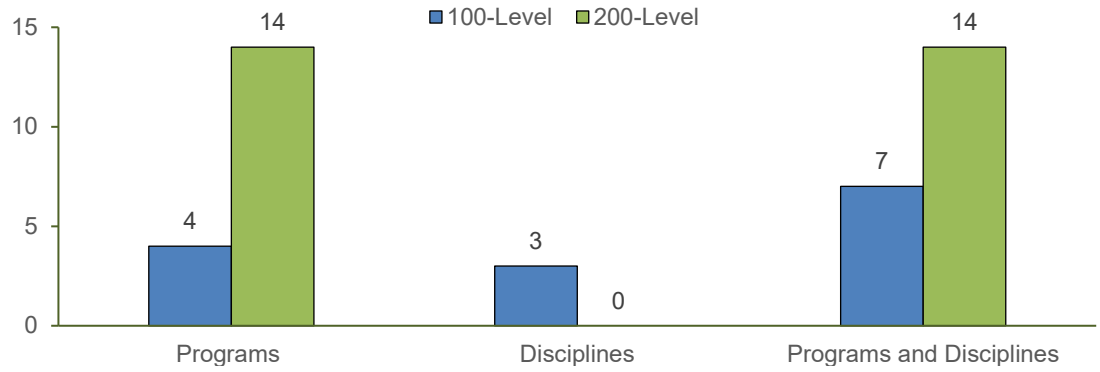


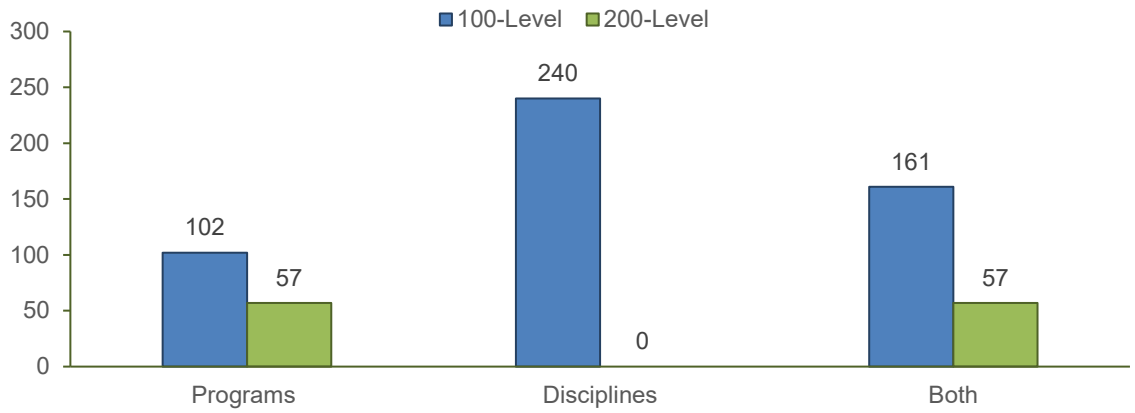
Figure 6. Number of Courses Assessing Quantitative Literacy by Program and Discipline[4]



The average number of students assessed in 100 and 200-level courses offers useful data over time and offers insight into current assessment processes. As mentioned above, 100-level courses assessed by non-degree granting disciplines often have large sample sizes primarily because they satisfy general education requirements for an associate degree. Along with satisfying general education requirements, these courses tend to easily transfer to four-year colleges and universities. Meanwhile, courses assessed by degree programs, tend to have smaller sample sizes; the sample size ranged from 11 – 111 students compared to disciplines which ranged from 86 – 324 students. Program courses at the 100-level had an average sample size of 102 students (Figure 7). Comparatively, 200-level courses had an average sample size of 57 students (Figure 7). More so than the 100-level program courses, the 200-level program course content is aimed at refining the students' knowledge and skills in the program (e.g., Engineering), therefore fewer students will be enrolled in these courses.

[3] Emergency Medical Services assessed 100-level and 200-level courses. Therefore, they are counted twice (once at the 100-level and once at the 200-level).
[4] The number of programs and disciplines assessing QL is 20 (17 programs and 3 disciplines). However, Emergency Medical Services assessed one class at the 100-level and another at the 200-level. EMS is counted twice in this graph—once in each category, thus it appears we have one too many programs.

Figure 7. Average Number of Students Assessed in 100 and 200-level Courses by Program and Discipline



Section III: Measuring Student Achievement in Quantitative Literacy

Course embedded assessment requires a minimum threshold of success for 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 Chemicals Society's Guidelines for Lab Safety for Chemistry); or by faculty using their professional expertise.

Target goals are commonly set at a student performance level of 70 percent or better on an assignment or exam. The college aggregates program and discipline student data to examine college-wide performance on a given CLO, in this case quantitative literacy. The target goal data is shared with faculty and the public via NOVA's website, campus TV monitors, and various infographics shared at high school events.

Success regarding target goals signals student achievement of the assessed competencies. Achievement of target goals may also signal improvements in the assessment process, the culture of assessment, and student learning. The target goal data is shared with faculty and the public via NOVA's website, campus TV monitors, and various infographics shared at high school events.

Section III focuses on: (1) the methodologies used to assess quantitative literacy (e.g., how programs/disciplines assessed this CLO and the effectiveness of their assessment method) and (2) how, and to what degree, programs/disciplines and students met target goals.

A. Methods for Assessing Quantitative Literacy

Categories of Quantitative Literacy

In order to assess quantitative literacy college-wide, the Office of Academic Assessment collates the data from all assessments of QL: assignment descriptions, exams, and rubrics, noting key terms used. Then these key terms are organized into lists of "like-minded" terms. For quantitative literacy this process resulted in six distinct forms of QL assessed in 2017-2018. These categories were then used to parse the program and discipline data into college-wide QL data. Table 5 delineates the 6 college-wide categories of quantitative literacy.

Table 5. Major Categories of Quantitative Literacy

Category	Description
Data Interpretation (DI)	Rubric assesses students' ability to interpret data in a thoughtful and critical manner.
Presentation of Quantitative Information (PQ)	Rubric assesses students' ability to graphically depict important information (e.g., charts, graphs, etc.).
Calculation (C)	Rubric assesses students' ability to identify the right formula and/or perform the calculation correctly.
Application/Analysis (AA)	Rubric assesses students' ability to analyze quantitative information and/or use it as justification for solutions or as a persuasion technique.

Assumptions (A)	Rubric assesses students' ability to identify the assumptions from data.
Communication (COM)	Rubric assesses students' ability to present quantitative information properly and effectively to an audience (e.g., stakeholders, classroom, etc).
Other (O)	

Program and discipline quantitative literacy assessments are coded using the categories above. This coding allows for a college-wide analysis of quantitative literacy across NOVA. It is important to note that one rubric or exam may require students to engage in more than one form of quantitative literacy. Therefore, the number of instances of QL coded is higher than the number of programs and disciplines assessing QL. For example, students utilized their quantitative literacy skills nine times to meet the target goal in Interior Design: data interpretation (two times), calculation (four times), application/analysis (one time), present quantitatively (one time), and communication (one time).

As mentioned above, it is common for quantitative literacy and quantitative reasoning to be considered interchangeable. This false equivalency pervades students' skill developments with educational institutions often focusing on in calculation-based mathematical problems rather than analysis and application-based problems. It is common for quantitative literacy to be used synonymously with quantitative reasoning and numeracy. However, an important distinction between these two terms is while quantitative reasoning/mathematics focuses primarily on calculating for abstract situations, quantitative literacy is anchored in everyday life and applying knowledge from various fields of thought.[5]The United States government continues to focus on mathematics, rather than quantitative literacy; as does the American Association of Colleges and Universities' VALUE rubric, Lumina Degree Qualifications, and the Mathematical Association of America. [6] Therefore, it is unsurprising that 50 percent of QL assessment focuses on calculation or application/analysis of mathematical data (Figure 8).

The American Association of Colleges and Universities' report, *Fulfilling the American Dream: Liberal Education and the Future of Work,* rates the ability to communicate effectively to others as the number one quality executives and hiring managers want from recent college graduates.[7] Specifically, 80 percent of executives and 90 percent of hiring managers look for new graduates' able to communicate successfully with others.[8] This concern with students' ability to communicate is of interest here, as it relates to communicating/presenting *quantitative* information to an audience. Eight percent of all QL assessment measures used the presenting/communicating data category to define quantitative literacy (Figure 8). Given the desires of executives and hiring manages, this number is encouraging. The Office of Assessment will work with the QL Working Group to consider ways to increase the number of programs and disciplines focusing on communicating/presenting quantitative data.

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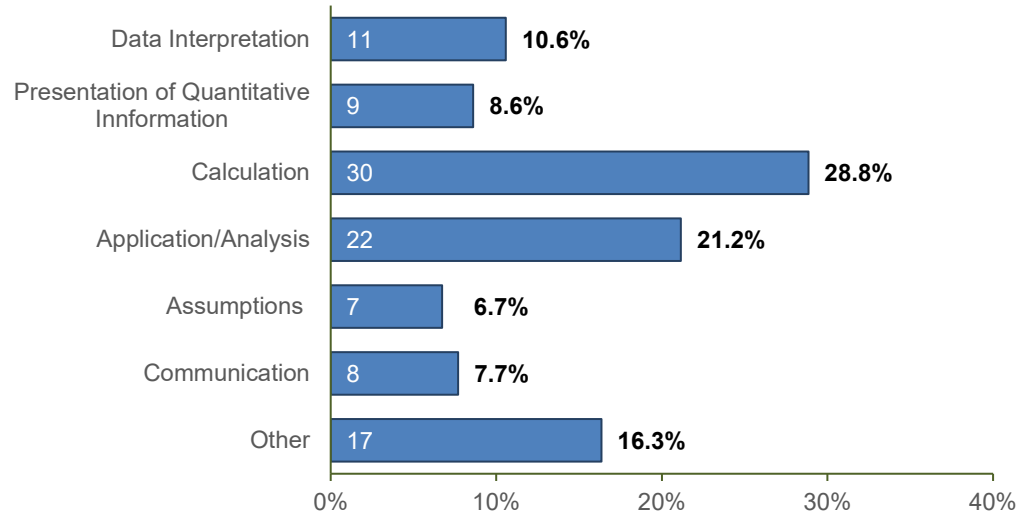
[5] Crotts-Roohr, K., Graf, E., & Liu, O. (2014). *Assessing Quantitative Literacy in Higher Education: An Overview of Existing Research and Assessments. ETS Research Report No. Rr-14-22.* ETS Research Report Series.
[6] Crotts-Roohr, K., Graf, E., & Liu, O. (2014). *Assessing Quantitative Literacy in Higher Education: An Overview of Existing Research and Assessments. ETS Research Report No. Rr-14-22.* ETS Research Report Series.
[7] Hart Research Associates. (2018). *Fulfilling the American Dream: Liberal Education and the Future of Work.*
[8] Hart Research Associates. (2018). *Fulfilling the American Dream: Liberal Education and the Future of Work.*

Figure 8. Quantitative Literacy Categories Used in Assessment Measures[9]

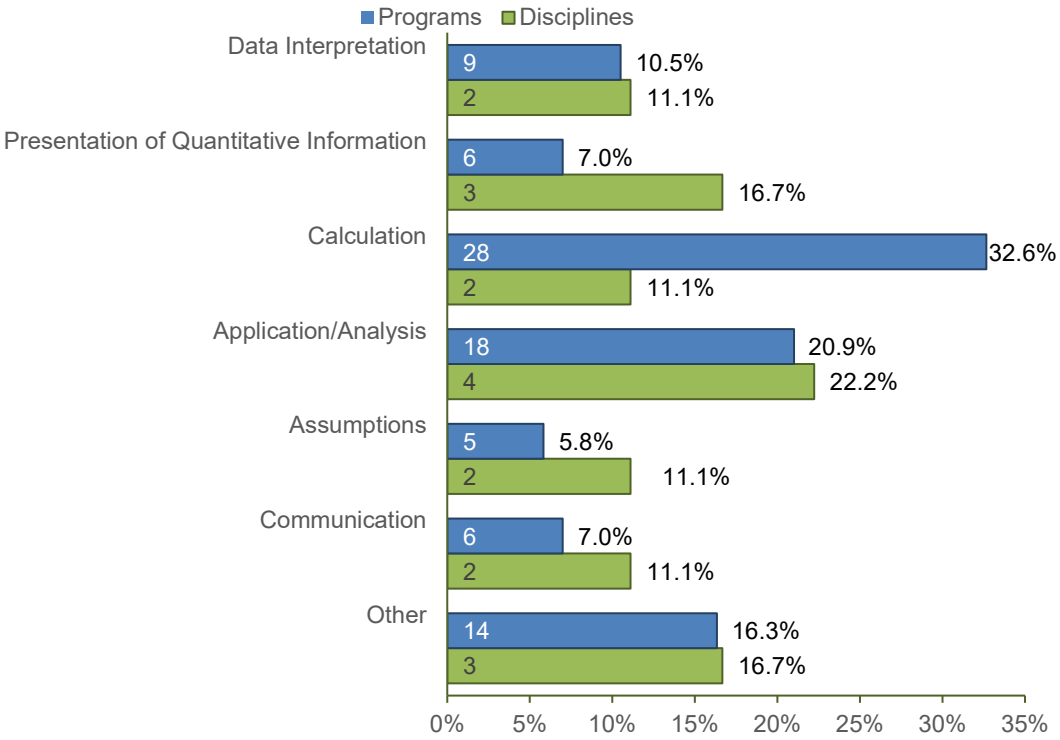


Across all rubrics and exams, 104 instances of quantitative literacy assessment were coded. Programs used the six quantitative literacy categories 86 times. Disciplines used the categories 18 times (Figure 9). When disaggregating the data by programs and disciplines, the Office of Academic Assessment found notable details.

At first glance, calculation and application/analysis of mathematical data were the two most common categories used to assess quantitative literacy. This suggests students are building skills in the calculation and application arenas of "quantitative literacy." Calculation and application/analysis spring to mind when most people consider QL, therefore it is not surprising that these two categories are used frequently as assessment measures. Three in four of the uses of calculation as an assessment measure were by programs (Figure 9). Meanwhile, programs and disciplines used application/analysis at almost the same rate (Figure 9). Disciplines made greater use of the following QL categories: presentation of quantitative information (17 percent vs. 7 percent), assumptions (11 percent vs. 6 percent), and communication (11 percent vs. 7 percent; Figure 9). Programs focused on data calculations (32 percent of total categorizations of QL; Figure 9) and analysis/application (21 percent of total categorizations of QL; Figure 9 However, given the small sample size, comparisons will be made in the next assessment of quantitative literacy to confirm this observation.

[9]Numbers on the base of the bars in the graph above indicate absolute values while numbers on the outside of the bar indicate percentage of programs using each category.

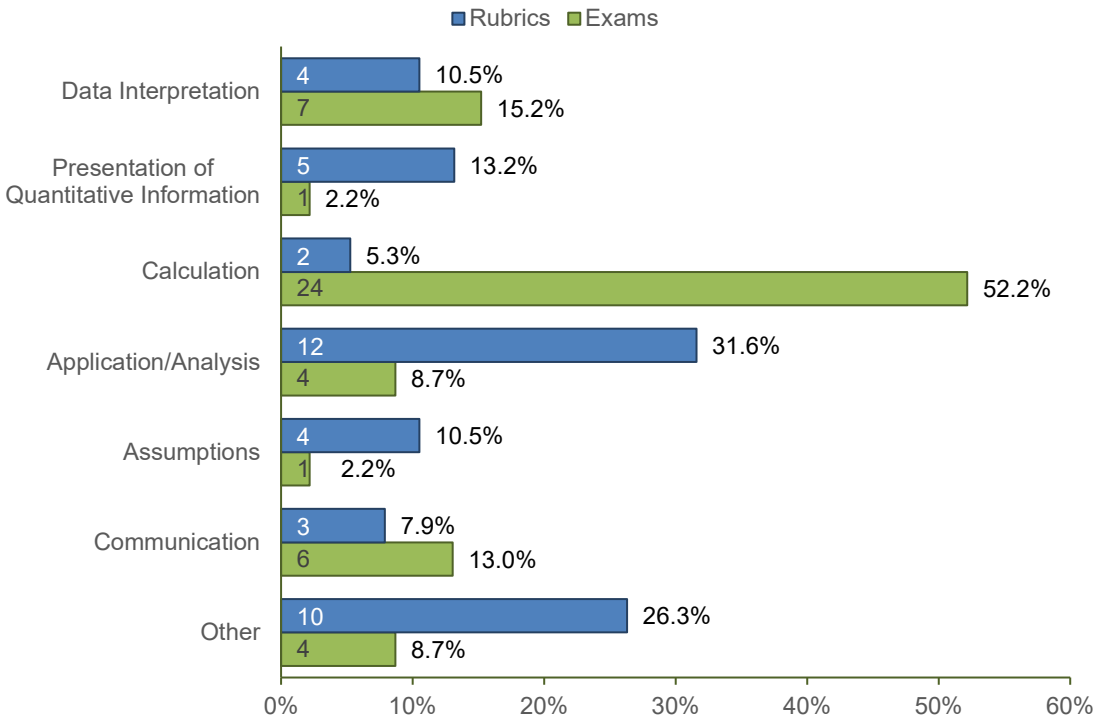
Figure 9. Quantitative Literacy Categories Assessed by Programs and Disciplines



Faculty-designed quantitative literacy rubrics primarily assessed the following categories of QL: analysis/assumption (32 percent), other (26 percent), and the presentation of quantitative information (13 percent; Figure 10). In contrast, faculty-built exams utilized calculation (52 percent), communication (13 percent), and data interpretation (15 percent) most often (Figure 10). These exams reflect some of the biases toward numeracy explained above, and a history of assessing quantitative *reasoning* at NOVA, which was NOVA's approach before transitioning to quantitative literacy. This history may explain why exams are calculation-based more than application-based.

Rubrics assessing QL tended to go beyond numeracy incorporating the broader elements of quantitative literacy, (analysis, communication, and presentation of quantitative information). Rubrics use the full range of QL categories, (Figure 10). Alternatively, exam questions tended to focus narrowly on the numeracy side of QL. Exams tend to categorize QL in more traditional mathematical terms. For example, calculation was most often used to assess QL in exams (52 percent; Figure 10).

Figure 10. Quantitative Literacy Categories Assessed by Method



Assessment Measures' Alignment with the Quantitative Literacy Competency

To ensure NOVA's assessment of QL accurately reflected the VCCS definition of quantitative literacy, all QL assessment measures were coded using the elements in Table 5. Each individual test/rubric item fitting into one of the six categories of QL was counted. For example, one exam question requiring three different types of quantitative literacy would score a three. Coders noted, by category, each item requiring quantitative literacy on every exam and rubric. Therefore, the number of items categorized as QL is greater than the number of assessment tools used to assess quantitative literacy.

Beyond coding for instances of quantitative literacy, rubrics and exams were also examined to assess the clarity of the operational definitions of QL (Table 6). Sample sizes were categorized (small, medium, or large). Assessment methods were examined for their alignment with relevant operational definitions of QL.[10] Finally, the Office created two additional codes to capture the relationship between student achievement and the target goal set by the faculty.

[10] For example, when defining QL as creating a visual representation of a mathematical equation, the Office of Academic Assessment examined the measure to ensure students were asked to *create* a visual representation, not simply recognize the correct graph, etc.

Table 6. Coding Descriptions of Assessment Method and Target Data

Category	Description
Operationalization (O)	Program/discipline provided an operationalized definition of the CLO that was clear and measurable; includes actions students will take to learn this outcome (e.g., demonstrate proficiency in, analyze data, interpret information, etc.)
Sample Size	*SSS – Small Sample Size:* Samples with 33 students or under.
	MSS – Medium Sample Size: Samples between 34 and 69 students.
	*LSS – Large Sample Size: S*amples over 70 students.
Outcome-Method Match (OMM)	Method/assignment used effectively measures the operationalized CLO.
Rubric/Measure	*Rubric in APER (R):* Separate Rubric/assessment measure and/or grading scale was not provided but was explained in the *APER*.
	No Rubric Provided (NRP): No rubric was provided either with the *APER* submission email or in the *APER*.
	Assignment-Specific Rubric (ASR): Rubric primarily evaluates the CLO being assessed and one or both of the following aspects: 1. Clear description of grading criteria/grading scale is provided 2. Provides purpose of assignment
	Generic Rubric (GR): Does not evaluate the CLO being assessed, is vague/not clear, grading scale not provided, no purpose presented.
Examination	*Outcome-Specific Examination (OS):* The exam questions evaluate the assessed CLO by addressing 3 or more aspects of the CLO.
	Generic Examination (OFF): The exam questions do not fully evaluate the assessed CLO. Only assessed 2 or less of the concepts and/or is vague/unclear.
Target	*Criteria Target (CTA):* Target was met in 75% of the criteria, but not overall.
	Overall Target (OT): Target was met overall.
Other (OTH)	

Analysis of the assessment measures found that 80 percent (or 16/20) of programs' and disciplines' assessments clearly aligned with the VCCS quantitative literacy competency. This means, in this first year of CLO assessment, NOVA faculty successfully created appropriate operational definitions of QL 80 percent of the time. While 80 percent is high for a first assessment of QL, NOVA will work with faculty to tighten the relationship between their operationalizing of QL and the VCCS definition.

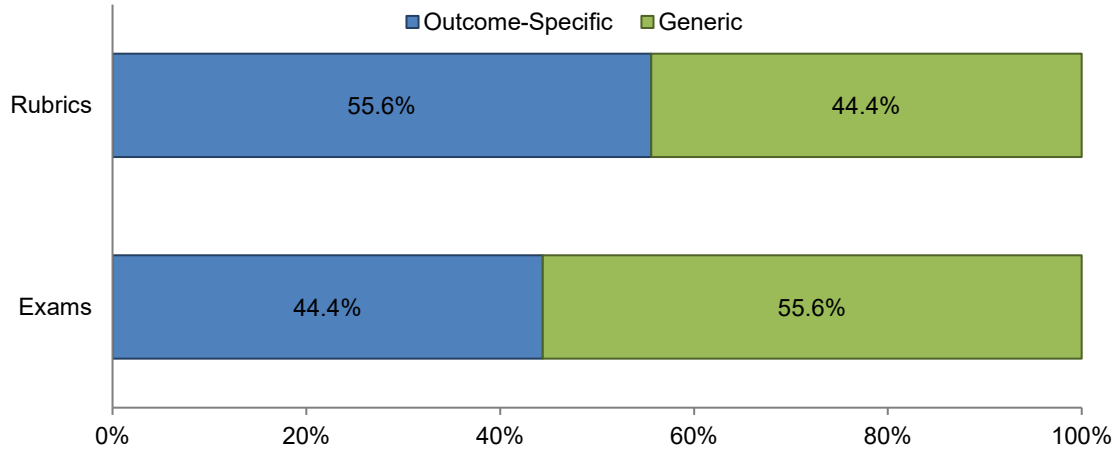
The faculty of nine programs and disciplines used rubrics to assess QL.[11] Twelve programs and disciplines used exams as their assessment method. When looking at rubrics, the Office of Academic Assessment coded almost 56 percent of rubrics as assignment/outcome-specific[12] (Figure 11). This means the rubrics are clear regarding grading criteria and the purpose of the assignment. This specificity makes the assignment more easily understood by students.

[11] While nine programs used rubrics, two did not include a rubric in their *APER/CLO Report* or did not attach it separately. Therefore, the sample size of rubrics assessed is seven, not nine. Similarly, twelve programs/disciplines indicated exams as their assessment method, but only nine exams were provided for coding. Therefore, the sample size of exams is nine, not twelve.
[12] One important distinction to be made is that rubrics were assigned an *assignment*-specific code while exams were assigned an *outcome*-specific code. For the purpose of conciseness, the rest of the report will use the phrase "outcome-specific".

Extensive research suggests that clear guidelines for content and assessment on an assignment improves student success on an assignment.[13]

Conversely, about 44 percent of program and discipline rubrics either lacked detail or missed important elements (Figure 11). These rubrics are categorized as generic rubrics (Table 6). Additionally, 56 percent of QL exam questions coded as generic (Figure 11). Here, generic means the questions were either vague/unclear, or they did not fully address the CLO, (they only assessed two or fewer QL definitions; Table 5 and Table 6). The Office of Academic Assessment will encourage those programs and disciplines with generic exam questions to reconsider their content.

Figure 11. Programs and Disciplines Using Assignment/Outcome-Specific or Generic Rubrics and Exams



Out of the nine rubrics used to assess quantitative literacy, the Office of Academic Assessment found two rubrics exemplifying assignment-specific rubrics:

1. *Assignment-Specific Rubric: Graphic Design* (see Appendix D). Graphic Design's faculty provide a rubric with clear, descriptive expectations for each criteria. Students can clearly understand how the assignment will be marked by the faculty. The rubric is detailed, touching upon multiple categories of quantitative literacy: data interpretation, presents quantitative information (e.g., charts, graphs, etc.), application/analysis, forming assumptions and implications, and communication. Graphic Design's rubric also points to another code the Office of Academic Assessment may consider adding: Investigation and Research.
2. *Assignment-Specific Rubric: Chemistry* (see Appendix E). The Chemistry faculty employed NOVA's quantitative literacy Rubric to assess student learning. NOVA's rubric

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

provides clear, descriptive expectations for each criteria and explicitly states what is expected for all possible points a student can earn. NOVA's Rubric includes elements of all seven quantitative literacy categories: data interpretation, presentation of quantitative information, calculation, application/analysis, assumptions, communication, and other (understanding relevant data/facts to answer the question).

3. *Outcome-Specific Exam: Interior Design.*[14] Interior Design created an Outcome-Specific exam by using questions of identification and analysis. While assessing how well students could properly light and furnish a space, the faculty created questions requiring students to calculate the number of lumens needed in the space, interpret and communicate the data to justify their calculations and results, and draw a diagram of the luminaire spacing. These questions required students to engage in five types of quantitative literacy: data interpretation, calculation, analysis/assumption, presenting quantitative information, and communicating data.

The assessment measures described by the assignment-specific rubrics from Graphic Design and Chemistry require students to display strengths in several different areas of quantitative literacy. Both rubrics require students to analyze and interpret, form assumptions and create a method as well as present and communicate the data. In other words, these rubrics require students to go beyond calculations and apply previous knowledge to form conclusions and assumptions. Comparatively, many exams focused on calculation-based questions when assessing this CLO. A potential reason may be that it is hard to capture these other categories of quantitative literacy in an exam, however, Interior Design did well. This shows to the Office of Academic Assessment that, despite its difficultness, it is possible.

The program and discipline success rates regarding outcome-specific assessment measures, are lower than expected. However, the Office of Academic Assessment understands this is the first-time quantitative literacy and views this as an opportunity to improve in the next assessment of this core learning outcome. The QL Working Group will take-up this issue and provide suggestions to administration and faculty.

B. Achieving Quantitative Literacy Target Goals

There are two sample sets to discuss when considering success via target goals. Disciplines and programs set target goals or minimum scores students were expected to reach on the assessment measure. As well, programs and disciplines investigate their own ability to achieve the target goals. They examine student success in relation to their target goals. They then analyze the results and take measures to improve student learning. The Office of Academic Assessment compiles the program and discipline data analyzing how well individual programs and disciplines are meeting their target goals. The data examined below discusses two samples in concert: student data and program/discipline data.

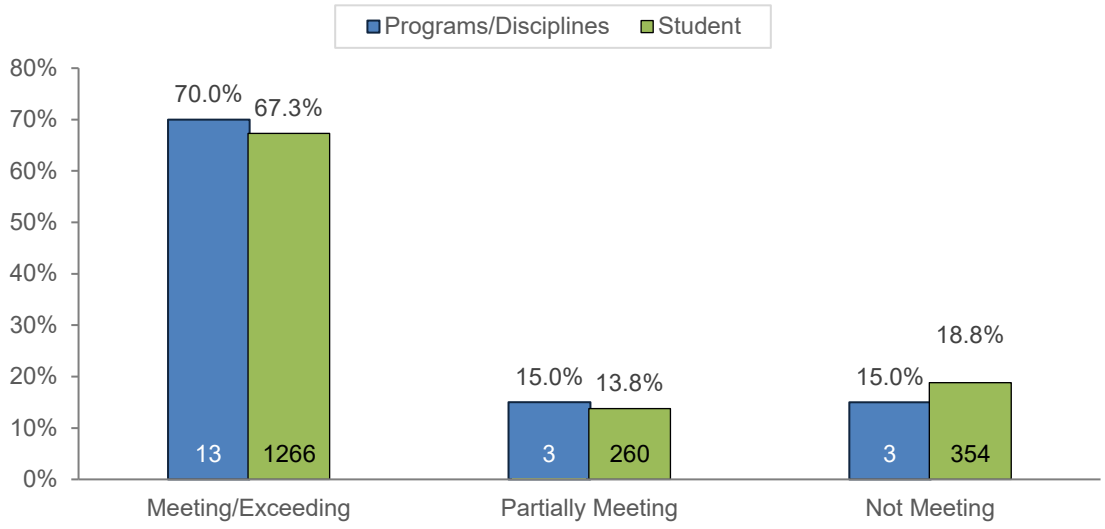
The degree of success regarding target goals is organized into four categories: exceeded target (i.e., students exceeded the target goal by 10 percent or more); met target; partially met target;

[14] Interior Design's exam questions are not provided in this report since it will be published. Please contact The Office of Academic Assessment for questions relating to this exam.

or did not meet target. In 2017-2018, of the 19 educational programs and disciplines assessing quantitative literacy, 85 percent programs/disciplines and 81 percent of students exceeded, met, or partially met their target goals (Figure 12).

Overall, 1,880 students participated in the assessment of quantitative literacy at NOVA.[15] Of this sample, 67.3 percent of students exceeded or met their program/discipline's target goal (Figure 12). Additionally, 13.8 percent of students partially met the target goals and 18.8 percent did not meet the target goal (Figure 12).

Figure 12. Programs/Disciplines and Students Achieving Quantitative Literacy Targets



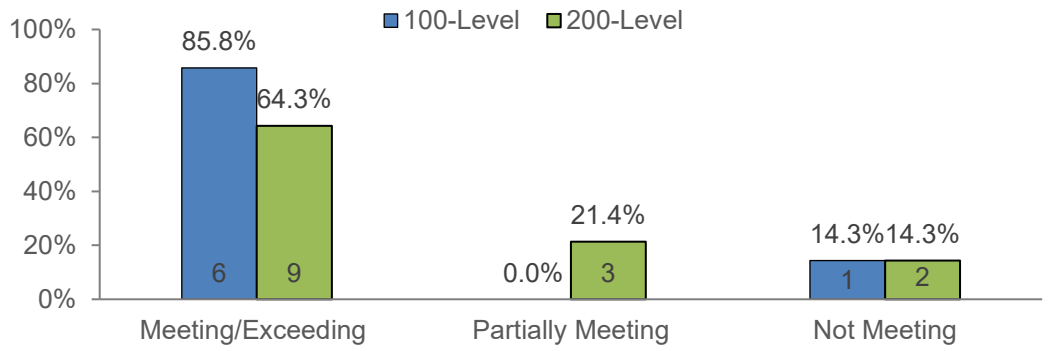
Disaggregating program and discipline target goal data by 100-level and 200-level courses, reveals significant differences (Figure 13). Overall, 100-level courses landed at both ends of the scale, where they either met/exceeded their target or did not meet their goals. Of the 100-level courses 86 percent of programs/disciplines met their goals and 14 percent did not (Figure 13). In contrast, at the 200-level the target goals fell into all three categories. At the 200-level 58 percent of programs/disciplines meet/exceed their goals; 25 percent partially meet their goals, and 17 percent did not meet their goals (Figure 13).

The Office of Academic Assessment believes those programs and disciplines not meeting their target goals had difficulty with the assessment process, rather poor student learning. In their 2017-2018 Reports, the seven programs and disciplines not meeting their targets reported two common areas of difficulty. The first: creating a representative student sample, across campuses, modalities, and class sections. Faculty charged with organizing assessment sometimes had difficulty engaging their peers in data collection. Additionally, there is a learning curve to successfully capturing dual enrolled and online students. The College provosts, deans, relevant administrators, and program heads and discipline chairs are working together to improve sample construction.

[15] The Office of Academic Assessment counted Information Technology and Information Systems Technology once.

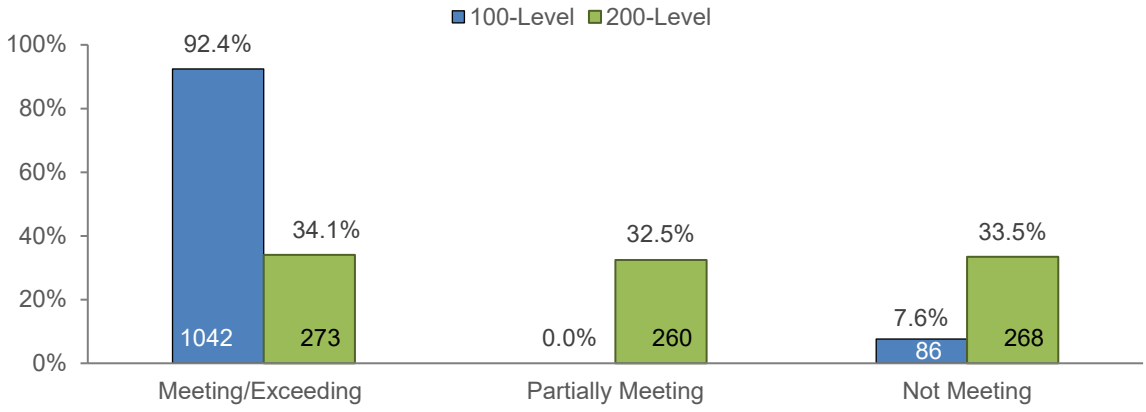
The second: difficulties with assessment method. Some programs and disciplines with the following three methodological issues did not meet their target goal: assessment measure was not closely aligned with the operational definition of quantitative literacy; an overly generic rubric; and/or an above average target goal. The average target goal is around 70 percent, but the College does not mandate target goals. Programs and disciplines are much better equipped to understand the needs of their students. Some faculty may have been overly enthusiastic when determining target goals for their students.

Figure 13. Programs and Disciplines Achievement of Quantitative Literacy Targets by 100-Level and 200-Level Courses[16]



When disaggregating student data by 100-and 200-level courses, differences arise. In 200-level courses student performance fell relatively evenly across all categories: met/exceed target (34 percent; Figure 14), partially met target (32 percent; Figure 14), and did not meet target (34 percent; Figure 14). At the 100-level, 94 percent of students met or exceeded their target goals (Figure 14). Only 7 percent of 100-level students did not meet their target goals (Figure 14).

Figure 14. Students Achievement of Quantitative Literacy Targets by 100-Level and 200-Level Courses



[16] Programs and Disciplines assessing both 100- and 200-level courses were counted in both categories.

Section IV: Actions to Improve Student Learning

Integral to the assessment process is using the results from assessment to make changes, or "closing the loop." This section examines the "Use of Results" section of the APER. The changes outlined in the "Use of Results" section are coded into five major categories: Curriculum Specific, Program Resources, Co-Curricular Resources, Assessment Process, and College-Level (Table 7; See Table M in Appendix A for Descriptions and Examples of Major and Subcategories. See Table O in Appendix A for Actions to Improve the Assessment Process by Subcategory in Descending Order of use).[17]

Table 7. "Actions to Improve" Codes: Major and Subcategories

Major Category	Subcategories
Curriculum-Specific	Curricular Change
	Course Revision
	Pedagogy
	Pre-requisites
	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	Dual Enrollment
	Articulation Agreement
	Recruitment/Marketing

A. Analysis of Actions for Improvement by Major Category

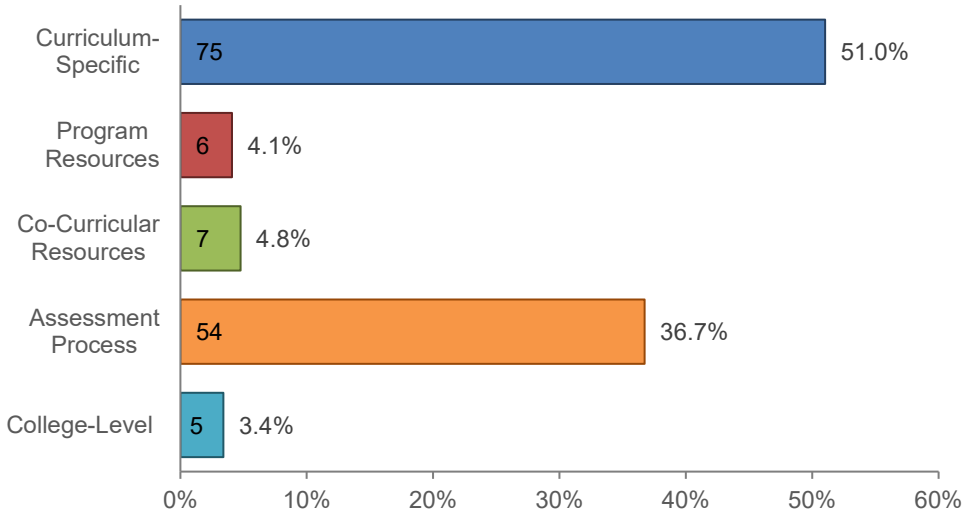
In 2017-2018, the 20 educational programs and disciplines assessing quantitative literacy made 147 changes to improve student learning and assessment, with an average of 6.8 actions for improvement per program/discipline (see Table L in Appendix A).[18] With programs and disciplines making about 6.8 changes to their assessment process and/or their educational process, it is safe to argue they are actively using their assessment data to plan and make improvements.

Fifty-one percent of the actions to improve student learning and the assessment process were curriculum specific (Figure 15). At 36.7 percent, changes to the assessment process are the

[17] This section of the report focuses on the most utilized major categories and relevant associated subcategories. Data for all the "Actions to Improve" subcategories can be found in Appendix A, Tables N, P-T. Additionally, the code sheet includes an "Other" category, but it has not been used in several years, so it is not considered in this report.
[18] Regarding the three multidisciplines, the number of actions reflects them as three separate reports rather than one, single report.

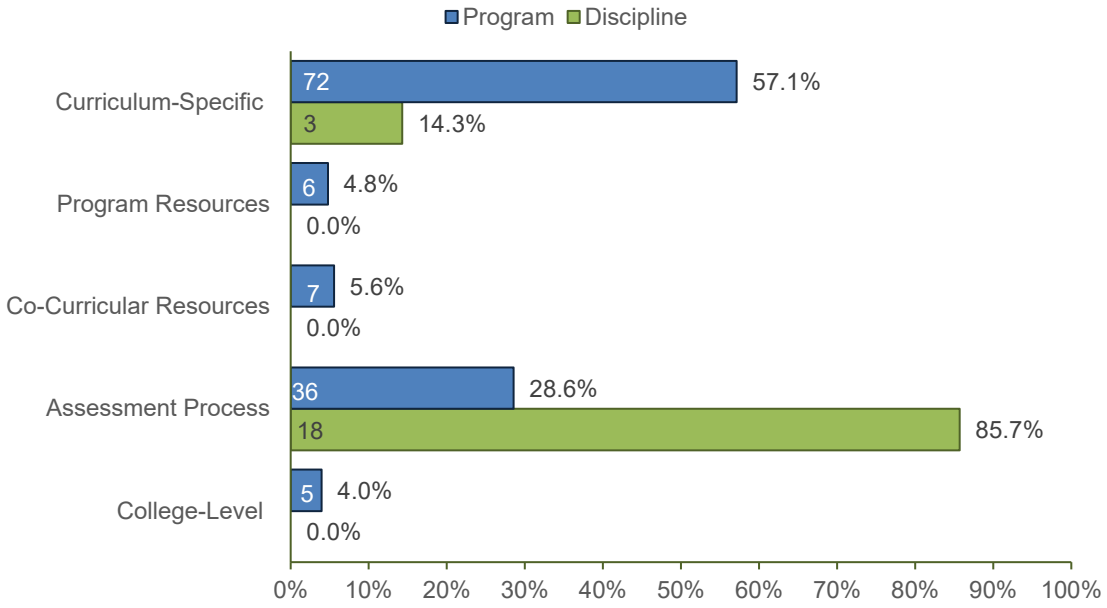
second most frequently mentioned (Figure 15). Figure 15 delineates the changes made by programs *and* disciplines in the five major categories mentioned above. The data shows programs and disciplines tend to make changes in areas over which they have control. Therefore, there are few attempts to: change their resources (new faculty, facilities, etc.); increase the use of co-curricular resources; or make college level changes.

Figure 15. Actions to Improve Students' Quantitative Literacy Skills and the Assessment Process



Disaggregating the data by program and discipline yields additional useful information (Figure 15). The data reveals programs and disciplines are in two different stages regarding assessment and student learning. Typically, it is best practice to refine data collection and analysis techniques prior to making curricular or other changes based on that assessment process. 2017-2018 is the first year disciplines were required to report on learning outcomes assessments in this format. Unsurprisingly, 85.7 percent of the discipline's changes were made in their assessment process (Figure 16). Meanwhile, educational programs and select certificates have been assessing student learning outcomes in this format for some time, explaining why only 28.6 percent of their actions were assessment oriented (Figure 16). Educational programs have moved far enough along in assessment that most of their actions (57.1 percent) are oriented towards improving student learning of quantitative literacy (Figure 16).

Figure 16. Actions Taken to Improve Students Learning and/or the Assessment Process by Programs and Disciplines



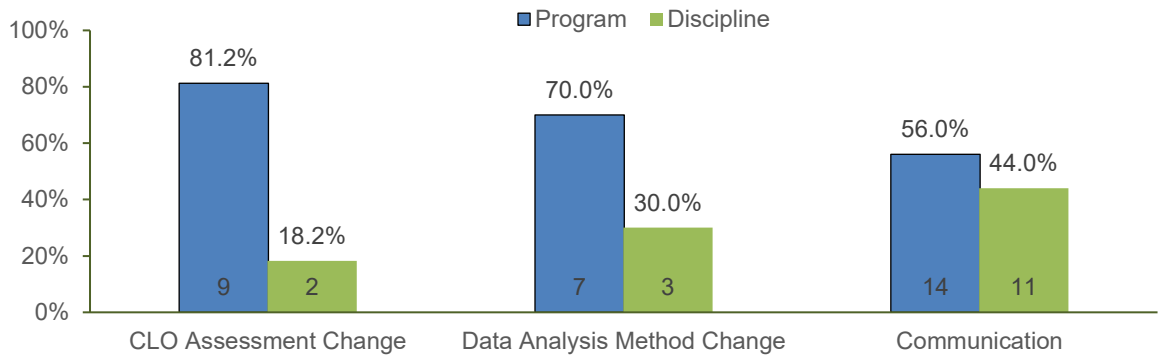
B. Key Actions to Improve Quantitative Literacy Outcomes by Program and Discipline

Assessment Process Actions

As Figure 16 indicates, disciplines made 57.1 percent more changes in their assessment process when compared to programs (86 percent vs. 29 percent). Figure 17 disaggregates these changes subcategory *and* by programs and disciplines. Disciplines and programs made 25 changes to the assessment process in the communication category (Figure 17). This suggests that programs and disciplines are improving their communication process around assessment issues. They are providing the results of the assessment and discussing the next steps to the faculty. Underlying this is the indication that the culture of assessment is, in fact, spreading across NOVA. The Office expects programs and disciplines to adjust their assessment processes as this is the first-time quantitative literacy has been assessed. A comparison for this data will be performed again following the 2020-2021 assessment of this CLO.

Programs and disciplines split their numbers pretty evenly between the other two subcategories of assessment change. The subcategory CLO assessment change refers to changing the assessment method and/or disaggregating the CLO components, and assessing each one individually. While the data analysis method change subcategory focuses on collecting or analyzing data, including the development and implementation of new rubrics. Programs made nine changes in the CLO assessment subcategory and seven changes in the data analysis method subcategory (Figure 17). Disciplines made two changes in the CLO assessment subcategory and three changes in the data analysis method subcategory (Figure 17).

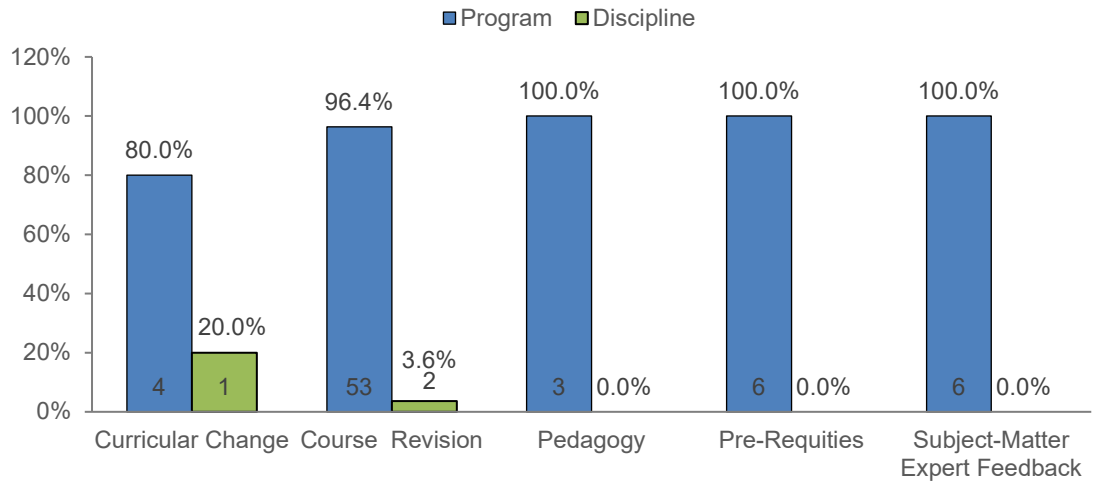
Figure 17. Key Actions to Improve the Assessment Process by Programs and Disciplines



Curriculum-Specific Actions

In 2017-2018 programs most frequently made changes directly related to improving student learning. Course revision, a subcategory of curriculum-specific actions refers to actions programs and disciplines take to improve student learning at the course level (e.g., syllabi revision, course content change, etc.). This subcategory represents the most frequent types of changes made by programs and disciplines via curricular changes. Programs made 53 course revision changes and disciplines made 2 (Figure 17). Following course revision, programs took three actions regarding pedagogy (class discussion or small group work or more interactive or experiential activities), and four curricular changes (Figure 18). Disciplines made one curricular change (Figure 18). Curricular change relates to broader changes to the degree program: adding a course or other requirement; changing course sequences or the program focus; or the availability and/or modality of a course.

Figure 18. Key Actions Taken by Program and Disciplines to Improve Curriculum



Overall, only disciplines utilized actions relating to course revision and subject-matter expert feedback (see Table P in Appendix A). As seen in the figure above, course revision was utilized eight times. Even though the disciplines were not primarily focused on curriculum-specific

actions, using these two categories indicates that disciplines are starting to work on revising and reviewing their courses. In combination with course revision, gaining subject-matter expert feedback helps disciplines improve their curriculum. These actions further indicate that disciplines are thinking from the macro perspective. It is likely that once disciplines' assessment methods are reliable and valid, they will shift their focus towards the curriculum.

Section V: Working Group Comments and Recommendations

The Quantitative Literacy Working Group considered the data presented in this quantitative literacy audit. The meeting was intended to be discussion-based, ending with suggestions for future QL assessments at NOVA. This section of the audit discusses highlights from the discussion and Zoom poll responses.

A. Quantitative Literacy Working Group Participants

Faculty and administrators involved in the 2017-2018 and 2020-2021 assessment of QL were invited to attend the QL working group. The 2017-2018 Quantitative Literacy Working Group Zoom meeting was attended by thirteen provosts, deans, and faculty members. Figures 19 and 20 below detail the attendee's position at NOVA as well as their home campuses, (see Appendix G for a list of registrants).

Figure 19. Distribution of Working Group Participants by Position

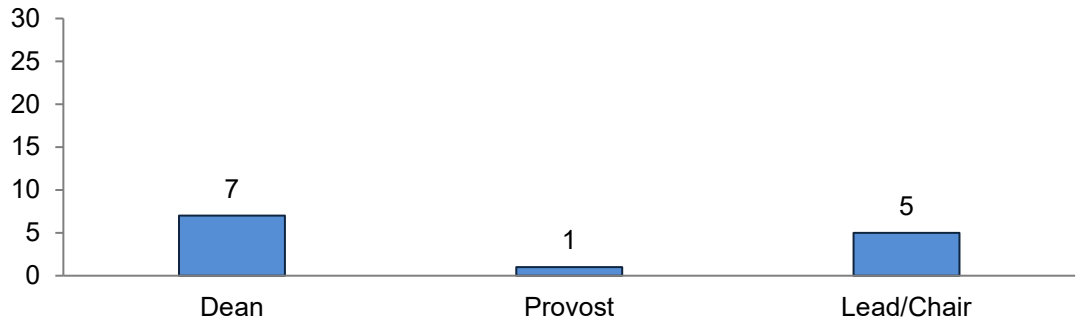
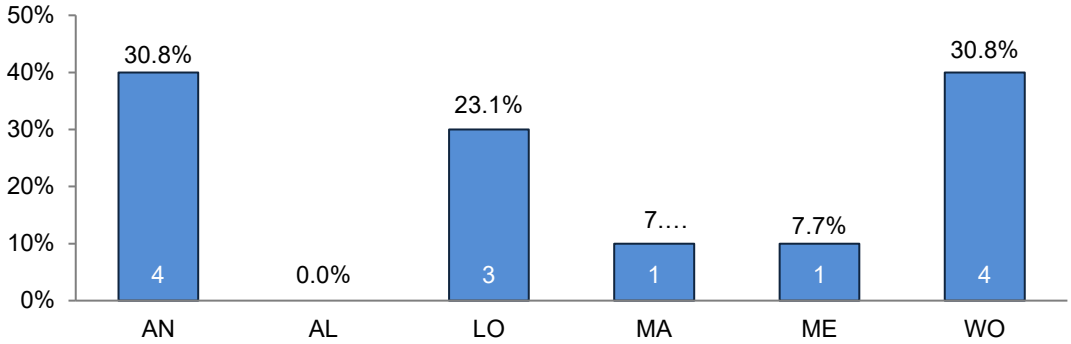


Figure 20. Distribution of Working Group Participants by Campus



B. Recommendations and Suggestions from the QL Working Group

Recommendations and suggestions from the QL working group included:

- Each semester provide faculty (full and part-time) with a brief summary of the assessment plan for the semester. Include information concerning participation expectations and any content coverage.
- Provide commonly used phrases/categories to describe quantitative literacy in order to help programs and disciplines broaden their assessment options.

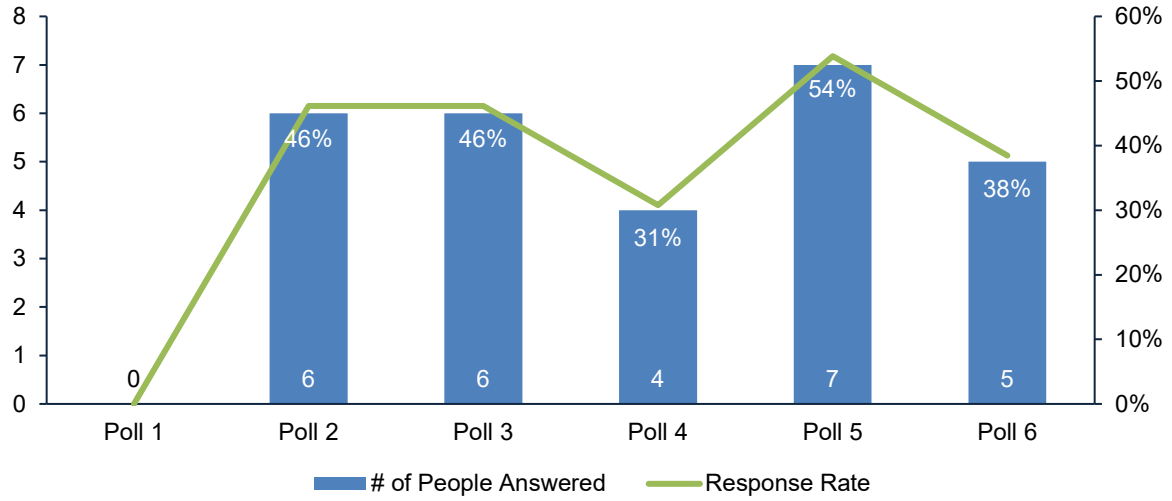
- Create a common rubric for QL that programs/disciplines can edit as needed.
- Consider the relationship between reading comprehension and QL.
- Increase participation in QL assessment across the College. Most programs and disciplines choose to assess QL over Critical Thinking (CT), primarily because they already had a common QL assessment across the program.

C. Working Group Polling and Response Highlights

Polling Participation

Using the Zoom Poll feature, the Office of Academic Assessment focused on specific topics in the *Institutional Effectiveness Audit of Quantitative Literacy: 2017-2018*. Figure 21 summarizes participant response rates. Please note the number of questions within each poll section varied.[19] See Appendix H for list of questions in each poll.

Figure 21. Response Rate for Poll Sections



Poll Response Highlights

- 83% of respondents found the QL target data to accurately reflect student QL ability.
- When asked if working group members had seen the Office of Academic Assessment infographics describing the core learning outcomes (on campus, on the tv monitors, on the NOVA website), 57% indicated they have not. Those who had seen the infographics had seen them on the Office of Academic Assessment webpage.
- 60% of respondents indicated that faculty would like the opportunity to learn about innovative classroom assessment tools/methods. Assessments discussed included: concept maps, ePortfolios, podcasts, YouTube tutorials, and video games.

[19] Poll 1: 1 question; Poll 2: 1 question; Poll 3: 2 questions; Poll 4: 2 questions; Poll 5: 3 questions.

Section VI: Conclusion

1,880 NOVA students participated in the assessment of quantitative literacy, across six campuses and all modalities of teaching during the 2018-2019 college-wide QL assessment. 85 percent of the programs and disciplines exceeded, met, or partially met their target goals. And 81 percent of students exceeded, met, or partially met their target goals.

NOVA's quantitative literacy assessment measures, college-wide, fell into one of six categories: data interpretation; presentation of quantitative information; application/analysis; applying quantitative assumptions; and communication. Despite the varied rubrics and exams used to measure QL, in the end, NOVA's assessment of QL clustered around these six types of quantitative literacy. This indicates that NOVA faculty have a collective sense of what constitutes QL for NOVA students.

Approximately 72 percent of programs used previously established student learning outcomes to assess quantitative literacy. Disciplines did not use previously developed SLOs when assessing quantitative literacy. This means, though this is the first year NOVA assessed QL college-wide using course embedded assessment, programs have been assessing it, via their SLOs for some time.

Based on 2018-2019 results, disciplines and programs indicated 147 actions to improve students' quantitative literacy skills and/or the assessment process. These action plans point to a culture of assessment that focuses on continuous improvement. At NOVA, the phrase "no changes need to be made at this time," is strongly discouraged. The content and determining factors of a "quality education" are moving targets, which means the process of education must also continually seek improvement and change.

Future goals for assessing quantitative literacy include increasing the number of programs and disciplines assessing the CLO; incorporating workshops helping faculty assess quantitative literacy; conducting focus groups and/or surveys with faculty and students regarding QL at NOVA.

Final Recommendations from the Office of Academic Assessment

Based on the 2017-18 analysis of program and discipline assessment methods, the following changes are encouraged to improve the assessment of, and student learning of, quantitative literacy:[20]

- Increase the number of programs and disciplines assessing QL.
- Encourage innovative QL assessment in the Trade, Liberal Arts, and Social Sciences courses.
- Encourage faculty to move QL assessments beyond numeracy.

[20] See Appendix I for sample Quantitative Literacy assessment methods from the Office of Academic Assessment.

- Encourage faculty to “meet students where they live” by creating assignments using social media, gaming, or other Millennial and Gen-Z focused topics/media.
- Tighten the operationalization of QL to ensure it conforms to the VCCS definition.
- Let the students know what they are learning: use the language of the SLOs, CLOs, course objectives, and assignment goals when writing-up assignment descriptions/rubrics. Write specific, concise, and clear instructions for every assignment. Include all assignment descriptions/rubrics in the syllabus.
- Provide adjuncts with assessment resources and program/discipline contact in advance of assessments.

Appendix A: Quantitative Literacy Data Tables

Table A. Submission of Quantitative Literacy Assessments: 2017-18

	Core Learning Outcome: Quantitative Literacy
Program	17
Discipline	3
Total	**20**

Table B. Number of Programs and Disciplines Using SLOs for Quantitative Literacy Assessment

	# Using SLOs	Percentage
Program	13	72
Discipline	0	0
Total	**13**	**72**

Table C. Quantitative Literacy Sample Sizes by Course Level

	100-Level	200-Level
Programs	407	801
Disciplines	721	0
Total	**1128**	**801**

Note: Emergency Medical Services is counted twice. Once at the 100-Level and once at the 200-Level since they assessed both course levels.

Table D. Number of Courses Assessed and Average Sample Size by Course Level

	Number of Courses Assessed		Average Sample Size	
	100-Level	200-Level	100-Level	200-Level
Programs	4	14	102	57
Disciplines	3	0	240	0
Total	**7**	**14**	**161**	**57**

Table E. Effectivity of Rubrics and Exams by Discipline Group

	Rubrics				Exams			
	Assignment-Specific		Generic		Outcome-Specific		Generic	
	#	%	#	%	#	%	#	%
Program	3	60.0	4	100	4	100	5	100
Discipline	2	40.0	0	0	0	0	0	0
Total	**5**	**100**	**4**	**100**	**4**	**100**	**5**	**100**

Table F. Quantitative Literacy Code Utilization by Educational Units

	Programs		Disciplines		Programs and Disciplines	
	#	%	#	%	#	%
Data Interpretation	9	10.5	2	11.1	11	10.6
Presentation of Quantitative Information	6	6.9	3	16.7	9	8.6
Calculation	28	32.6	2	11.1	30	28.8
Application/Analysis	18	20.9	4	22.2	22	21.2
Assumptions	5	5.8	2	11.1	7	6.7
Communication	6	6.9	2	11.1	8	7.7
Other	14	16.3	3	16.7	17	16.3
Total	**86**	**100**	**18**	**100**	**104**	**100**

Table G. Quantitative Literacy Code Utilization by Assessment Method

	Rubric		Exam		Rubrics and Exams	
	#	%	#	%	#	%
Data Interpretation	4	10.5	7	15.2	11	13.1
Presentation of Quantitative Information	5	13.2	1	2.2	6	7.1
Calculation	2	5.3	24	52.3	26	30.9
Application/Analysis	12	31.6	4	8.7	16	19.0
Assumptions	4	10.5	1	2.2	5	5.9
Communication	3	7.9	6	13.0	9	10.7
Other	10	26.3	4	8.7	14	16.7
Total	**38**	**100**	**46**	**100**	**84**	**100**

Table H. Quantitative Literacy Target Achievement by Programs and Disciplines: All Level Courses

	Programs		Disciplines		Overall	
	#	%	#	%	#	%
Exceeded	5	29.4	2	66.7	7	35.0
Met	7	41.2	0	0.0	7	35.0
Partially Met	3	17.6	0	0.0	3	15.0
Did Not Meet	2	11.8	1	33.3	3	15.0
Total	**17**	**100**	**3**	**100**	**20**	**100**

Note: Liberal Arts, General Studies, and Social Sciences are multidiscipline and were counted as one report (rather than three individual reports). Information Technology and Information Systems Technology are counted as one report because the same students were assessed in both reports.

Table I. Quantitative Literacy Target Achievement by Programs and Disciplines: 100-Level and 200-Level Courses

	100-Level Courses						200-Level courses					
	Programs		Disciplines		Overall		Programs		Disciplines		Overall	
	#	%	#	%	#	%	#	%	#	%	#	%
Exceeded	1	25.0	2	100	3	42.9	4	28.6	0	0.0	4	28.6
Met	3	75.0	0	0.0	3	42.9	5	35.7	0	0.0	5	35.7
Partially Met	0	0.0	0	0.0	0	0.0	3	21.4	0	0.0	3	21.4
Did Not Meet	0	0.0	1	0.0	1	14.3	2	14.3	0	0.0	2	14.3
Total	**4**	**100**	**3**	**100**	**7**	**100**	**14**	**100**	**0**	**100**	**14**	**100**

Note: Liberal Arts, General Studies, and Social Sciences are multidiscipline and were counted as one report (rather than three individual reports). Information Technology and Information Systems Technology are counted as one report because the same students were assessed in both reports.

Table J. Quantitative Literacy Target Achievement by Sample Size: All Level Courses

	Number of Students	
	#	%
Exceeded	722	38.4
Met	544	28.9
Partially Met	260	13.8
Did Not Meet	354	18.8
Total	**1880**	**100**

Table K. Quantitative 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	12	2.9	635	88.1	647	57.4	75	9.4	0	0.0	75	9.4
Met	395	97.0	0	0.0	395	35.0	198	24.7	0	0.0	198	24.7
Partially Met	0	0.0	0	0.0	0	0.0	260	32.5	0	0.0	260	32.5
Did Not Meet	0	0.0	86	11.9	86	7.6	268	33.5	0	0.0	268	33.5
Total	**407**	**100**	**721**	**100**	**1128**	**100**	**801**	**100**	**0**	**0.0**	**801**	**100**

Table L. Average Number of "Use of Results" per Discipline Group: 2017-2018

	Annual Reports Submitted	Total # of Use of Results	Average # of Use of Results
Program	17	114	6.7
Discipline	3	21	7.0
Total	**20**	**135**	**6.8**

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

Subcategory	Description and Examples
Curriculum Specific	
Curricular Change	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 on-line 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
Course Revision	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	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
Pre-requisites	Changed entrance requirements 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
Subject Matter Expert Feedback	Sought recommendations from external and internal stakeholders, e.g., employers, on-site clinical coordinator/supervisor, program advisory board/committee, accreditation body, faculty cluster
Program Resources	
Financial	Requested additional fiscal resources; allocated funds from other budget area to focus on achieving SLO

Human Resources	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	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 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	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
SLO Assessment Process	
SLO Assessment Change	Changed or added to the assessment method for the SLO; broke out SLO components and assessed those individually
Data Analysis Method Change	Changed or modified data analysis method, e.g., developed a new rubric; added indirect measures such as surveys or student self-assessment
Student Learning Outcome Change	Refined or modified student learning outcome(s)
Target Increased	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	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 Clarified	Target was created/determined; target was revised or modified to be more clear or specific
Sample Size	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	Communicated with faculty to clarify or revise the assessment process
College-Level	
Dual Enrollment	Allowed students to take program courses during high school
Articulation Agreement	Increased number of transferrable credits to specific 4 year institutions; Agreement with 4 year institution to accept NOVA graduates
Recruitment/Marketing	Efforts to increase access, e.g., outreach to high schools, non-traditional students, non-declared students
Other	
Other	Please specify

Table N. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process: 2017-2018

"Use of Results" Major Categories												
	Curriculum-Specific		Program Resources		Co-Curricular Resources		Assessment Process		College-Level		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Program	72	57.1	6	4.8	7	5.6	36	28.6	5	3.9	126	100
Discipline	3	14.3	0	0	0	0	18	85.7	0	0	21	100
Program & Discipline	**75**	**51.0**	**6**	**4.1**	**7**	**4.8**	**54**	**36.7**	**5**	**3.4**	**147**	**100**

Table O. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory in Descending Order: 2017-2018

Subcategory	Number of Changes	% of Total
Course Revision	57	38
Communication	25	17
CLO Assessment Change	11	7
Data Analysis Method Change	10	7
Academic Support/Advising	7	5
Pre-Requisites	6	4
Subject Matter Expert Feedback	6	4
Sample Size	6	4
Curricular Change	5	3
Human Resources	4	3
Recruitment/Marketing	4	3
Pedagogy	3	2
General Resources	2	1
CLO Change	1	.7
Target Clarified	1	.7
Dual Enrollment	1	.7
Financial	0	0
Co-Curricular	0	0
Target Increased	0	0
Target Decreased	0	0
Articulation Agreement	0	0
Other	0	0
Total	**149**	**100**

Table P. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory: Curriculum-Specific

Use of Results Sub- Category: Curriculum-Specific Quantitative Literacy [2017-2018]										
	Curricular Change		Course Revision		Pedagogy		Pre-Requisites		Subject-Matter Expert Feedback (SMEF)	
	#	%	#	%	#	%	#	%	#	%
Program	4	80.0	53	96.4	3	100	6	100	6	100
Discipline	1	20.0	2	3.6	0	0.0	0	0.0	0	0.0
Total	**5**	**100**	**55**	**100**	**55**	**100**	**3**	**100**	**6**	**100**

Table Q. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory: Program Resources

Use of Results Sub- Category: Program Review Quantitative Literacy [2017-2018]						
	Financial		Human Resources		General Resources	
	#	%	#	%	#	%
Program	0	0	4	100	2	100
Discipline	0	0	0	0	0	0
Total	**0**	**0**	**4**	**100**	**2**	**100**

Table R. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory: Co-Curricular Resources

Use of Results Sub- Category: Program Review Quantitative Literacy [2017-2018]				
	Co-Curricular Opportunities		Academic Support/Advising	
	#	%	#	%
Program	0	0	7	100
Discipline	0	0	0	0
Total	**0**	**0**	**7**	**100**

Table S Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory: Assessment Process

Use of Results Sub- Category: Assessment Process Quantitative Literacy [2017-2018]																
	CLO Assessment Change		Data Analysis Method Change		Communication		CLO Change		Target Increased		Target Decreased		Target Clarified		Sample Size	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Program	9	81.2	7	70.0	14	56.0	1	100	0	0.0	0	0.0	0	0.0	5	83.3
Discipline	2	18.2	3	30.0	11	44.0	0	0.0	0	0.0	0	0.0	1	100	1	16.7
Total	**11**	**100**	**10**	**100**	**25**	**100**	**1**	**100**	**0**	**0**	**0**	**0**	**1**	**100**	**6**	**100**

Table T. Actions to Improve Students' Quantitative Literacy Skill and the Assessment Process by Subcategory: College-Level

Use of Results Sub- Category: College-Level Quantitative Literacy [2017-2018]						
	Dual Enrollment		Articulation Agreement		Recruiting/ Marketing	
	#	%	#	%	#	%
Program	1	100	0	0	4	100
Discipline	0	0	0	0	0	0
Total	**1**	**100**	**0**	**0**	**4**	**100**

Appendix B: 2017-18 Operationalized Definitions of Quantitative Literacy

Table A. Quantitative Literacy Operational Definitions by Programs

Program Name	Course Level Assessed	Operationalization
Air Conditioning and Refrigeration, A.A.S.	100	Students will demonstrate Quantitative Literacy skills calculating superheat and sub-cooling.
Emergency Medical Services, A.A.S.	100	The EMS Advanced Life Support Student will demonstrate competent affective behavior related to emergency medical care, as measured by the Northern Virginia Community College EMS Program Affective Behavior Assessment tool.
Engineering Technology, A.A.S.	100	Students will be able to synthesize their knowledge of the fundamentals and practices of engineering technology.
General Studies, A.S.	100	Students will use graphical methods to organize and interpret data.
Liberal Arts, A.A.	100	Students will: 1. Interpret Quantitatively: Explains the numerical information presented in mathematical forms (equations, formulas, graphs, diagrams and tables). 2. Present quantitatively: Converts the given information into mathematical forms such as tables, graphs, diagrams, and equations. 3. Analyze thoughtfully: Draws relevant conclusions from provided information and data, and predicts future trends. 4. Communicate qualitatively and persuasively: uses quantitative evidence to support the argument or purpose of the work (what evidence is used, how it is formatted and contextualized). 5. Problem solving: Sets up a numerical problem and calculates the solution correctly
Science: Mathematics Specialization, A.S.	100	Grade on Final Exam in MTH 173.
Social Sciences, A.S.	100	Students will: 1. Interpret Quantitatively: Explains the numerical information presented in mathematical forms (equations, formulas, graphs, diagrams and tables). 2. Present quantitatively: Converts the given information into mathematical forms such as tables, graphs, diagrams, and equations. 3. Analyze thoughtfully: Draws relevant conclusions from provided information and data, and predicts future trends. 4. Communicate qualitatively and persuasively: uses quantitative evidence

		to support the argument or purpose of the work (what evidence is used, how it is formatted and contextualized). 5. Problem solving: Sets up a numerical problem and calculates the solution correctly
Architecture Technology, A.A.S.	200	Students will be able to describe how buildings are constructed.
Business Administration, A.S.	200	Students will be able to calculate the basic impact of marginal cost for the production of goods in a capitalist system.
Business Management, A.A.S.	200	Students will be able to calculate the basic impact of marginal cost for the production of goods in a capitalist system.
Construction Management Technology, A.A.S.	200	SLO 2 which measures mathematically the areas, sizes and quantities of a typical building system (i.e. Masonry System).
Contract Management, A.A.S.	200	Students will be able to recognize and apply fundamental contracting techniques by utilizing the basic Federal contracting processes: cost estimation procedures, requirement determinations, and characteristics of best value analysis.
Dental Hygiene, A.A.S.	200	A comparative analysis using appropriate statistics, graphs and charts, and accurate labeling and explanation of graphs. Includes determination of success of reaching program goals.
Engineering, A.S.	200	Student will apply and demonstrate engineering problem solving methodology.
Graphic Design, A.A.S.	200	Students were given a project in which the learning outcome was to represent mathematical information numerically, symbolically, and visually, using graphs and charts for a product brochure or presentation.
Information Systems Technology, A.A.S.	200	Five categories of QL problems: 1. Binary to Decimal Conversion 2. Hexadecimal to Decimal 3. Decimal to Binary 4. Hexadecimal to Binary 5. Two's Complement Notation
Information Technology	200	Five categories of QL problems: 1. Binary to Decimal Conversion 2. Hexadecimal to Decimal 3. Decimal to Binary 4. Hexadecimal to Binary 5. Two's Complement Notation
Interior Design, A.A.S.	200	There were five questions on the test: 1. Interprets Quantitatively 2. Presents Quantitatively 3. Analyzes Thoughtfully

		4. Communicates Qualitatively and Persuasively 5. Problem Solving
Marketing, A.A.S.	200	Students will be able to apply basic business math to inventory planning and control, pricing strategies, budget calculations, stock turns, and inventory loss.
Respiratory Therapy, A.A.S.	200	Students will appropriately interpret graphic depictions of ventilator waveforms as it applies to the patient's clinical status**.**
Science, A.S.	200	Correctly answering the assigned problem: 1.) identifying the correct formula 2.) utilizing the correct information/parameters 3.) using the correct algebra to solve the problem

Table B. Quantitative Literacy Operational Definitions by Disciplines

Discipline Name	Course Level Assessed	Operationalization
Chemistry	100	Five criteria presented on the Quantitative Literacy **(QL)** Rubric I. Interprets Quantitatively: Explains the numerical information presented in mathematical forms (equations, formulas, graphs, diagrams and tables). II. Presents Quantitatively: Converts the given information into mathematical forms such as tables, graphs, diagrams, and equations. III. Analyzes Thoughtfully: Draws relevant conclusions from provided information and data, and predicts future trends. IV. Communicates Qualitatively and Persuasively: Uses quantitative evidence to support the argument or purpose of the work (what evidence is used, how it is formatted and contextualized). V. Problem Solving: Sets up a numerical problem and calculates the solution correctly
Geology	100	Students will use graphical methods to organize and interpret quantitative data**.**

Appendix C: Codes for Targets and Quantitative Literacy

Table A. Target Codes

Category	Description
Operationalization (O)	Program/discipline provided an operationalized definition of the CLO that was clear and measurable; includes actions students will take to learn this outcome (e.g., demonstrate proficiency in, analyze data, interpret information, etc.)
Sample Size	*SSS – Small Sample Size* Samples with 33 students or under.
	MSS – Medium Sample Size Samples between 34 and 69 students.
	LSS – Large Sample Size Samples over 70 students.
Outcome-Method Match (OMM)	Method/assignment the program/discipline used effectively measures the operationalized CLO.
Rubric/Measure	*Rubric in APER (R)* Separate Rubric/assessment measure and/or grading scale was not provided but was explained in the *APER*.
	No Rubric Provided (NRP) No rubric was provided either with the *APER* submission email or in the *APER*.
	Assignment-Specific Rubric (ASR) Rubric primarily evaluates the CLO being assessed and one or both of the following aspects: 1. Clear description of grading criteria/grading scale is provided 2. Provides purpose of assignment
	Generic Rubric (GR): Does not evaluate the CLO being assessed, is vague/not clear, grading scale not provided, no purpose presented.
Examination	*Outcome-Specific Examination (OS):* The exam questions evaluate the assessed CLO by addressing 3 or more aspects of the CLO.
	Generic Examination (OFF): The exam questions do not fully evaluate the assessed CLO. Only assessed 2 or less of the concepts and/or is vague/unclear.
Target	*Criteria Target (CTA)* Target was met in 75% of the criteria, but not overall.
	Overall Target (OT) Target was met overall.
Other (OTH)	

Appendix D: Graphic Design Rubric

Criteria	Excellent	Good	Average	Poor	Total Points for Criteria
1. Investigation and research	□ Subject has been thoroughly researched □ Submits proper documentation of research and cites sources □ Collects written and visual research in a journal □ Clearly organizes research Provides many insightful comments and analysis	□ Subject has been well researched □ Finds multiple relevant and cited sources □ Collects written and visual research into a journal □ Research is well organized Provides above average comments and analysis	□ Subject has been researched □ Cites some sources □ Collects research into a journal □ Cites some sources □ Finds a few sources that are visual and written □ Research is organized Provides some comments and analysis	□ Subject has not been researched □ Does not cite sources □ Does not collect research into a journal □ Does not finds sources that are visual and written □ Research is not organized Does not provide comments and analysis	**5 points**
2. Interpretation and Concept Formulation	□ Research has been evaluated well-supported, and logical conclusions have been drawn. □ Clearly communicates the information through symbols, numbers and text. Design, composition and aesthetics support information	□ Research has been evaluated, supported, and conclusions have been drawn. □ Communicates the information through symbols, numbers and text. Above average design, composition, and aesthetics support information	□ Average solution to the problem for the assignment. □ Average communication of the information through symbols, numbers and text. Average design, composition, and aesthetics support information	□ Final solution to the problem is not seen in the assignment. □ the information is not communicated through symbols, numbers and text. Design, composition, and aesthetics do not support information	**5 points**
3. Mathematical Visualization Proficiency	□ Shows an excellent level of proficiency in understanding the mathematical aspects of the project □ Accurately executes the project using the necessary tools for graphing or charting	□ Shows a good level of proficiency in understanding the mathematical aspects of the project Executes the project using the necessary tools with no visible problems	□ Shows a basic level of proficiency in understanding the mathematical aspects of the project Executes the project using the necessary tools with visible problems	□ Shows no level of proficiency in understanding the mathematical aspects of the project □ Improperly executes the project. Does not use the necessary tools for charting and graphing	**5 points**

4. Final infographic execution	Thorough evidence of strong research and development. Concept is well thought out and accurate Student followed all the specified instructions for the project. Thorough level of success of the project in relationship to the assignment.	Above average research and development. Concept is well thought out but needs further development. Student followed most (but not all) the specified instructions for the project. Above average level of success of the project in relationship to the assignment.	Average research and development. Only a basic overall concept was thought out and was not a Student followed some (but not all) the specified instructions for the project. Average level of success of the project in relationship to the assignment.	No evidence of strong research and development. Concept is not thought out and developed. Student did not follow all the specified instructions for the project. Weak level of success of the project in relationship to the assignment.	**10 Points**
TOTAL					**25 points**

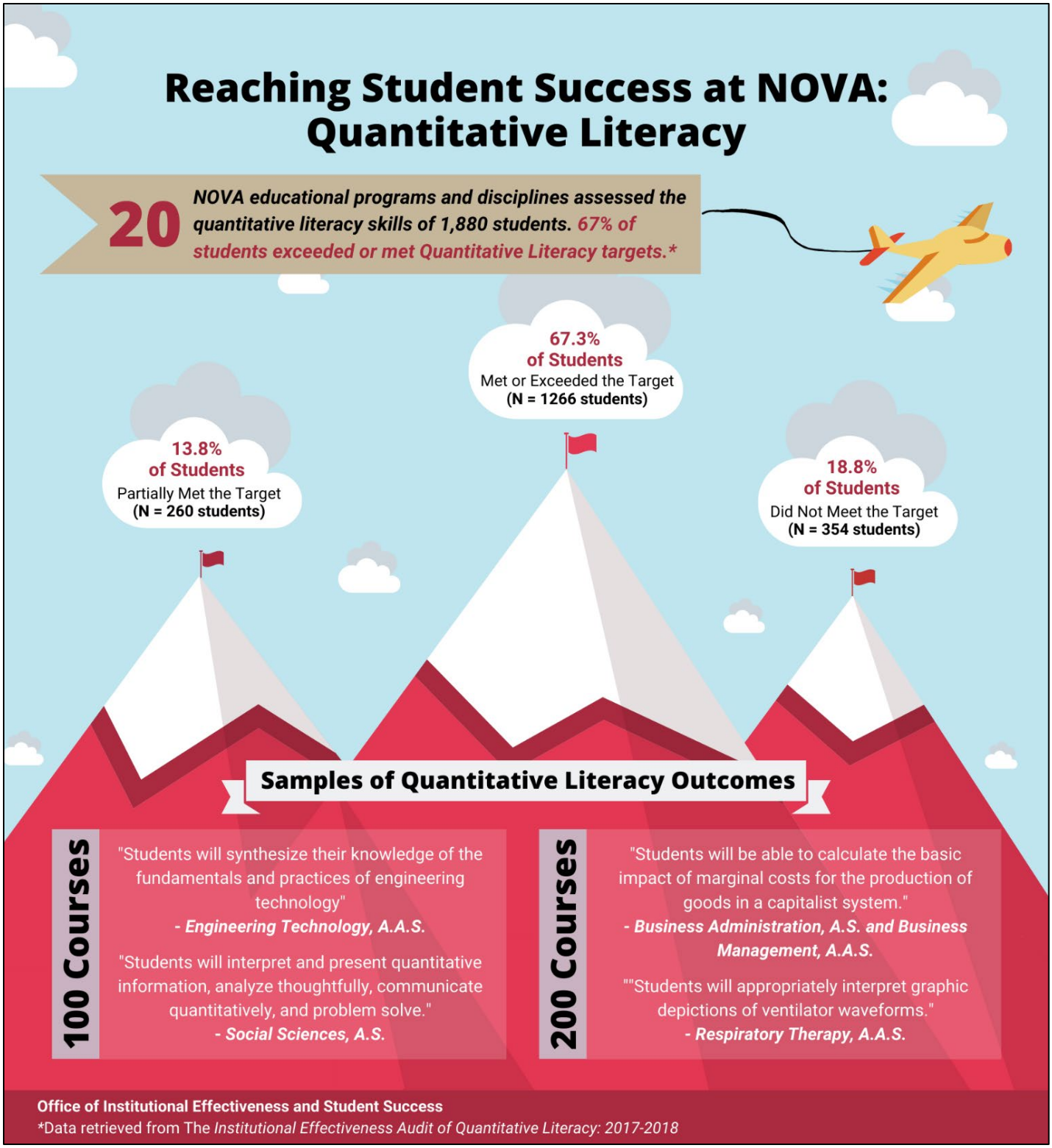
Appendix E: Chemistry Rubric

Criteria	Points Earned	**4-Mastering:** Demonstrates a thorough understanding of the given information and the relationship between different criteria	**3-Acceptable:** The criteria being assessed are presented clearly and include details	**2-Developing:** Some aspects are incorrect, or key details are missing	**1-Needs Improvement:** The criteria being assessed are unclear, inappropriate, or wrong	**0-Emerging:** Does not attempt
Interprets Quantitatively: Explains the numerical information presented in mathematical forms (equations, formulas, graphs, diagrams, and tables).		1. Recognizes the data or facts available for answering the question. 2. Interprets **logically** and explains the mathematical information provided in numerical forms such as tables, graphs, and equations. (e.g., Can read the temperature from a graph and includes correct unit and the correct significant figures, etc.). 3. Draws inferences from the given information (e.g., can calculate and presents the slope of a graph correctly).	1. Recognizes most of the data or facts available for answering the question. 2. Interprets and explains the mathematical information provided in numerical forms (tables, graphs, and equations), but occasionally makes minor errors related to units (e.g., reads the temperature from a chart, but doesn't include the correct unit). 3. Draws inferences from the given information with minor errors (e.g., calculates the slope correctly but doesn't present the answer in the correct number of significant figures).	1. Recognizes some of the data or facts available for answering the question. 2. Explains the mathematical information provided in numerical forms using tables, graphs, and equations, but makes some errors related to computations and units (e.g., reads the temperature from a chart, but doesn't include the correct unit, significant figures, etc.) 3. Draws inferences from the given information with some errors in the answer (e.g., calculates the slope by using the right equation or formula but the answer is inaccurate).	1. Somewhat unclear about the data or facts available for answering the question. 2. Attempts to explain the mathematical information provided in numerical forms using tables, graphs, and equations, but the answer is unclear. 3. Draws inferences from the given information with major errors (e.g., calculates the slope using wrong values or wrong equations).	Does not attempt
Presents quantitatively: Converts the given information into mathematical forms such as tables, graphs, diagrams, and equations.		1. Represents relevant qualitative and/or quantitative data by using an **efficient,** correct, and **simple** methods of presentation, such as tables. 2. **Effectively** organizes and/or expresses	1. Represents relevant qualitative and/or quantitative data by using correct methods of presentation, such as tables. 2. Organizes and expresses quantitative and/or qualitative	1. Represents relevant qualitative and/or quantitative data by using somewhat correct methods of presentation, such as tables. 2. Organizes and expresses quantitative and/or qualitative	1. Creates a relevant qualitative and/or quantitative data by using incorrect methods of presentation, such as tables. 2. Organizes and expresses quantitative and/or qualitative	Does not attempt

		quantitative and qualitative evidence in an appropriate form using equations, graphs, diagrams, tables, and/or words.	evidence in an appropriate form using equations, graphs, diagrams, tables, and/or words.	evidence in the form of equations, graphs, diagrams, tables and/or words with minor error (e.g. labeling or units have minor errors)	evidence in the form of equations, graphs, diagrams, tables and/or words that are/is unorganized and have some errors.	
Analyzes thoughtfully: Draws relevant conclusions from provided information and data, and predicts future trends.		1. Accurately interprets the results and makes a connection to the hypothesis, theory, or the question presented. 2. Describes assumptions made and provides a clear rationale for appropriateness of each assumption. 3. Clearly evaluates and analyzes inadequacies and limitations of the data collected or the methods used. 4. Explains past trends in data clearly and predicts future trends accurately.	1. Interprets the results and makes a connection to the hypothesis, theory, or the question presented. 2. Describes assumptions made but does not provide a clear rationale for appropriateness of each assumption. 3. Mostly evaluates and analyzes inadequacies and limitations of the data collected or the methods used. 4. Explains past trends that are mostly accurate and predicts future trends.	1. Somewhat accurately interprets the results and makes a connection to the hypothesis, theory, or the question presented. 2. Somewhat describes assumptions made but does not provide a rationale for appropriateness of each assumption. 3. Somewhat evaluates, but doesn't analyze inadequacies and limitations of the data collected or the methods used. 4. Somewhat explains the past trends in data, but does not evaluate future trends.	1. Inaccurately interprets the results concerning the hypothesis, theory, or the question presented. 2. Draws incorrect assumptions and does not provide a rationale for appropriateness of each assumption. 3. Inaccurately evaluates and analyzes inadequacies and limitations of the data collected or the methods used. 4. Explains the past trends in data incorrectly and does not evaluate future trends.	Does not attempt
Communicates qualitatively and persuasively: using quantitative evidence to support the argument or purpose of the work.		1. Provides **effective** quantitative evidence to support the work. 2. Uses evidence and reflective reasoning to analyze and interpret numerical data in oral or written form. 3. Communicates meaning to readers with clarity and fluency.	1. Provides quantitative evidence to support the work. 2. Uses evidence and some reasoning and logic to analyze and interpret numerical data in oral or written form. 3. Communicates meaning to readers completely.	1. Provides some quantitative evidence to support the work. 2. Uses some evidence, but very little reasoning to analyze and interpret numerical data in oral or written form. 3. Communicates meaning to readers somewhat completely.	1. Provides very little quantitative evidence to support the work. 2. Uses only some evidence without reasonably analyzing the data. 3. Communicates meaning to readers incompletely.	Does not attempt.

Problem-solving: Sets up a numerical problem and calculates the solution correctly.		1. Accurately and correctly organizes the problem into clear steps. 2. Provides correct and logical steps for solving the problem. 3. Provides the correct answer to the problem including details such as correct significant figures and units. 4. Estimates the answer to mathematical problems correctly.	1. Correctly organizes the problem into steps. 2. Provides correct steps for solving the problem. 3. Provides the correct answer to the problem with some details. 4. Estimates the answer to mathematical problems almost correctly.	1. Organizes the problem somewhat correctly into steps. 2. Provides some correct steps for solving the problem. 3. Provides the answer to the problem with minor error in the unit or significant figures. 4. Estimates the answer to mathematical problems somewhat correctly.	1. The steps to the problem are disorganized and contain some errors. 2. Provides very few correct steps for solving the problem. 3. The answer to the problem is wrong. 4. Estimates the answer to mathematical problems inaccurately.	

Appendix F: Quantitative Literacy Target Goal Infographic



Appendix G: Working Group Attendees

Pathway	Program/Discipline
Business and Hospitality Management	-
Education and Public Service	-
Engineering and Applied Technology	Provost[21]
	Engineering
General Studies, General Education, Global Studies	Dean
Health Sciences	Dean
Information and Engineering Technology	Interim Dean
Languages	
Life Sciences	Dean
Liberal Arts and Communication	
Mathematics and Computer Science	Dean
Nursing and Surgical Technologies	-
Physical Sciences	Science, A.S.
	Chemistry (2)
Social Sciences	Dean
Visual, Performing, and Media Arts	Dean
	Interior Design

[21] Individual is the Provost for Engineering and Applied Technologies and Mathematics and Computer Science

Appendix H: Polling Questions Presented

Poll 1: Assessing Critical Thinking

1. In the 2017-2018 assessment year, did you use an existing SLO?
2. For the 2020-2021 assessment year, are you assessing Critical Thinking or Quantitative Literacy?[22]

Poll 2: Assessment Participation

1. While the numbers are great, many leads indicated they had difficulty to participate. Did you have difficulty getting faculty to participate?

Poll 3: Meeting Targets

1. Did it [target results] reflect students' Critical Thinking ability?
2. Do you think your assessment of Critical Thinking was rigorous in 2017-2018?

Poll 4: Critical Thinking Categories

1. Are there any categories you feel are not necessary?
2. Would you like a set of criteria you could use as appropriate to your assignments or exams?

Poll 5: Actions to Improve Students' Critical Thinking Skills

1. After seeing the three areas NOVA's assessment touches upon, where do you think your program/discipline is at for the current assessment year (2020-2021)?
2. Compared to 2017-2018, which level are you in?
   "In 2017-18, my program/discipline was in the ____ level, but in 2020-21, my program/discipline is in the ___ level."
3. Where do you think your changes need to focus as a whole?

Poll 6: Awareness of Infographic

1. Have you seen any of the Core Learning Outcomes infographics?

Poll 7: Working Group Recommendations

1. Should NOVA be asking innovative assessments and ideas?
2. Should NOVA create a College-wide target goal? Of 70%?
3. Should target goals be comparable across similar programs/disciplines?

[22] This question was directed primarily at faculty, however, deans and provosts answered this question as well.

Appendix I: Quantitative Literacy Assignment Recommendations

Based on the analysis of 2017-2018 program and discipline assessment methods, the Office of Academic Assessment has compiled the following sample assignments that were found to organically assess Quantitative Literacy:

- Presentations: provide students a data-driven problem and have them answer it by performing calculations/tests, analyzing and interpreting the data, and presenting it to the class using visuals (e.g., infographic, PowerPoint, video).
- Infographics: similar to Graphic Design's assignment, have students use data to provide information on an issue (see Appendix D for an example of a statistically driven infographic and Appendix F in the *Institutional Effectiveness Audit of Quantitative Literacy: 2017-2018)*.
- Project Evaluations: for programs/discipline that require more hands-on assignments, have students perform various tasks requiring them to calculate, interpret, and solve problems based on data provided (e.g., dimensions of a space/object, number of light fixtures needed to create the proper lighting, etc.).
- Assignments using online free gaming platforms (Minecraft, etc.) where students use QL to survive and engage in universe building.

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, the 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

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.**

To advance the completion agenda described above, thereby promoting students' success and enhancing their social mobility, ensuring that programs achieve, and producing an educated citizenry for the 21st Century, the following goals and objectives are adopted:

GOAL 1: Every Student Succeeds

- **Objective 1:** Develop a College-wide approach to advising that ensures all students are advised and have access to support throughout their time at NOVA
- **Objective 2:** Implement VIP-PASS System as the foundational technology based on NOVA Informed Pathways for student self-advising, assignment and coordination of advisors, and course registration

GOAL 2: Every Program Achieves

- **Objective 3:** Develop comprehensive, fully integrated Informed Pathways for every program to ensure seamless transitions from high school and other entry points to NOVA, and from NOVA to four-year transfer institutions or the workforce
- **Objective 4:** Develop effective processes and protocols for programmatic College-wide collective decisions that include consistent, accountable leadership and oversight of each academic program with designated "owners," active advisory committees, clear student learning outcomes and assessments, and program reviews in all modalities of instruction
- **Objective 5:** Align NOVA's organizational structures, position descriptions, and expectations for accountability with its overarching mission to support student engagement, learning, success and institutional effectiveness

GOAL 3: Every Community Prospers

- **Objective 6:** Enhance the prosperity of every community in Northern Virginia by refocusing and prioritizing NOVA's workforce development efforts
- **Objective 7:** Further develop NOVA's IT and Cybersecurity programs to support regional job demand and position NOVA as the leading IT community college in the nation
- **Objective 8:** Re-envision workforce strategies and integrate workforce development into a NOVA core focus
- **Objective 9:** Plan to expand the breadth and reach of NOVA's healthcare and biotechnology programs, and prioritize future programs to support regional economic development goals

NOVA

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