



Student Learning Outcomes Assessment

AGEC/GECCO Report

Scientific Literacy

Data Report:

Assessment Director (Molly Beauchman)

Data Collected Fall 2014 – Spring 2016

Report Completed: March 2017

Analysis of Data Completed:

Science Department (Paul Smolenyak, Joanne Oellers)

Analysis Submitted September 2017

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General Education Outcomes Assessment Data Report Analysis Directions

Please use the following guidelines when completing your department/discipline annual outcomes assessment report.

General Education Assessment Information

The General Education Core Curriculum Outcomes (GECCO) are assessed each semester using a common 4-point rubric and scores for a random sample of ten students are submitted through Banner. Scoring guidelines for assessing student attainment of GECCO outcomes are:

- **Advanced Proficiency (4):** This is highest level of proficiency that characterizes student attainment of the outcome as exceptional and above-and-beyond expectation. This is student work that “goes the extra mile”.
- **Proficiency (3):** This level represents a student who has submitted work that meets expectations. They have exhibited that they have attained every aspect of the outcome.
- **Developing Proficiency (2):** This level represents a student who is very close to meeting expectations, but is not yet able to demonstrate that they have attained all aspects of the outcome.
- **Limited or No Proficiency (1):** This is the lowest level of proficiency that describes student work that does not demonstrate understanding of the outcome. This does not describe the student who did not submit work.
- **Vanished (V):** Vanished is intended for students who are on your roster, but who did not complete the assignment/activity used to assess the outcome.
- **Not Applicable (NA):** This option is for Associate of Applied Science courses that do not incorporate a particular outcome(s) from a GECCO category in their course/program. AAS program courses are required to assess at least one outcome from each GECCO category.

NOTE: Courses on the General Education list may not assign NA for any outcome in the GECCO categories (all outcomes must be assessed).

General Education Data Report Description

The data report contains displays of data submitted for the General Education Core Curriculum Outcomes (GECCO) over a two-year period. The data is disaggregated and results are displayed in several ways:

- All Yavapai College courses combined (General Education and AAS Program)
- All Yavapai College courses combined by delivery method (F2F, Online, Hybrid, ITV)
- All General Education courses
- All Associate of Applied Science courses
- General Education courses by prefix and/or department/discipline

Analysis of Data and Displays of Data

When analyzing the data report, consider attainment of the outcomes for:

- all YC students.
- students in the AAS programs.
- students in the General Education program.
- students taking courses in your specific department/discipline.

How well are students attaining the desired outcomes?

What benchmark for success is reasonable for your data?

What percentage of students successful (scoring 3 or 4) would you consider acceptable?

Are there any trends in student attainment of the outcomes?

Describe in terms of the benchmarks how well students are doing.

Are there any outcomes or content areas where students score very high or very low?

What are possible reasons why students score very high or low on a particular outcome?

Discuss any changes in curriculum or instruction that may help students learn the desired information. If the possible reason is the assessment process itself, review and make improvements to the process.

Does the assessment process need to be revised?

Do the outcomes clearly state what you would like students to be able to do?

Does the rubric clearly define levels of attainment?

Does the course assignment or process used to assess the outcome need to be revised?

How will you communicate the outcomes and process to all faculty and students between now and the next collection cycle?

What actions or resources are needed to help students attain the outcome?

What adjustments or improvements are needed to improve curriculum or instruction?

What adjustments or improvements are needed to the assessment process so information is valid and reliable?

What resources are needed?



**General Education Outcomes Assessment
Scientific Literacy Report:
Data totals for F2014, S2015, F2015 and S2016**

Student Learning Outcomes Assessment

Prepared by Molly Beauchman (March 9, 2017)
District Assessment Director

Scientific Literacy

As science and technology increasingly affects every aspect of our daily lives, the need for scientific literacy becomes more urgent. Therefore, in the fall of 2012, a new college General Education outcome was created: Scientific Literacy. This new category also addresses the AGEC Physical and Biological Sciences requirement, for those earning an AGEC certificate or Associates degree. The following was included in the new General Education Values and Outcomes approved by the Curriculum committee in December 2012.

Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity. (taken from the National Science Education Standards.)

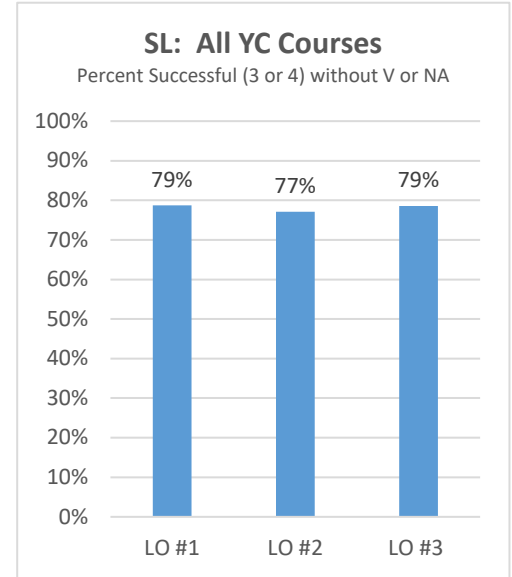
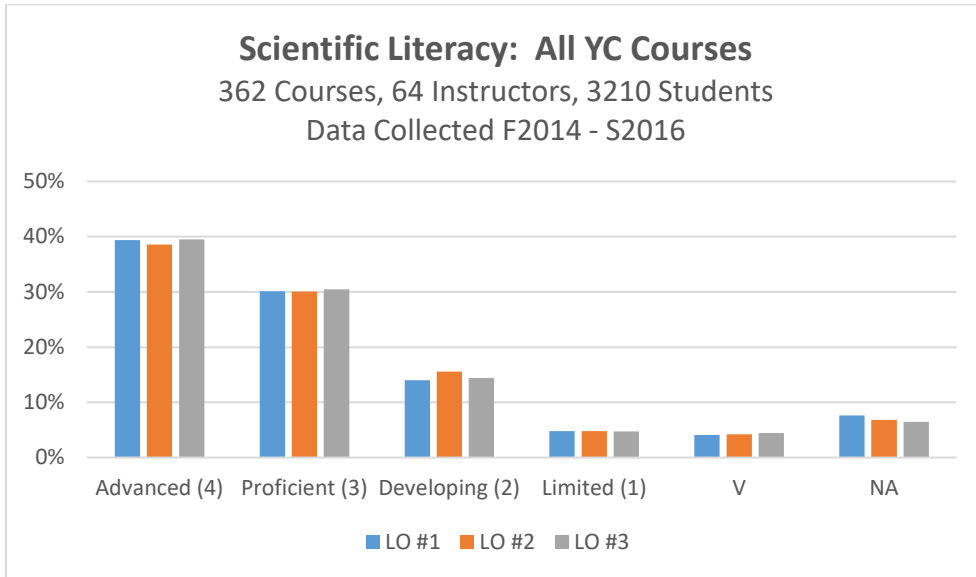
Students who graduate from Yavapai College with a degree or AGEC certificate will be able to:

- LO #1: Demonstrate comprehension of the scientific approach.
- LO #2: Produce and/or interpret scientific information presented in a variety of formats
- LO #3: Use scientific sources to support an argument or discussion.

	Advanced Proficiency (4)	Proficiency (3)	Developing Proficiency (2)	Limited/ No Proficiency (1)
LO #1: Demonstrates comprehension of the scientific approach	Student demonstrates advanced comprehension of the scientific approach	Student demonstrates comprehension of the scientific approach	Student demonstrates limited comprehension of the scientific approach	Student does not demonstrate comprehension of the scientific approach
LO #2: Produces and/or interprets scientific information in a variety of formats	Student produces and/or interprets scientific information in a variety of formats with advanced proficiency	Student produces and/or interprets scientific information in a variety of formats with proficiency	Student demonstrates marginal proficiency to produce and/or interpret scientific information in a variety of formats	Student does not produce or interpret scientific information presented in a variety of formats
LO #3: Uses scientific sources to support an argument or discussion	Student uses scientific sources to support an argument or discussion with advanced proficiency	Student capably uses scientific sources to support an argument or discussion	Student demonstrates developing proficiency in using scientific sources to support an argument or discussion	Student is unable to use scientific sources to support an argument or discussion

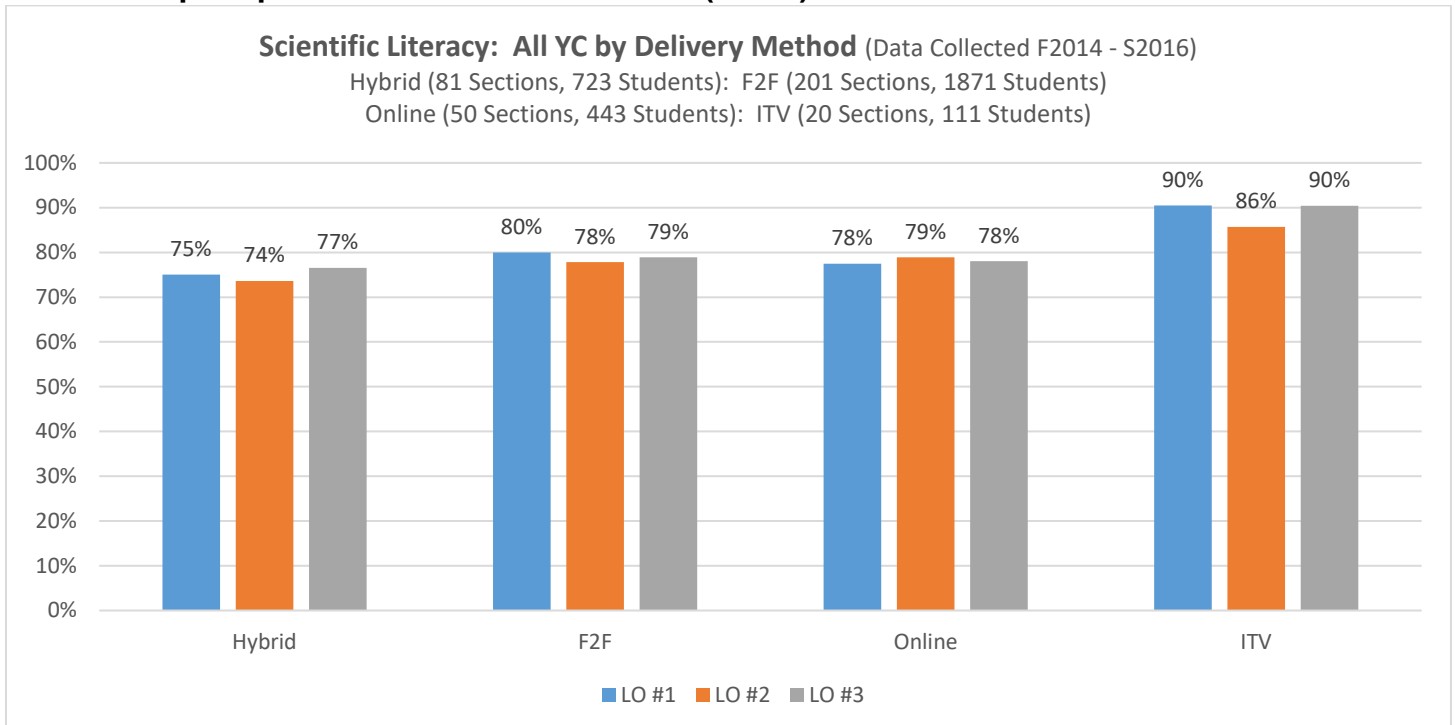
1: Scientific Literacy for all of Yavapai College (all AAS and Science courses)

All Yavapai Courses						
	Advanced Proficiency (4)	Proficiency (3)	Developing Proficiency (2)	Limited Proficiency (1)	Vanished	N/A
LO #1	1264	967	450	153	132	245
LO #2	1239	965	500	153	135	218
LO #3	1268	977	462	151	142	208



Scientific Literacy for all YC Students by Delivery Method

NOTE: Graph represents Percent Successful (3 or 4) without V and NA

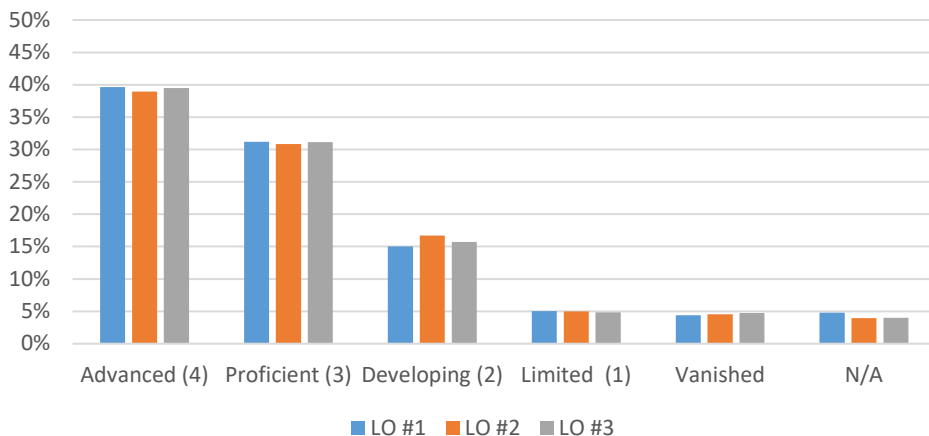


2: Scientific Literacy for all Science courses

All Science Courses						
	Advanced Proficiency (4)	Proficiency (3)	Developing Proficiency (2)	Limited Proficiency (1)	Vanished	N/A
LO #1	1027	808	389	130	114	124
LO #2	1009	799	433	129	118	103
LO #3	1023	807	407	126	123	104

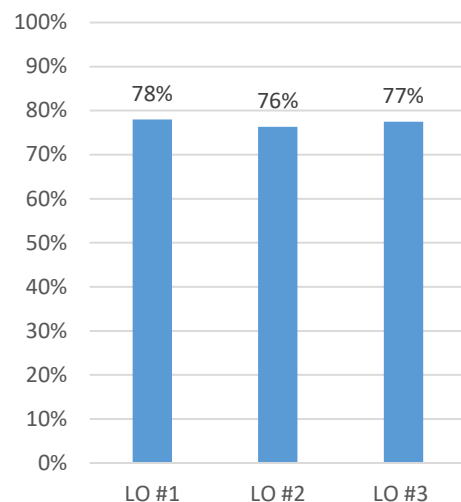
Scientific Literacy: All Science Courses

278 Courses, 38 Instructors, 2591 Students
Data Collected F2014-S2016



SL: All Science Courses

Percent Successful (3 or 4) without V or NA

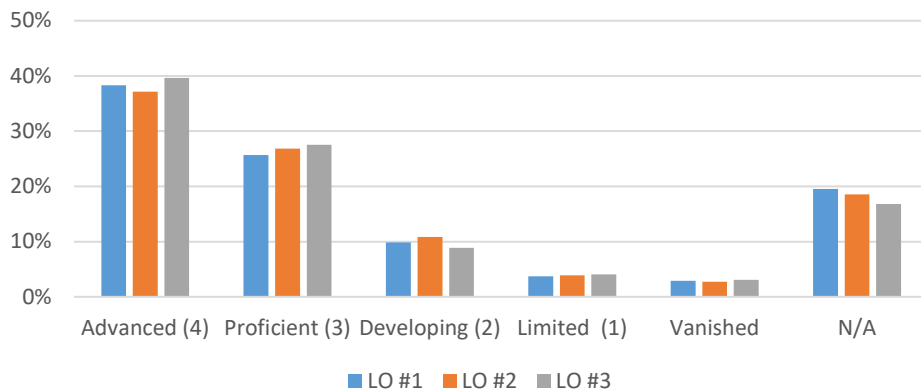


3: Scientific Literacy for all Associate of Applied Science courses

All Associate of Applied Science Courses						
	Advanced Proficiency (4)	Proficiency (3)	Developing Proficiency (2)	Limited Proficiency (1)	Vanished	N/A
LO #1	237	159	61	23	18	121
LO #2	230	166	67	24	17	115
LO #3	245	170	55	25	19	104

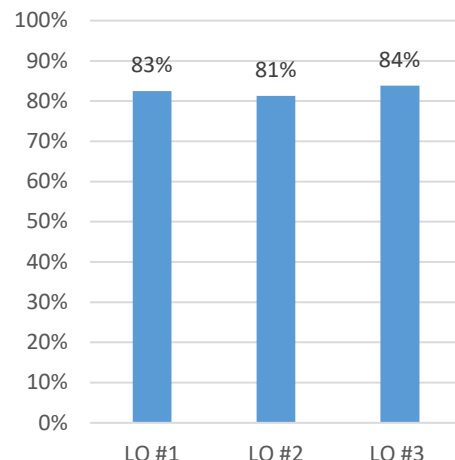
Scientific Literacy: All AAS Courses

84 Courses, 35 Instructors, 619 Students
Data Collected F2014-S2016



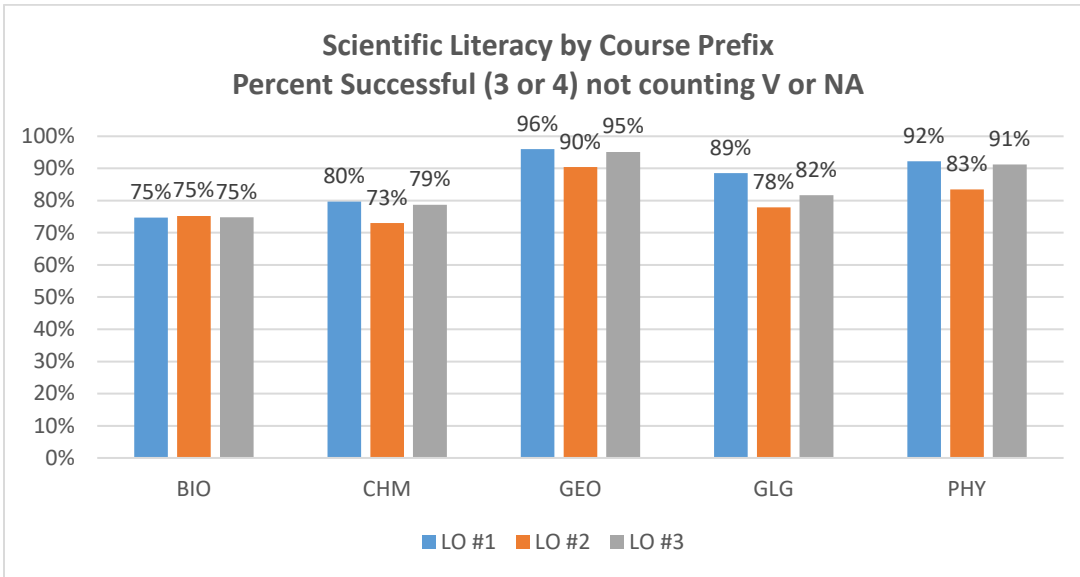
SL: All AAS Courses

Percent Successful (3 or 4) without V or NA

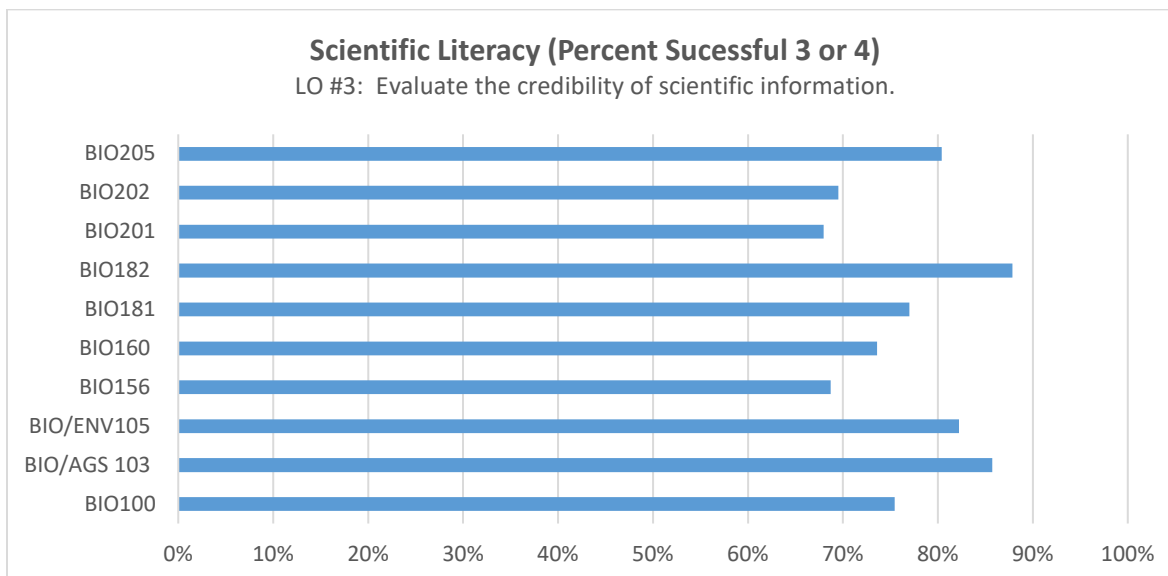
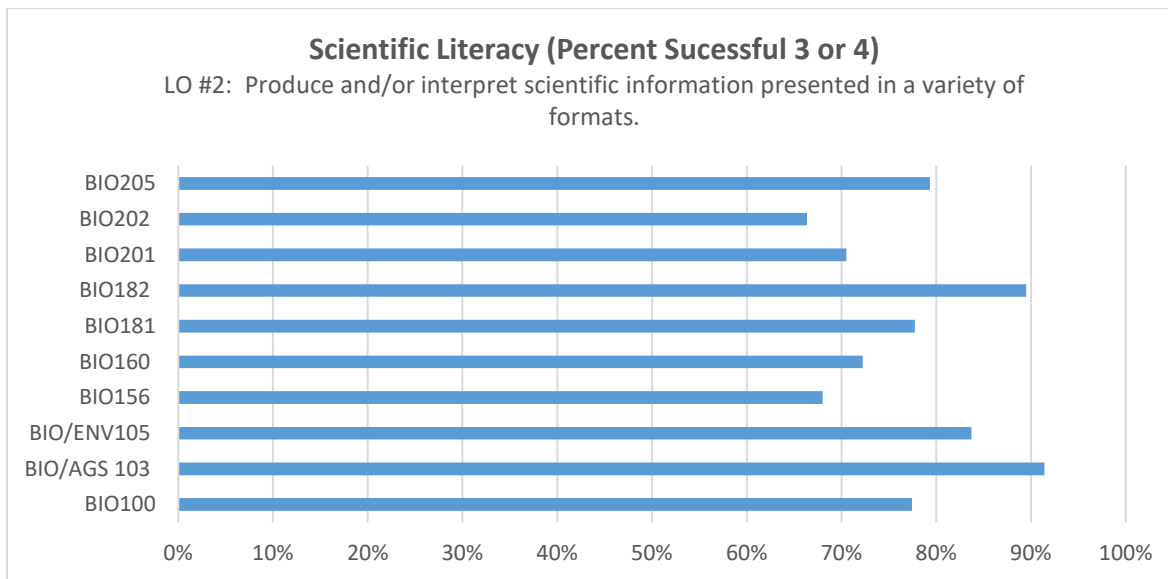
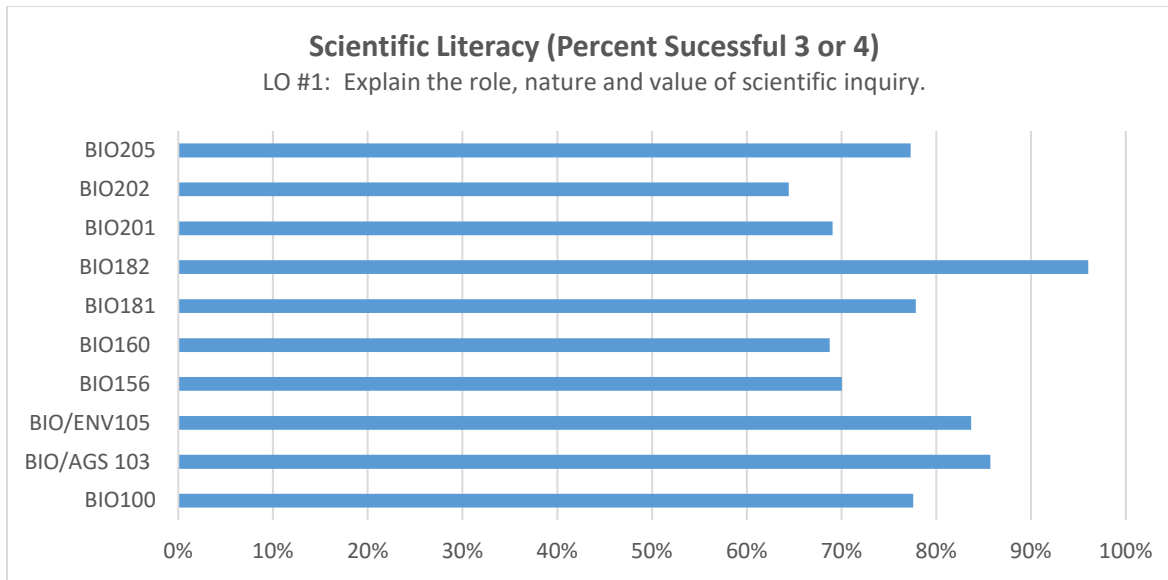


4: Scientific Literacy for Science courses by Prefix

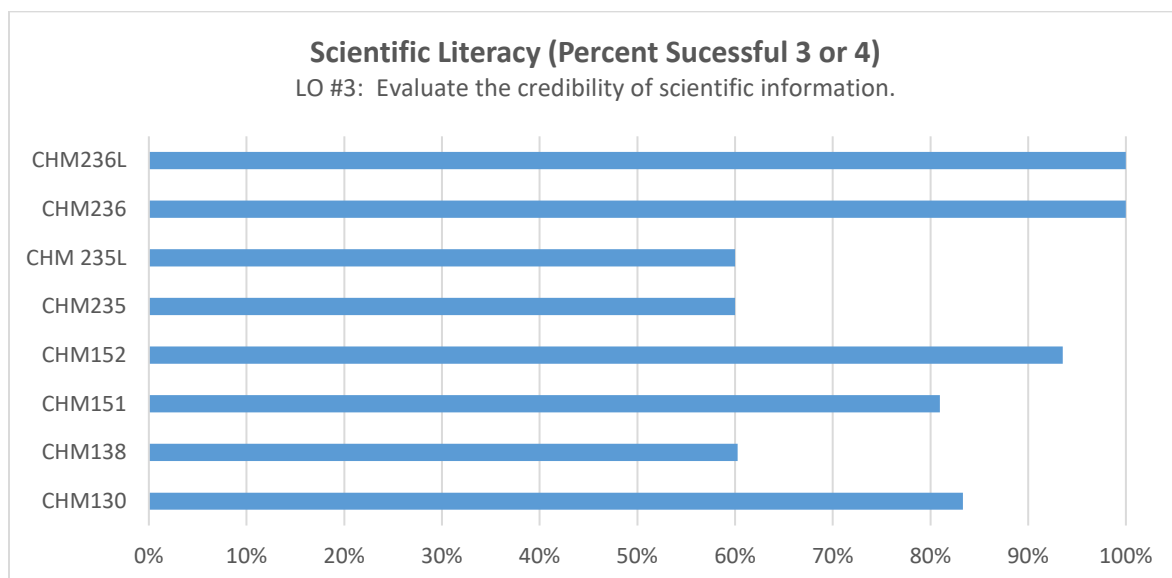
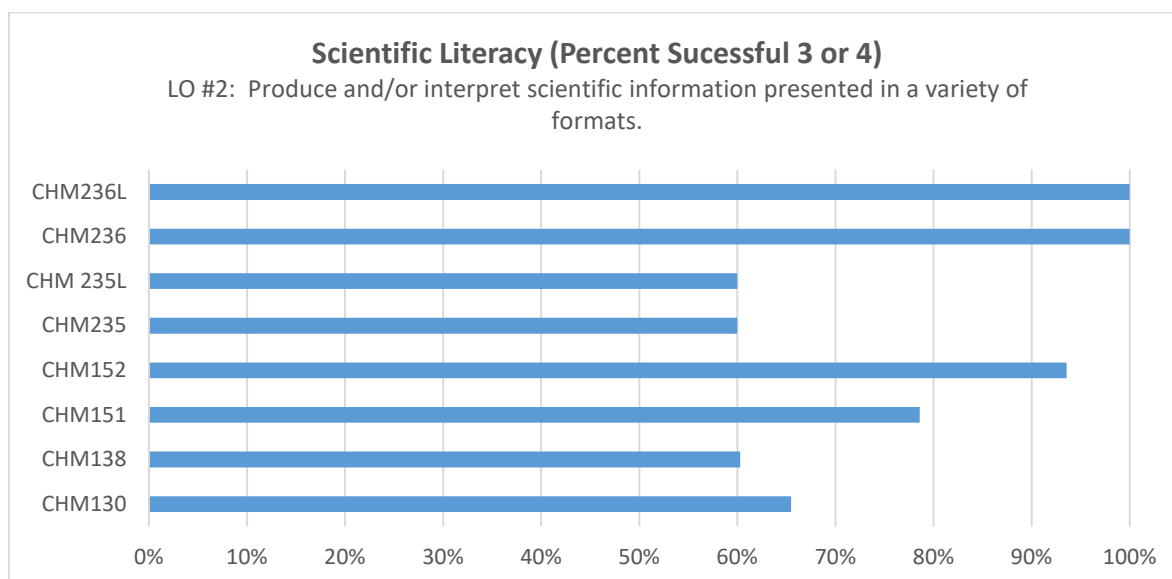
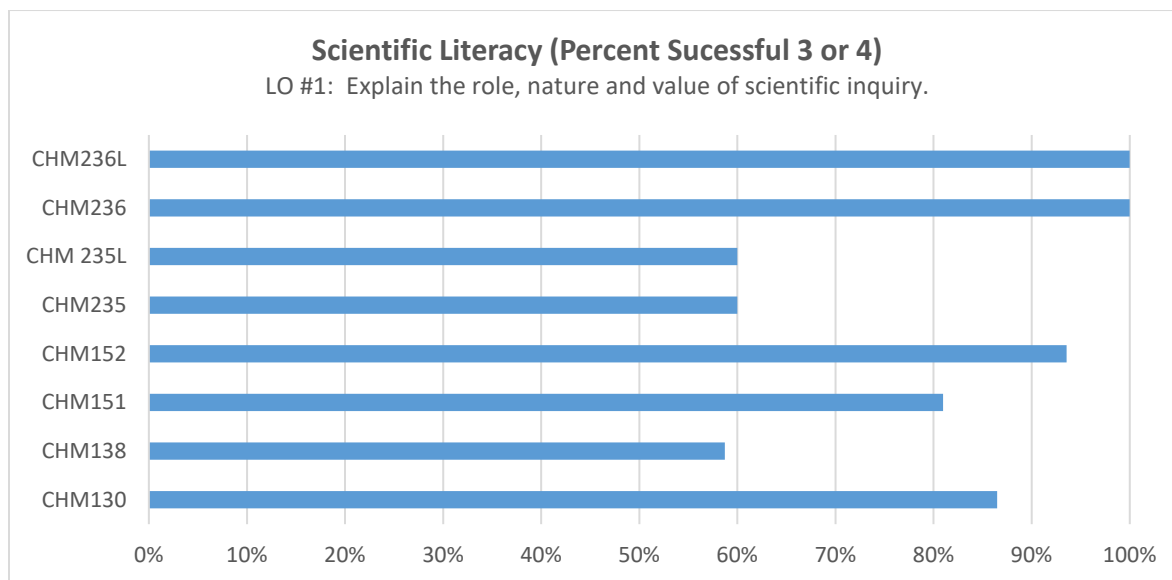
Science Courses by Prefix		
Prefix	Number of Courses	Number of Students
BIO-Biology	297	1860
CHM-Chemistry	41	353
GEO-Geography	13	127
GLG-Geology	16	144
PHY-Physics	11	106



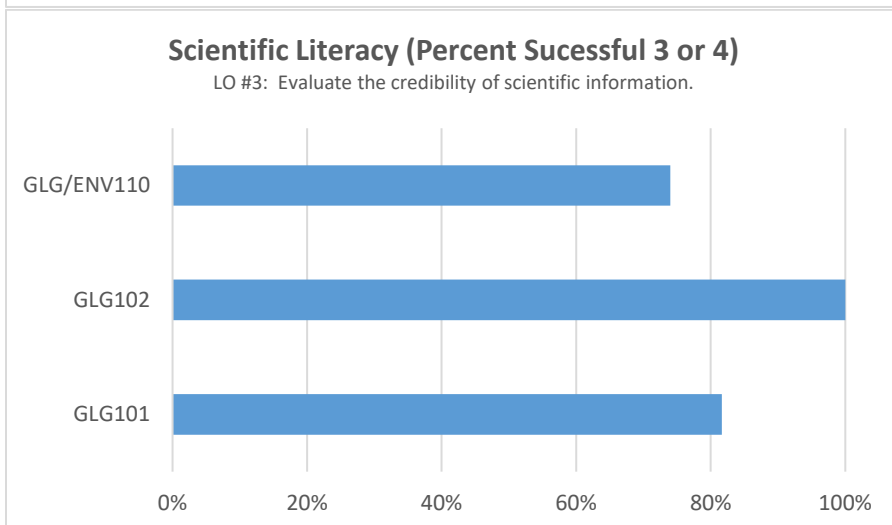
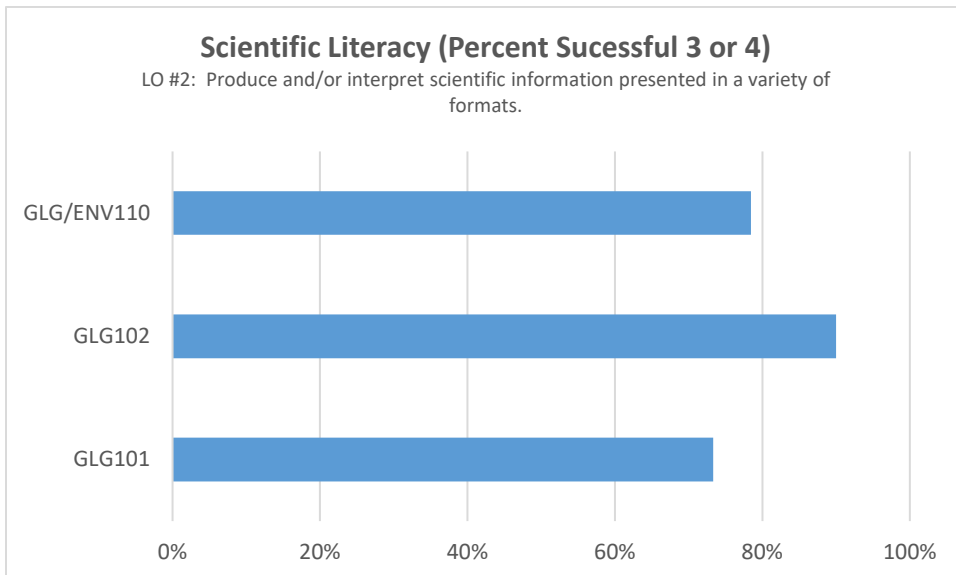
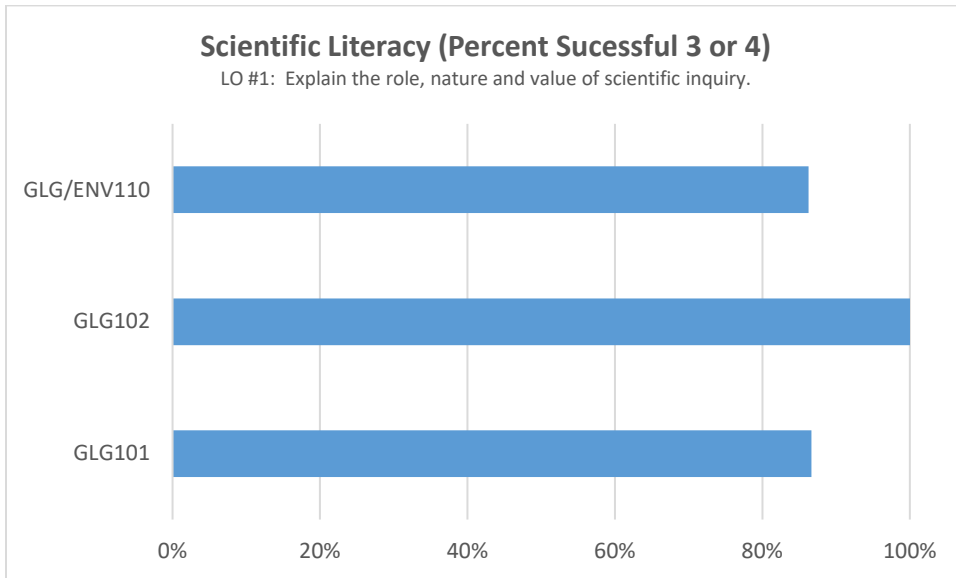
5: Scientific Literacy by Subject: Biology



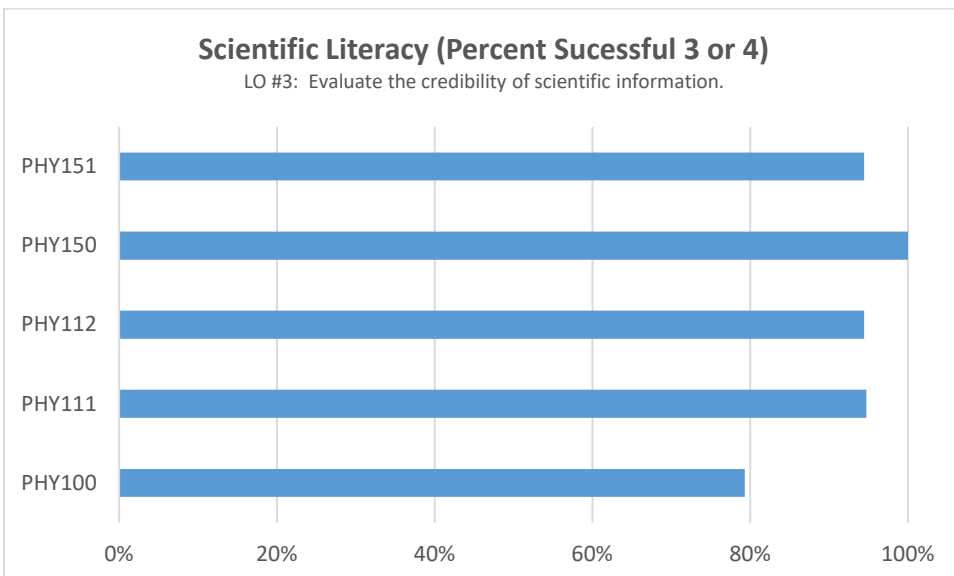
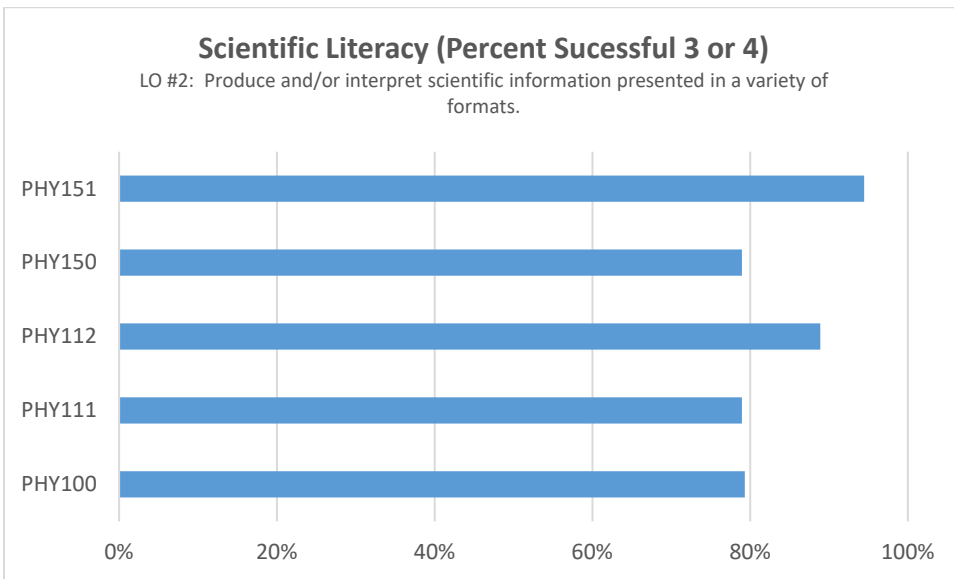
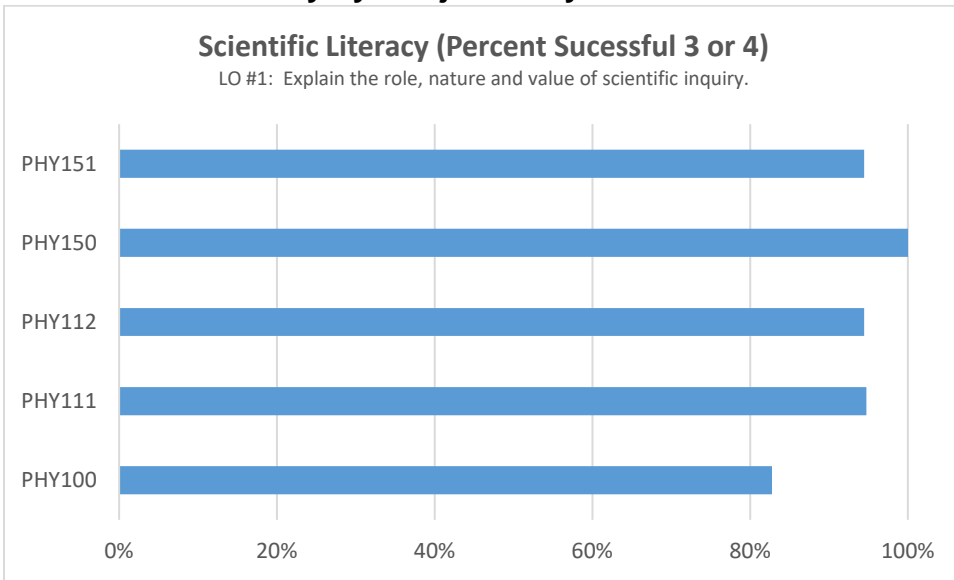
6: Scientific Literacy by Subject: Chemistry



7: Scientific Literacy by Subject: Geology



8: Scientific Literacy by Subject: Physics



Report Year	2016/2017 (revised April 16, 2018 JO)
Academic Department/Discipline	Science
Contact Person (include email)	Paul.Smolenyak@yc.edu , Joanne.Oellers@yc.edu
Date Submitted Email Completed Report to: Molly.Beauchman@yc.edu (Assessment Director)	

Section A: General Education Outcomes Assessment: If your department/discipline participated in General Education assessment, please provide a summary of your General Education outcomes assessment activities this year along with results and any recommended actions/changes.

Scientific Literacy Year 3 Return (2016/2017) Year 4 Revise (2017/2018)

General Education Category	Learning Outcome(s) Assessed	What assessment measure(s) was used?	Findings and recommended actions based on assessment data.	Resources or support needed.
Scientific Literacy	LO #1: Demonstrate comprehension of the scientific approach.	Classwork, homework, quizzes and exams, lab exercises, and formal lab reports.	Assessment data provided show an average for all science courses at >78% success (students rated as 3 or 4). This is higher than the benchmark of 70% science department target. A few courses fell below 70% but were near or above 60% including (BIO201,202,and 160) and (CHM235, 235L and 138) For the few courses that fell below the 70% success benchmark it may be useful to see success rate as a function of delivery method. In the case of CHM235 and CHM235L the small class size and the level of difficulty may suggest a lower benchmark of 60% is appropriate. Longer term monitoring of the course with the current system may provide additional insight.	Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning. Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.
Scientific Literacy	LO #2: Produce and/or interpret scientific information presented in a variety of formats.	Classwork, homework, quizzes and exams, lab exercises, and formal lab reports.	Assessment data provided show an average for all science courses at 76% success (students rated as 3 or 4). This is higher than the benchmark of 70% science department target. A few courses fell below 70% but were near or above 60% including (BIO201,202,and 160) and (CHM235, 235L and 138) For the few courses that fell below the 70% success benchmark it may be useful to see success rate as a function of delivery method. In the case of CHM235 and CHM235L the small class size and the level of difficulty may suggest a lower benchmark of 60% is	Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning. Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.

			appropriate. Longer term monitoring of the course with the current system may provide additional insight.	
Scientific Literacy	LO #3: Use scientific sources to support an argument or discussion.	Classwork, homework, quizzes and exams, lab exercises, and formal lab reports.	<p>Assessment data provided show an average for all science courses at >77% success (students rated as 3 or 4). This is higher than the benchmark of 70% science department target.</p> <p>A few courses fell below 70% but were near or above 60% including (BIO201,202,and 160) and (CHM235, 235L and 138)</p> <p>For the few courses that fell below the 70% success benchmark it may be useful to see success rate as a function of delivery method.</p> <p>In the case of CHM235 and CHM235L the small class size and the level of difficulty may suggest a lower benchmark of 60% is appropriate. Longer term monitoring of the course with the current system may provide additional insight.</p>	<p>Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning.</p> <p>Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.</p>

Review of Assessment Processes and Tools for General Education Assessment		
*Any changes to the General Education Outcomes and/or rubric must be submitted to the Curriculum Committee on or before the October deadline during Year 4 (Revision) of General Education Cycle.		
Assessment Process or Tool	Strengths and/or Weaknesses	Changes Made (if any)
No change to SL rubric recommended	Data suggests our current strategy is producing satisfactory results.	None

Summary of Section A: Please write a paragraph summarizing the findings, recommended actions and resources needed for the General Education Outcomes Report.

The assessment data does not show some details that faculty have observed. We respectfully submit some critical observations here.

Physics and chemistry classes have been adversely affected by the trend in math courses to “data-driven” curriculum. The foundational laws of physics and chemistry are based on symbolic equations. Strong skills in symbolic math are needed, especially in proportional reasoning. Taking class time to get the students up to the necessary math skill level slows down the course. Not taking class time to address the weakness impacts student success.

Formal technical writing skills are critical to preparation in the sciences. Most students can keep an acceptable lab notebook of what they did, and what data they acquired, particularly if they have a lab manual. However, most come in with poor writing skills, and have trouble effectively, concisely, and professionally summarizing their results. This is the mark of true synthesis and analysis, and represents what is ultimately expected of professionals in our fields. Most of us wish we could include a significant student writing component in our courses. Unfortunately, we must severely limit the writing experience, owing to our required teaching overloads. The personal time needed to teach science students technical writing skills is more than faculty have available. Labs are often reduced to filling out lab sheets by necessity. Many of us have tried to incorporate more critical writing in the past, and had to concede that it was unfeasible in all but a few cases. **Effective teaching requires the resource of TIME.** YC has devalued the teaching of science labs, giving us less time to serve our students. Sciences need 100% teaching load for ALL of our science teaching.

Lack of logistical support has curtailed field trip opportunities. Vans specifically designated for academic field trips would help facilitate field trips.

Advising problems still exist. Students often get mis-information regarding 4 year science programs of study.

Section B: Course Outcomes Assessment: Please provide a summary of your course outcomes assessment activities this year along with results and any recommended actions/changes.

Course(s) Assessed (Prefix and number: AAA111)	Learning Outcome(s) Assessed	What assessment measure(s) was used?	Findings and recommended actions based on assessment data.	Resources or support needed.
BIO182	Apply the scientific method in problem solving.	Classwork, homework, quizzes, exams and laboratory assignments.	Current institutional assessment information provides broad information about program learning outcomes, as expected for the institution, and favorable results are indicated. Success rates near 90% were somewhat higher than all other bio courses except BIO103. Instructors may need to review criterion prior to the next cycle of data collection.	Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning. Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.
CHM151	1. Use scientific reasoning to evaluate physical and natural phenomena. A. Solve chemical problems using the concepts central to chemistry. B. Draw conclusions regarding physical and chemical phenomenon through evaluation of data and observations.	Classwork, homework, quizzes, exams and laboratory assignments.	Current institutional assessment information provides broad information about program learning outcomes, as expected for the institution, and favorable results are indicated. YC student results were near or above national mean scores for the American Chemical Society final exams – consistent with the result suggested by the YC-SLOA assessment tools. Success rates near 80% are consistent with the results found using national standardized exam.	Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning.
GLG101	Use scientific reasoning to evaluate physical and natural phenomena.	Classwork, homework, quizzes, exams and laboratory assignments.	Current institutional assessment information provides broad information about program learning outcomes, as expected for the institution, and favorable results are indicated. Success rates near 80%.	Lack of logistical support has curtailed field trip opportunities. Vans specifically designated for academic field trips would help facilitate field trips. Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.

PHY111	<p>11. Evaluate qualitatively and quantitatively the kinematics and dynamics of constant velocity motion, constant acceleration motion, projectile motion, uniform circular motion, rotational motion, collisions and explosions, simple harmonic motion, and basic wave phenomena.</p> <p>7. Interpret the numerical and/or graphical presentation of scientific data.</p>	Classwork, homework, exams, and laboratory experiments.	Current institutional assessment information provides broad information about program learning outcomes, as expected for the institution, and favorable results are indicated. Success rates near 80%.	Support is needed for students to acquire strong skills in symbolic math, especially in proportional reasoning. Support is needed for students to develop formal technical writing skills concurrently or as prerequisite for taking science classes.
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Review of Assessment Processes and Tools for Course Assessment		
Assessment Process or Tool	Strengths and/or Weaknesses	Changes Made (if any)
Classwork, homework, quizzes, exams and laboratory assignments/reports.	Each science course uses a variety of assessment tools, and documents student achievement, with writing, concept tests, and problem solving exercises. For some classes national standardized final exams are used.	None

Section C: Additional Activities or Initiatives that Support Student Learning and Success, Retention, or Recruitment:

Additional Activities or initiatives that support student learning, retention, or recruitment.	Findings and recommended actions based on assessment data.	Resources or support needed.
Additional Initiatives: Please include other activities or initiatives within the department or discipline that support student learning and success.		
NASA internship recruitment talk		
Directed Research Programs		
Science Bowl		
Field Trips		