Institutional Student Learning Outcome (ISLO) Assessment Summary Report Academic Year: 2020-2021 ISLO3: Scientific Reasoning

Scientific Reasoning

Students will apply the scientific method, develop hypotheses, analyze results and draw conclusions.

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Report submitted on October 1, 2021

Executive Summary

SCOPE:

Courses from which assessment data was gathered (# of students): AST 131 (10); AST 132 (9); BIO 103 (141); BIO 104 (24); BIO 105 (76); BIO 106 (59); BIO 115 (19); BIO 131 (43); BIO 132 (21); BIO 231 (23); MLT 106 (23); PHS 111 (21); PHY 121 (37); PHY 151 (17).

Participating faculty and academic department:

- AHBS: Cheryl Barnhill, Terri Burke, Matthew Clegg, Mark Condon, Dinor Dhanabala, Katherine Espinosa, Sandra Fraley, John Herles, Karen Ingham, Elizabeth Justin, Richard Kirker, Erich Markert, Deborah Mautone, Mariana Melo, Lauren Molella, Carolyn Rounds, Brian Sohan, Patricia Wells-Glancey, Alan Zucker
- PSET: Manish Jadhav, Samantha Langton, Renee Lathrop

Total # of Sections: 30

Total # of Students: Valid data collected for 523 out of 828 possible assessments (209 in Fall 2020; 314 in Spring 2021)

RESULTS:

- Student outcomes from 2020-2021 outperformed those from 2017-2018 in Hypothesis and Conclusion, but there were no significant differences in Organization and Results.
- Student outcomes in courses in which ISLO3 skills are reinforced outperformed those in courses in which the skills are introduced, with the exception of Hypothesis, for which there was no significant difference.
- There is a correlation between high school GPA and student outcomes on the assessment. Students with stronger high school GPAs (≥3.00) outperformed those with lower GPAs (≤2.99).

CONCLUSIONS AND RECOMMENDATIONS:

The assessment team proffered the following conclusions and recommendations.

Result/Conclusion	Recommendation for Action
Student outcomes from 2020-2021 outperformed those from 2017-2018 in Hypothesis and Conclusion, but there were no significant differences in Organization and Results.	Relevant departments continue to discuss the pedagogical practices and changes that have had the greatest positive impact on student outcomes. Workshops or cross-departmental meetings to consider further changes to improve outcomes in all courses connected to ISLO3.
Student outcomes in courses in which ISLO3 skills are reinforced outperformed those in courses in which the skills are introduced, with the exception of Hypothesis, for which there was no significant difference.	For the 2023-2024 assessment of ISLO3, differentiate between courses for science majors and those for non-majors. Faculty continue to scaffold assignments, particularly for introductory courses, but also stress student self-assessment as part of the scaffolding of ISLO3 skills, helping them see their own areas of strengths and weaknesses.
There is a correlation between high school GPA and student outcomes on the assessment. Students with stronger high school GPAs (≥3.00) outperformed those with lower GPAs (≤2.99).	Consult with ACT Center to assist with student placement in science courses and to reconsider sequencing of courses (including when students should take courses that might support their success in science courses, such as Math classes). Reconsider other academic support for students in science courses, such as workshops supported by the ACT Center (with faculty input) or the Math & Science Center, as well as the potential for offering courses such as BIO001 (possibly in remote environment).

ACTION PLAN:

Recommendation/Action Item	Potential Resources
Relevant departments continue to discuss the pedagogical practices and changes that have had the greatest positive impact on student outcomes. Workshops or cross-departmental meetings to consider further changes to improve outcomes in all courses connected to ISLO3.	Improvement of Instruction or Assessment Grants to support faculty workshops/meetings, particularly to compensate part-time faculty participation. FAL and/or departmental representatives could lead these discussion.
For the 2023-2024 assessment of ISLO3, differentiate between courses for science majors and those for non-majors. Faculty continue to scaffold assignments, particularly for introductory courses, but also stress	FAL, Associate Dean of Academic Affairs, and relevant faculty work with Institutional Research to prepare for the 2023-2024 assessment cycle by considering different modes of data collection and analysis. FAL

student self-assessment as part of the scaffolding of ISLO3 skills, helping them see their own areas of strengths and weaknesses.	and relevant faculty report out to departments about best practices that have led to student success in ISLO3.
Consult with ACT Center to assist with student placement in science courses and to reconsider sequencing of courses (including when students should take courses that might support their success in science courses, such as Math classes). Reconsider other academic support for students in science courses, such as workshops supported by the ACT Center (with faculty input) or the Math & Science Center, as well as the potential for offering courses such as BIO001 (possibly in remote environment).	FAL and Associate Dean(s) of Academic Affairs meet with ACT Center staff to discuss impact of using high school GPA to assist in student registration. Additional resources to the Math & Science Center to take on academic support previously provided by the Academic Services Center for students in science classes. AHBS faculty needed to update and offer BIO001. Potential training of said faculty to offer the course in non-traditional modalities.
FAL to update PCC regarding status of these actions steps at the PCC meetings on November 19, 2021, and March 10, 2022.	

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1 State the specific question(s) asked

The last assessment of ISLO3-Scientific Reasoning occurred during the 2017-2018 academic year. The general consensus of the faculty who performed that assessment was that DCC students revealed only modest skills in scientific reasoning. Recommendations to improve those skills included expanding instructional time, reducing class sizes (especially in lecture courses), and developing recitation sections. To improve the assessment process for the current cycle, faculty also suggested working with students to help them recognize the purpose and value of scientific reasoning in their academic development, maximizing inter-rater reliability with the rubric scoring, framing high-impact research questions, and utilizing more qualitative methods of gathering information.

The faculty believed it would be important to compare the results from this current cycle with the those from the last one to see if pedagogical changes have had an impact on student outcomes, so we decided to keep the same rubric and work to more clearly establish inter-rater reliability with it. The changes to course offerings due to the COVID-19 pandemic, which forced the college to move many classes to remote environments, also led to a specific research question listed below.

Research Questions:

1. What impact have curricular or pedagogical changes in courses, programs, or the College in general had on student outcomes regarding ISLO3?

2. Are there differences between the student outcomes in courses in which the ISLO is introduced and those in which it is reinforced? What do comparisons between those courses reveal about efforts to scaffold scientific reasoning skills within courses and programs?

3. What is the relationship between the high school a student attended/graduated from and the outcome in the assessment of that student's skill in ISLO3? What is the relationship between a student's high school GPA and the outcome in the assessment of that student's skill in ISLO3?

4. Are there differences between the student outcomes in courses offered synchronously during the 2020-2021 academic year and those offered asynchronously?

2 Describe the methods used to answer the question(s)

An outline of the methodology is provided below:

- In January 2020, all faculty and staff were invited to a workshop to discuss plans for the 2020-2021 assessment of ISLO3. At that workshop, attendees reviewed the definition of the outcome, the current and the VALUE rubrics, the results and recommendations of the 2017-2018 assessment, and ways to improve inter-rater reliability by discussing shared standards for the outcome. The faculty decided against shifting the rubric to the VALUE one, and instead chose to retain the same rubric to allow for clearer conclusions regarding the comparison between the current and previous cycles.

    - The discussion at this workshop was followed up at the March 5, 2020, Program Chairs Council meeting, to which all faculty in the sciences were invited. Further discussion focused on the research questions and particular demographic information regarding the students that might be collected as part of the assessment.

- During the Spring 2020 semester, the global pandemic of COVID-19 led to a massive disruption of both the culture at-large and DCC specifically. By May 2020, with the college faculty focused on getting students through their courses, the Faculty Assessment Leader and the Associate Dean of Academic Affairs decided it would be best to cancel the usual end of semester planning workshops and instead finalize those plans via email. A message was sent to all faculty that summarized the January workshops, provided clear drafts of the research questions, and asked for feedback. By the end of faculty contractual obligation, those plans were set.

- In consultation with department and program chairs, the following courses were selected to participate in the 2020-2021 assessment of ISLO3: AST131; AST132; BIO103; BIO104; BIO105; BIO106; BIO115; BIO131; BIO132; BIO231; MLT106; PHS111; PHY121; PHY151; PHY152.

- Using the agreed upon rubric (see Appendix A), the faculty teaching these courses used a variety of instruments to collect data on the ISLO3 skills (see Appendix B for examples), including:
    - Standard course assignments, such as homework;
    - Major course assignments, such as significant projects;
    - Multiple assignments.

- Faculty in the Department of Allied Health and Biological Sciences were awarded three assessment grants to assist in the assessment process, totaling 63.5 hours.

- During the academic year, faculty input the data gathered in TracDat/Nuventive (allowing assessment results to be associated with a student and student information in Banner). At the end of the academic year, the data was downloaded and tabulated by the Associate Director of Institutional Research, Planning, and Assessment (IR), who performed further statistical analysis.

- Using the information provided by IR, the Faculty Assessment Leader prepared a draft report of the assessment and provided it to participating faculty for their review. Faculty provided continued feedback for revision of the draft via an August 2021 workshop and through email and conversation with the Faculty Assessment Leader through September 2021.

- The final report was submitted on October 1, 2021.

The COVID-19 novel coronavirus outbreak of 2020 continued to have a significant impact on assessment activities during the 2020-2021 academic year. While we were able to continue those activities – to plan and execute the assessment of ISLO3, to meet virtually to discuss that assessment, and to analyze and report out the data as we have for many years now – we would be remiss not to note the ways in which shifting to a mostly remote educational environment affected instruction, student learning, personal connections (between faculty and staff members, between students, and perhaps most importantly, between faculty/staff and students), and potentially the outcomes of this assessment. As the specific research question noted above regarding differences in outcomes in synchronous v. asynchronous courses suggests, we have considered that impact as we analyzed the results outlined below and suggested recommendations moving forward. As we move beyond the pandemic and hopefully back to a more typical learning environment in the coming years, we look to use what we have learned during this extraordinary time to inform our work and improve the student learning experience.

3 Summarize the Results

3.1 Total Tabulated Data and Comments

There were 828 possible assessments across 30 sections. Valid data was collected for 523 assessments (209 in Fall 2019, 314 in Spring 2020), a rate of 63.2%. Statistics exclude sections where no data was collected.

The rubric shared by all faculty assessing this ISLO (see Appendix A) included four (4) assessment items as provided in the table below. Each item is referred to in the results using the identifier indicated in the table.

Table 1 Assessment Items/Categories for ISLO1

Item	Identifier	Abbreviated Description
1	Hypothesis	**Hypothesis/Goals/Purpose:** Constructs a testable hypothesis or sets or identifies goals based on the question or problem
2	Organization	**Data Organization:** Acquires/organizes/critiques observations and other evidence in a way that is useful
3	Results	**Analyze Results:** Evaluates data obtained for accuracy and completeness
4	Conclusions	**Draw Conclusions:** Interprets data/observations and makes appropriate conclusions based on evidence

Overall average ratings using the shared rubric were 3.09 for Hypothesis, 2,99 for Organization, 2.77 for Results, and 2,81 for Conclusions, where 4.0 represents an outcome that exceeds expectations and 1 represents an outcome not meeting expectations at all. Table 2 provides the percentage of students scoring each individual rating for each category.

Table 2 Percentage of students earning individual rating for ISLO1 items

	Hypothesis	Organization	Results	Conclusions
4 = exceeds expectations	41.3	35.0	27.9	31.5
3 = meets expectations	34.2	38.2	37.5	32.3
2 = approaches expectations	16.8	17.6	18.7	22.0
1 = does not meet expectations	7.6	9.2	15.9	14.1

Table 3 provides the percentage of students who have either met or exceeded expectations in each category, as well as the percentage of those who did not meet college expectations.

Table 3 Percentage of students meeting or exceeding expectations as opposed to not meeting expectations

	Hypothesis	Organization	Results	Conclusions
3/4 = did meet expectations	75.5	73.2	65.4	63.9
1/2 = didn't meet expectations	24.5	26.8	34.6	36.1

Inter-item reliability was assessed using Pearson correlations and Cronbach's alpha. All ISLO items were positively correlated with one another ($rs > .39$, $ps < .001$). Reliability was good ($\alpha = .82$). This result implies that the items could be combined to form a single score representing scientific reasoning competency.

Furthermore, the means (provided in Table 4, along with standard deviations) for each item were compared using a repeated-measures ANOVA. The results indicate an overall significant difference between items [$F(3,1566) = 25.42$, $p < .001$]. Bonferroni-corrected pairwise comparisons indicate that Hypothesis and Organization had higher ratings than Results and Conclusions ($ps < .001$), but there were no other significant differences.

Table 4 Overall Ratings (Mean Scores and Standard Deviations)

	Hypothesis	Organization	Results	Conclusions
Overall Ratings (n=523)	3.09 (0.94)	2.99 (0.95)	2.77 (1.03)	2.81 (1.03)

Finally, independent t-tests were used to compare the results from the Fall and Spring semesters. Ratings for Hypothesis were higher in the Fall as compared with the Spring semester, $t(521) = 4.54$, $p < .001$. There were no other significant differences. Table 5 provides those results.

Table 5 Outcomes by Semester

	Hypothesis	Organization	Results	Conclusions
Fall 2020 (n=209)	3.32 (0.83)	2.94 (0.97)	2.78 (0.99)	2.88 (1.01)
Spring 2021 (n=314)	2.94 (0.98)	3.03 (0.93)	2.77 (1.05)	2.77 (1.05)

3.2 Types of Assignment Data and Comments

Faculty were asked to describe the assignment(s) used for assessment. Methods varied from lab exercises to lab reports, with at least one graded assignment. Many faculty had to rely on lab simulation due to the restrictions on in-person laboratories during the 2020-2021 academic year. Samples of the assignments can be found in Appendix B.

3.3 Student Academic Experiences

Traditionally, the College has collected information on student academic experience in order to disaggregate the assessment data; therefore, student characteristics that might impact their experience (such as full-time versus part-time, or previous course work) were examined in relation to performance on the assessment criteria.

3.3.1 Student Characteristics

The students' higher education history (i.e., whether they were new/continuing/transfer/high-school concurrent) was analyzed. The numbers of students in each group were as follows: New First-Time (n=70), Continuing (n=421), Transfer (n=20), and High-School Concurrent (n=12). Given the small sample sizes for Transfer and Concurrent students, those results were excluded. Using independent t-tests, New and Continuing students were compared. However, no significant differences were found.

Students were also grouped into full-time (FT; n=357) and part-time (PT; n=166). Independent t-tests revealed that PT students outperformed FT in Organization, Results, and Conclusions [$ts(521) > 2.25$, $ps < .05$]. The groups did not differ significantly on Hypothesis. See Table 6.

Table 6 Full-time v Part-time Students

	Hypothesis	Organization	Results	Conclusions
Full-time (n=357)	3.08 (0.92)	2.93 (0.96)	2.69 (1.02)	2.69 (1.03)
Part-time (n=166)	3.12 (0.97)	3.13 (0.90)	2.95 (1.01)	3.08 (0.98)

Statistical analyses were also performed on the data to test for differences between students who had passed the course in which the ISLO skills were assessed (n=479, grades of A, B, C) and those who did not pass (n=44, grades of D, F, I, W, or ZF). Independent t-tests revealed that students who passed the course had higher ratings for all ISLO items than students who did not pass [ts (521) > 6.45, ps < .001]. See Table 7.

Table 7 Course Passed

	Hypothesis	Organization	Results	Conclusions
Yes, passed course (n=479)	3.17 (0.89)	3.08 (0.89)	2.86 (0.99)	2.91 (0.99)
No (n=44)	2.25 (1.08)	2.02 (1.05)	1.80 (0.90)	1.77 (0.94)

Further analyses were performed to test correlations between course grades and the outcomes of the assessment. Grades were transformed to the 4.0 GPA scale (NOTE: withdrawals and other grades not included in GPA calculations were excluded). All ISLO items were positively correlated with course grades [rs (516) > .33, ps < .001], meaning that higher ISLO ratings were associated with higher grades in the course.

Data was also collected on the type of degree the student was pursuing (associate, certificate, or non-degree); however, the sample size for certificate (n=4) was insufficient to conduct inferential analyses. That said, the Non-degree group outperformed the Associate degree group on Conclusions (3.12 v 2.79 [t (517) = 1.97, p = .05]), but no other significant differences were found.

A specific research question asks about the high school GPA of the students assessed, as well as about information regarding the school those students attended. Independent t-tests were used to compare students with HS GPAs ranging 0.00 to 2.99 versus those with HS GPAs of 3.00 or greater. The 3.00-4.00 group outperformed the 0.00-2.99 group on all ISLO items, ts (420) > 4.10, ps < .001. Independent t-tests were also used to compare high schools in Dutchess and Putnam counties to those in other New York State counties. (Other locations and types of schools were excluded. A breakdown of individual results by Dutchess and Putnam county high schools is available in Appendix E) There were no significant differences. See Tables 8 and 9 for full results.

Table 8 Student High School GPA

	Hypothesis	Organization	Results	Conclusions
0.00-2.99 (n=213)	2.86 (0.97)	2.77 (0.98)	2.57 (1.09)	2.53 (1.06)
3.00-4.00 (n=209)	3.27 (0.86)	3.17 (0.86)	2.97 (0.9)	3.03 (0.95)

Table 9 High School Location/Type

	Hypothesis	Organization	Results	Conclusions
NY Dutchess/Putnam (n=365)	3.11 (0.92)	2.98 (0.93)	2.81 (0.98)	2.81 (1.03)
NY Other County (n=89)	2.97 (0.98)	2.87 (1.01)	2.65 (1.14)	2.80 (1.04)
US not NY (n=19)	3.42 (0.90)	3.47 (0.77)	3.11 (0.94)	3.26 (0.81)
GED/HSE (n=22)	2.91 (0.97)	3.09 (0.87)	2.41 (1.05)	2.64 (1.05)

Home School (n=6)	3.50 (0.55)	3.00 (0.89)	3.17 (0.75)	3.17 (0.98)
Foreign HS (n=10)	2.50 (1.18)	2.80 (1.40)	2.40 (1.26)	2.30 (1.16)
Unknown (n=12)	3.58 (0.67)	3.50 (0.80)	2.92 (1.24)	2.92 (1.16)

3.3.2 Course Characteristics Data and Comments

Statistical analyses based on the course level in which the ISLO items were not computed because only one 200-level course was assessed.

However, faculty could indicate which courses were designed to introduce the ISLO3 skills and which were designed to reinforce those skills, and so those courses were compared using independent t-tests. Ratings in Reinforced courses were higher than ratings in Introduced courses for Organization, Results, and Conclusions, ts (521) > 3.15, ps < .01. The groups did not differ significantly on Hypothesis. See Table 10.

Table 10 Courses that Introduce the Skill v Courses that Reinforce the Skill

	Hypothesis	**Organization**	**Results**	**Conclusions**
Introduced (n=397)	3.05 (0.94)	2.86 (0.98)	2.69 (1.06)	2.73 (1.04)
Reinforced (n=126)	3.23 (0.93)	3.39 (0.72)	3.05 (0.85)	3.06 (0.99)

Finally, given the disruptive nature of the pandemic and the fact that many traditionally in-person courses and laboratories were shifted to remote environments, the faculty was interested in looking at the differences between asynchronous and synchronous instructional methods. Using independent t-tests, the courses taught asynchronously were compared to those taught synchronously. However, there were no significant differences in the outcomes. See Table 11.

Table 11 Asynchronous v Synchronous Courses

	Hypothesis	**Organization**	**Results**	**Conclusions**
Asynchronous (n=465)	3.10 (0.95)	3.02 (0.95)	2.79 (1.03)	2.83 (1.03)
Synchronous (n=58)	3.03 (0.88)	2.79 (0.91)	2.67 (0.96)	2.71 (1.04)

3.4 Current Assessment Cycle Compared to Last Cycle

ISLO3 Scientific Reasoning was last assessed in 2017-2018 (AY17/18) using the same rubric and scale. Please note that the dataset only included students who had ratings for all items.

Independent t-tests were used to compare the ratings between academic years. Ratings for Hypothesis and Conclusions were higher in AY2021 than they were in AY1718, ts (1279) > 2.01, ps < .05. There were no significant differences in Organization or Results. See Table 12.

Table 12 Comparing Results AY17/18 v AY20/21

Average ratings	**Hypothesis**	**Organization**	**Results**	**Conclusions**
AY1718 (n=758)	2.73 (1.10)	2.91 (1.07)	2.74 (1.10)	2.69 (1.14)
AY2021 (n=523)	3.09 (0.94)	2.99 (0.95)	2.77 (1.03)	2.81 (1.03)

Percentage meeting expectations	**Hypothesis**	**Organization**	**Results**	**Conclusions**
AY1718 (n=758)	58.7%	66.6%	59.5%	57.3%
AY2021 (n=523)	75.5%	73.2%	65.4%	63.9%

3.5 Assessment Results Disaggregated by Program

ISLO3 Scientific Reasoning outcomes were disaggregated by program (see Appendix C). Table 13 provides an accounting of which courses students were assessed in for each program and how many students were in each of those courses. This data allows programs chairs to know if students in their programs were assessed, and if the major-specific data is generalizable to the program as a whole.

Table 13 Accounting of Students Assessed by Course and Program

*total # of students data extracted from SUNY BI and reflects the unduplicated headcount for the academic year for each program.

Program	Total Students*	Total # Students Assessed	Total # Assessments	Course ID (# of Students)
ACC	40	2	2	BIO 103 (2)
ACR	2			
ARC	68	1	1	PHY 121 (1)
AVI	42	3	3	PHS 111 (1), PHY 121 (2)
AVM	19	1	1	PHS 111 (1)
BAT	456	13	13	AST 131 (1), BIO 103 (8), BIO 104 (2), PHS 111 (2)
BOK	14			
BUS	197	6	6	BIO 103 (5), PHS 111 (1)
CDC	6			
CHC	11			
CIS	82	3	3	BIO 103 (2), PHY 121 (1)
CMH	24			
CNC	7			
CNS	32			
COM	149	10	10	AST 131 (2), AST 132 (1), BIO 103 (5), PHS 111 (2)
CPS	152	7	7	BIO 105 (1), PHY 121 (3), PHY 151 (3)
CRJ	65	3	3	BIO 103 (3)
CRT	264	20	20	BIO 103 (17), BIO 104 (3)
DRC	2			
ECC	4			
ECH	50	8	8	BIO 104 (8)
EDB	10	2	2	BIO 105 (1), BIO 106 (1)
EDH	71	8	8	AST 131 (1), AST 132 (1), BIO 103 (3), BIO 104 (1), BIO 105 (1), PHS 111 (1)
EDL	31	2	2	BIO 103 (1), PHS 111 (1)
EDM	14	2	2	PHY 121 (1), PHY 151 (1)
EDP	1			
EDS	3			
EDX	2	1	2	PHY 121 (1), PHY 151 (1)
EED	179	11	11	AST 131 (1), AST 132 (1), BIO 103 (5), BIO 105 (1), BIO 231 (3)
ELT	47	3	3	PHY 121 (3)

ENR	119	16	21	BIO 105 (2), BIO 106 (2), PHY 121 (7), PHY 151 (10)
ESW	96	15	22	BIO 105 (9), BIO 106 (12), BIO 231 (1)
FIR	3			
FPT	5	1	1	PHY 121 (1)
GSP	1,238	123	127	AST 132 (2), BIO 103 (38), BIO 104 (6), BIO 105 (11), BIO 106 (6), BIO 115 (1), BIO 131 (37), BIO 132 (18), PHS 111 (6), PHY 121 (2)
HMS	369	20	20	BIO 103 (17), BIO 104 (1), BIO 105 (1), PHS 111 (1)
INM	11	1	1	BIO 103 (1)
LAH	461	36	40	AST 131 (4), AST 132 (4), BIO 103 (18), BIO 104 (2), BIO 105 (5), BIO 106 (2), BIO 131 (1), PHS 111 (4)
LAM	13	1	1	PHY 151 (1)
LAX	310	65	77	BIO 105 (26), BIO 106 (23), BIO 231 (17), PHY 121 (10), PHY 151 (1)
MLT	66	30	35	BIO 105 (5), BIO 106 (6), BIO 131 (1), MLT 106 (23)
MPC	1			
NUR	130			
PAL	44	1	1	BIO 103 (1)
PAR	52	17	17	BIO 115 (17)
PBH	21	2	2	BIO 105 (2)
PDC	61	3	3	BIO 103 (3)
PFA	48			
PLL	10			
PRR	5	1	1	BIO 115 (1)
VAT	152	4	4	AST 131 (1), BIO 103 (3)
WAC	2			
UND	579	39	43	BIO 103 (9), BIO 104 (1), BIO 105 (11), BIO 106 (7), BIO 131 (4), BIO 132 (3), BIO 231 (2), PHS 111 (1), PHY 121 (5)

3.6 Assessment Results Relevant to Diversity and Equity Concerns

The Diversity Council at Dutchess Community College has taken an interest in gathering more data based on demographic information that might shed light on how well different students are reaching the desired institutional learning outcomes, and therefore reveal potential areas of focus for the College. To that end, outcomes based on gender, race/ethnicity, age group, and Pell Grant status were gathered and the results were analyzed.

Gender. Used independent t-tests to compare men and women. There were no significant differences.

Table 14 Gender Comparison

	Hypothesis	**Organization**	**Results**	**Conclusions**
Male (n=196)	3.10 (0.94)	2.94 (0.94)	2.72 (1.05)	2.83 (1.02)
Female (n=327)	3.09 (0.94)	3.02 (0.95)	2.81 (1.01)	2.80 (1.04)

Race/Ethnicity. Used Oneway ANOVA to compare the White, Hispanic, and Black race/ethnic groups. (The other groups were excluded because of their small/disparate Ns.) Overall significant differences were found for all ISLO items, Fs (2,471) > 3.57, ps < .05. Bonferroni-corrected

pairwise comparisons indicated significant differences (ps < .05) between White and Hispanic students for all ISLO items. White students also outperformed Black students on Conclusions. There were no other significant differences.

Table 15 Race/Ethnicity Comparisons

	Hypothesis	Organization	Results	Conclusions
White (n=309)	3.18 (0.89)	3.07 (0.91)	2.89 (1.00)	2.93 (1.01)
Hispanic (n=107)	2.92 (1.06)	2.79 (1.07)	2.50 (1.08)	2.64 (1.09)
Black (n=58)	2.95 (0.96)	2.78 (0.92)	2.59 (0.96)	2.52 (0.98)
Asian (n=10)	2.60 (1.07)	2.90 (0.99)	2.20 (1.03)	2.00 (0.82)
Native American (n=3)	2.67 (0.58)	3.00 (0.00)	2.67 (1.15)	2.33 (0.58)
Two or more races (n=22)	3.23 (0.69)	3.14 (0.89)	3.05 (1.00)	3.14 (0.99)
Nonresident Alien (n=8)	3.38 (1.06)	3.63 (0.52)	3.25 (1.04)	2.88 (0.99)
Unknown (n=6)	3.00 (0.63)	3.17 (0.75)	3.00 (0.63)	3.00 (1.26)

Age Group. Used independent t-tests to compare students by age groups – the traditional 17 to 24 (excluding HS concurrent students) and the non-traditional 25 or older students. The non-traditional group outperformed the traditional group on Organization and Conclusions, ts (509) > 3.08, ps < .005. There were no other significant differences.

Table 16 Age Group Comparison

	Hypothesis	Organization	Results	Conclusions
17 to 24 (excludes HS) (n=395)	3.05 (0.94)	2.91 (0.95)	2.75 (1.01)	2.73 (1.05)
25 or older (n=116)	3.21 (0.93)	3.26 (0.85)	2.90 (1.08)	3.07 (0.95)

Pell Recipient. Used independent t-tests to compare Pell recipients and non-Pell students. There were no significant differences.

Table 17 Pell Recipient Comparison

	Hypothesis	Organization	Results	Conclusions
Pell (n=152)	3.02 (0.96)	2.94 (0.99)	2.71 (1.05)	2.74 (1.05)
No Pell (n=371)	3.12 (0.93)	3.01 (0.93)	2.80 (1.02)	2.84 (1.03)

3.7 Faculty Perspectives (Narrative Results by Course)

Faculty were asked to provide comments on the results of the assessment as they entered that quantitative data into the TracDat system. A full reporting of that commentary is in Appendix D. Below is a summary of the key points from that qualitative data.

- **Impact of COVID-19 Pandemic:** Most faculty expressed significant concern that the COVID-19 pandemic, which necessitated important changes to course delivery, had a largely negative impact on the outcomes of this assessment. Due to social distancing guidelines and student/faculty concerns about large groups gathering inside for labs, all relevant departments made changes to their courses, from teaching remotely to offering fewer lab hours to replacing labs with simulations. These changes meant less face-to-face time between instructors and students, fewer opportunities for instructors to teach specific skills and for students to practice in the development of those skills, and in all, fewer practical, hands-on experiences for the student, so crucial to scientific reasoning.

Furthermore, faculty noted increased attrition from years past and an inability to accurately ascertain whether students completed all necessary work to an appropriate level, all a result of the shift to more remote instruction. In the end, a number of faculty expressed their opinion that the 2020-2021 academic year was so impacted by this pedagogical change that it was not a true assessment of ISLO3 and likely will remain an outlier in the college's overall history of assessing the skill. That said, there were also a few faculty who saw the experience as illuminating, finding new ways to teach scientific reasoning and the scientific method, new tools to enhance student learning, and potential alternatives to delivering course material in the coming years.

- **Introducing the Skill v. Reinforcing It:** Many of the courses assessed during this cycle introduce students to scientific reasoning; a few others clearly reinforce it. Faculty often noted that difference in their narratives, recognizing when students should not be expected to perform above that introductory level because the course held no prerequisites, and suggesting that they expected the outcomes to improve as students continued on with further science courses. Even within those introductory courses, though, faculty noted how scaffolding the assignments, allowing students to build skill upon skill, and offering more practice in the scientific method would lead to stronger outcomes. Again, they felt the abbreviated lab schedule, caused by the pandemic, impacted their ability to offer those opportunities.

- **Changes to the Assessment Process:** Again mostly because of the pandemic, the faculty had to adjust the tools they used to assess ISLO3. Rather than students developing their own data in a lab, for instance, they were often provided that data. The faculty felt that change may have led to stronger outcomes in certain areas of skill development, but also a more difficult time for faculty to truly assess whether students understood the work they were doing. Some faculty suggested changing the rubric to better align with this new approach, while others suggested clarifying or revising the tool to better align with the rubric. That change also led to specific outcomes that the faculty focused on, including the trouble students had in creating graphs and tables, organizing the data on their own, and then writing their conclusions in clear, well-developed ways.

- **Access:** Faculty expressed concerns that not all students had the same kind of access to technology, such as software applications that help them create graphs and tables, which also may have impacted the outcomes.

- **Student Engagement:** Finally, some faculty believed students still struggled to engage with the work, either due to the remote nature of the course this academic year, the level of interest the students had in the work or the value they saw it held for their academic development, or their willingness to seek out assistance outside of the class, such as through office hours with the instructor or study groups with their peers. Those who could see the purpose and value of the work, as well as those who made the effort to engage outside the class, produced stronger outcomes.

4 Summarize Conclusions Drawn and Action Plan for Improvement

The 2020-2021 academic year proved unique due to the COVID-19 pandemic; however, the faculty and staff at DCC continued its diligent work of assessing the institutional student learning outcomes, and with 523 distinct assessments collected, a number of conclusions could be drawn.

Conclusions are presented below relative to the specific research questions asked:

What impact have curricular or pedagogical changes in courses, programs, or the College in general had on student outcomes regarding ISLO3?

Since the last assessment of ISLO3 in the 2017-2018 academic year, the science faculty have made a number of changes to their pedagogical approaches, including new lab activities, recitation sessions, and textbooks. Therefore, they held a natural interest in seeing whether there was a correlation between those changes and the outcomes of the 2020-2021 assessment. The quantitative data reveals positive change in student outcomes for the areas of Hypothesis and Conclusions, with scores improving from 2.73 to 3.09 in Hypothesis and 2.69 to 2.81 in Conclusions. While the improved average scores in Organization and Results were not statistically significant, it should be noted that the percentage of students meeting the expectations in those two areas also increased, from 66.6% to 73.2% in Organization, and from 59.5% to 65.4% in Results. Therefore, the pedagogical changes appear correlated to stronger student outcomes.

One important change was the additional lab hours added to BIO105 and BIO106. In Fall 2017, the Curriculum Committee approved a change in the labs for those courses to three hours. Faculty believe that additional instructional time has led in part to the positive outcomes of this current assessment.

However, the qualitative data does provide further context that might put a slight wrinkle in those positive results. As the faculty noted, the pandemic forced changes to how they assessed the student work. A main example of that point regards the fact that, while typically students would collect and then analyze their own data in labs, the remote environments and limited lab capacities meant faculty provided that data to the students, which impacted the faculty members' ability to judge the student skill in the same way they might have in the past. Being provided the data may have positively impacted certain areas of the assessment, while also making it more difficult to truly assess others, in particular for the area of Organization. Furthermore, faculty noted that they felt they had to "lead" students more directly in the remote environments than in previous, in-person courses, in essence providing some parts of an assignment that he students would typically do on their own. Finally, the remote environment caused shifts in course outlines and schedules, meaning material was taught out of its usual order, potentially impacted the outcomes depending on when an assessment was performed. So in the end, those positive quantitative outcomes might need an asterisk placed on them until the return to more traditional course delivery modes and further assessments.

Are there differences between the student outcomes in courses in which the ISLO is introduced and those in which it is reinforced? What do comparisons between those courses reveal about efforts to scaffold scientific reasoning skills within courses and programs?

The quantitative data suggests that student outcomes in courses in which ISLO3 skills are reinforced outperform those in courses in which the skills are introduced, with the exception of the area of Hypothesis, in which there was no statistically significant difference. These results appear to show that students are building stronger scientific reasoning skills as they continue to take courses within the program. The lack of statistical significance in the area of Hypothesis might provide an area of focus for faculty teaching in the courses that reinforce the ISLO, but it should be noted that there was still slight improvement.

An important point of context to this outcome, though, is that the introductory courses are often taught to non-science majors, while the other courses typically enroll mostly, if not all, science majors. Faculty believe that difference would clearly impact the outcomes, and that future assessments should differentiate the data between majors and non-majors. Further, some introductory courses might not be the most appropriate places to assess all the skills the rubric lists; for instance, Organization is not as relevant for non-major courses as it would be for the major ones. As we plan for the 2023-2024 cycle, faculty will need to discuss ways to plan the assessment to account more clearly for those types of differences.

The faculty did make clear that they believe offering students the opportunities to strengthen their scientific reasoning skills in the introductory courses—by breaking assignments down into parts and allowing students to build their knowledge piece by piece, and by offering avenues through which to further practice the scientific method—should help to continue this positive trend of stronger outcomes as the skills are reinforced. However, they also noted that this particular academic year made providing those opportunities more difficult.

What is the relationship between the high school a student attended/graduated from and the outcome in the assessment of that student's skill in ISLO3? What is the relationship between a student's high school GPA and the outcome in the assessment of that student's skill in ISLO3?

Faculty often desire a clearer understanding of the academic background of the students in their classes in order to present the material of their courses in the most effective ways. The faculty in this assessment were interested in learning about the specific high schools the students attended to ascertain if any meaningful relationship between the outcomes and those schools could be revealed. Institutional Research (IR) made clear that separating out individual high schools was likely to only provide descriptive statistics if the sample sizes were above 20, which was not the case for most high schools; however, again, that data is provided in Appendix E for review. Rather than look at each students' high school, IR gathered data on students attending Dutchess and Putman County schools and compared that data to outcomes from students who graduated from other schools outside the region. While the demographic sample included high schools from outside New York, outside the United States, and even some homeschooled and GED students, none of the sample sizes in those areas were sufficient to draw conclusions. In the end, results from the comparison between Dutchess and Putnam schools and those in New York

outside those counties revealed no significant differences. Future assessments may need to rethink the first question above to better frame it in such a way as to be able to truly gather the data the faculty desired.

However, significant results were derived from the comparison between a student's high school GPA and the outcomes of the assessment. As might be expected, the stronger the student's high school GPA, the stronger the assessment outcome. Students with a 3.00 or above high school GPA outperformed those with lower GPAs across the board. This information should be helpful for advisors as they look for the most appropriate science courses to place students when they enroll, as well as how to sequence courses (for instance, suggesting a Math course before enrolling in particular science courses); for student services, as it looks to enhance academic supports and target the students most in need of them; and for faculty, who might want to receive this information at the start of each semester so that they have a better snapshot of the skill level of the students in their classes.

General Conclusions:

The COVID-19 pandemic, as has been noted above, had a clear and distinct impact on this year's assessment of ISLO3. Faculty felt the changes to course delivery, and the pedagogical changes those changes necessitated, make it more difficult to truly compare this cycle to others, as was hoped. The pandemic created potential access discrepancies between the students that may not exist when classes and labs can be held fully on campus, and faculty expressed clear concern that student engagement with the work suffered from the remote environments, which meant less face time between students and instructors, fewer opportunities for students to ask questions and practice their skills, and more barriers for students to overcome in order to gain the assistance they may need. The hope is that future assessments occur after those barriers have been lifted.

Result/Conclusion	Recommendation for Action
Student outcomes from 2020-2021 outperformed those from 2017-2018 in Hypothesis and Conclusion, but there were no significant differences in Organization and Results.	Relevant departments continue to discuss the pedagogical practices and changes that have had the greatest positive impact on student outcomes. Workshops or cross-departmental meetings to consider further changes to improve outcomes in all courses connected to ISLO3.
Student outcomes in courses in which ISLO3 skills are reinforced outperformed those in courses in which the skills are introduced, with the exception of Hypothesis, for which there was no significant difference.	For the 2023-2024 assessment of ISLO3, differentiate between courses for science majors and those for non-majors. Faculty continue to scaffold assignments, particularly for introductory courses, but also stress student self-assessment as part of the scaffolding of ISLO3 skills, helping them see their own areas of strengths and weaknesses.
There is a correlation between high school GPA and student outcomes on the assessment. Students with stronger high	Consult with ACT Center to assist with student placement in science courses and to reconsider sequencing of courses (including

school GPAs (≥3.00) outperformed those with lower GPAs (≤2.99).	when students should take courses that might support their success in science courses, such as Math classes). Reconsider other academic support for students in science courses, such as workshops supported by the ACT Center (with faculty input) or the Math & Science Center, as well as the potential for offering courses such as BIO001 (possibly in remote environment).

5 Recommendations for Resources Needed to Implement Action Plan

Recommendation/Action Item	**Potential Resources**
Relevant departments continue to discuss the pedagogical practices and changes that have had the greatest positive impact on student outcomes. Workshops or cross-departmental meetings to consider further changes to improve outcomes in all courses connected to ISLO3.	Improvement of Instruction or Assessment Grants to support faculty workshops/meetings, particularly to compensate part-time faculty participation. FAL and/or departmental representatives could lead these discussion.
For the 2023-2024 assessment of ISLO3, differentiate between courses for science majors and those for non-majors. Faculty continue to scaffold assignments, particularly for introductory courses, but also stress student self-assessment as part of the scaffolding of ISLO3 skills, helping them see their own areas of strengths and weaknesses.	FAL, Associate Dean of Academic Affairs, and relevant faculty work with Institutional Research to prepare for the 2023-2024 assessment cycle by considering different modes of data collection and analysis. FAL and relevant faculty report out to departments about best practices that have led to student success in ISLO3.
Consult with ACT Center to assist with student placement in science courses and to reconsider sequencing of courses (including when students should take courses that might support their success in science courses, such as Math classes). Reconsider other academic support for students in science courses, such as workshops supported by the ACT Center (with faculty input) or the Math & Science Center, as well as the potential for offering	FAL and Associate Dean(s) of Academic Affairs meet with ACT Center staff to discuss impact of using high school GPA to assist in student registration. Additional resources to the Math & Science Center to take on academic support previously provided by the Academic Services Center for students in science classes. AHBS faculty needed to update and offer BIO001. Potential training of said faculty to offer the course in non-traditional modalities.

courses such as BIO001 (possibly in remote environment).	
FAL to update PCC regarding status of these actions steps at the PCC meetings on November 19, 2021, and March 10, 2022.	

Appendix A: ISLO3 Rubric

ISLO3: Scientific Reasoning Rubric

Students will apply the Scientific Method, develop hypotheses, analyze results, and draw conclusions.

Indicators	Exceeds expectations 4	Meets expectations 3	Partially meets expectations 2	Does not meet expectations 1
Hypothesis/Goals/Purpose: Constructs a testable hypothesis or sets or identifies goals based on the question or problem	Hypothesis/ Goal/Purpose is skillfully stated and clearly addresses the question/problem/theory being studied	Hypothesis/Goal/Purpose is stated and adequately addresses the question/problem/theory being studied	Hypothesis/Goal/Purpose is stated but it does not accurately address the question/problem/theory being studied	Hypothesis/Goal/Purpose is missing or has no relevance to the question/problem/theory being studied
Data Organization: Acquires/organizes/critiques observations and other evidence in a way that is useful	Appropriate methods for acquiring/organizing/critiquing qualitative and quantitative data are skillfully selected and applied	Appropriate methods for acquiring/organizing/critiquing qualitative and quantitative data are adequately selected and applied	Appropriate methods for acquiring/organizing/critiquing qualitative and quantitative data are not adequately selected and applied	Appropriate methods for acquiring/organizing/critiquing qualitative and quantitative data are missing/inaccurate
Analyze Results: Evaluates data obtained for accuracy and completeness	Results are skillfully analyzed for accuracy and significance. When appropriate, results are displayed using the correct graphical organizer/tool.	Results are adequately analyzed for accuracy and significance. When appropriate, the results are displayed using a graphical organizer/tool.	Results are inadequately analyzed and not all data are included.	Results are not correctly analyzed/mentioned.
Draw Conclusions: Interprets data/observations and makes appropriate conclusions based on evidence	Based on evidence, insightful conclusions are drawn/applied and errors/inaccuracies are explained.	Based on evidence, reasonable conclusions are drawn/applied but conclusions lack detail or information.	Conclusions lack substantial/supporting evidence.	No conclusion is made or is incorrect.

Appendix B: Sample Instruments Used to Collect Data

BIO106: General Biology II

See TracDat>BIO106>Course Planning>Results Summary/Analysis>Spring 2021 – contains a Power Point presentation of the BIO106 lab used for the assessment.

MLT106: Immunohematology/Serology

Assessment Method: Each student (n = 23) was provided with an unknown red blood cell suspension and serum sample. They were instructed to perform the following technical tests:

Red Blood Cell Suspension Sample
- Forward typing
- Rh typing
- Direct Antiglobulin testing
- Crossmatch with serum

Serum Sample
- Reverse typing
- Antibody screening
- Antibody panel

All student work was recorded on a "Grouping, Screening, Compatibility Worksheet" with conclusions recorded on an exam sheet. Students were also asked to state the purpose of performing the individual technical tests and the clinical significance of the identified antibody.

Appendix C: Student Performance on Assessment Disaggregated by Program

	3.1 Hypothesis/Goals/Purpose				3.2 Data Organization				3.3 Analyze Results				3.4 Draw Conclusions			
	AY1718		AY2021		AY1718		AY2021		AY1718		AY2021		AY1718		AY2021	
MAJOR	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
ACC	2	100.0%	2	100.0%	2	100.0%	2	100.0%	2	50.0%	2	100.0%	2	50.0%	2	100.0%
ARC	1	0.0%	1	100.0%	1	100.0%	1	0.0%	1	0.0%	1	0.0%	1	0.0%	1	0.0%
ASP	1	0.0%	3	33.3%	1	0.0%	3	33.3%	1	0.0%	3	66.7%	1	0.0%	3	33.3%
AVI	11	81.8%	1	100.0%	11	81.8%	1	100.0%	11	81.8%	1	100.0%	11	54.5%	1	0.0%
BAT	29	62.1%	13	69.2%	29	79.3%	13	92.3%	29	58.6%	13	76.9%	29	51.7%	13	84.6%
BUS	5	60.0%	6	83.3%	5	100.0%	6	50.0%	5	80.0%	6	33.3%	5	80.0%	6	50.0%
CNS	1	100.0%	3	100.0%	1	0.0%	3	100.0%	1	100.0%	3	100.0%	1	100.0%	3	33.3%
COM	12	50.0%	10	70.0%	12	66.7%	10	50.0%	12	41.7%	10	40.0%	12	50.0%	10	30.0%
CPS	8	62.5%	7	85.7%	8	37.5%	7	85.7%	8	37.5%	7	85.7%	8	62.5%	7	85.7%
CRJ	5	40.0%	3	66.7%	5	40.0%	3	33.3%	5	60.0%	3	66.7%	5	40.0%	3	66.7%
CRT	34	41.2%	20	75.0%	34	79.4%	20	75.0%	34	64.7%	20	45.0%	34	47.1%	20	50.0%
ECH	5	80.0%	8	12.5%	5	100.0%	8	100.0%	5	60.0%	8	100.0%	5	60.0%	8	37.5%
EDB	3	33.3%	2	100.0%	3	33.3%	2	100.0%	3	33.3%	2	50.0%	3	33.3%	2	50.0%
EDH	9	66.7%	8	75.0%	9	77.8%	8	50.0%	9	100.0%	8	50.0%	9	77.8%	8	62.5%
EDL	6	66.7%	2	100.0%	6	100.0%	2	50.0%	6	100.0%	2	0.0%	6	66.7%	2	0.0%
EDP	1	100.0%	2	50.0%	1	100.0%	2	50.0%	1	100.0%	2	100.0%	1	100.0%	2	50.0%
EDX	1	100.0%	2	50.0%	1	100.0%	2	50.0%	1	100.0%	2	100.0%	1	100.0%	2	50.0%
EED	10	40.0%	11	81.8%	10	40.0%	11	72.7%	10	40.0%	11	72.7%	10	50.0%	11	54.5%
ELT	2	0.0%	3	33.3%	2	0.0%	3	66.7%	2	0.0%	3	33.3%	2	50.0%	3	33.3%
ENR	19	73.7%	21	85.7%	19	73.7%	21	71.4%	19	52.6%	21	66.7%	19	84.2%	21	61.9%
ESW	41	41.5%	22	81.8%	41	39.0%	22	72.7%	41	41.5%	22	54.5%	41	34.1%	22	63.6%
FIR	1	100.0%	1	100.0%	1	100.0%	1	0.0%	1	100.0%	1	0.0%	1	0.0%	1	0.0%
GSP	159	57.2%	127	72.4%	159	65.4%	127	81.9%	159	57.9%	127	69.3%	159	58.5%	127	68.5%
HMS	28	28.6%	20	65.0%	28	67.9%	20	65.0%	28	67.9%	20	50.0%	28	35.7%	20	50.0%
INM	3	66.7%	1	100.0%	3	66.7%	1	100.0%	3	33.3%	1	0.0%	3	33.3%	1	0.0%
LAH	100	59.0%	40	80.0%	100	67.0%	40	62.5%	100	56.0%	40	65.0%	100	63.0%	40	65.0%
LAM	3	100.0%	1	100.0%	3	66.7%	1	0.0%	3	66.7%	1	0.0%	3	100.0%	1	0.0%
LAX	166	62.0%	77	76.6%	166	66.3%	77	64.9%	166	57.8%	77	64.9%	166	53.6%	77	63.6%
MLT	34	73.5%	35	85.7%	34	70.6%	35	85.7%	34	73.5%	35	77.1%	34	70.6%	35	80.0%
NUR	2	50.0%	1	0.0%	2	50.0%	1	0.0%	2	100.0%	1	0.0%	2	100.0%	1	0.0%
PAL	4	100.0%	17	88.2%	4	100.0%	17	76.5%	4	75.0%	17	82.4%	4	100.0%	17	76.5%
PAR	1	100.0%	2	50.0%	1	100.0%	2	100.0%	1	100.0%	2	50.0%	1	100.0%	2	50.0%
PDC	3	100.0%	3	0.0%	3	100.0%	3	66.7%	3	100.0%	3	0.0%	3	66.7%	3	0.0%
PFA	4	50.0%	1	100.0%	4	25.0%	1	0.0%	4	25.0%	1	100.0%	4	50.0%	1	100.0%
UND	32	75.0%	43	83.7%	32	71.9%	43	79.1%	32	81.3%	43	69.8%	32	75.0%	43	79.1%
VAT	12	50.0%	4	50.0%	12	66.7%	4	50.0%	12	50.0%	4	50.0%	12	58.3%	4	25.0%
Total	758	58.7%	523	75.5%	758	66.6%	523	73.2%	758	59.5%	523	65.4%	758	57.3%	523	63.9%

Appendix D: Faculty Narrative Data

AST131:SOLAR SYSTEM ASTRONOMY

Semester Assessed: 2020 Fall

Action Type: completed

The rubric average for 10 students assessed was 2.9. Overall, considering this was a on-campus lab semester during a pandemic, with sections divided into two groups, a 2.9 out of 4 is acceptable for an introductory, pre-requisite free, lab-based course for non-majors. The drawing conclusions aspect of the rubric scored the least averaging 2.5 out of 4, but otherwise, students have done reasonably well on this lab. This aspect can improve as students are exposed to more lab work during their future coursework. (12/29/2020)

Assessment Method: Kepler's Laws lab was used to assess Scientific Reasoning.

AST132:ASTRONOMY OF STARS & GALAXIES

Semester Assessed: 2021 Spring

Action Type: completed

The rubric average for 9 students assessed was 2.67. Overall, a 2.67 out of 4 is on the lower side, even for an introductory, pre-requisite free, lab-based course for non-majors. Considering this was an on-campus lab semester during a pandemic, with sections divided into two groups, one would have hoped for the rubric average to approach 3, but this fell a bit short. The analysis section aspect of the rubric scored the least averaging 2.0 out of 4, but otherwise, students have done reasonably well on this lab. Hopefully, this aspect can improve as students are exposed to more lab work during their future coursework. Also, more in-person lab meetings during a regular semester (11 or 12 as opposed to 5 or 6 during the pandemic) would help in dealing with the math or analysis section of the lab reports better. Students at this level need more help with Math as there are no pre-requisites, and in-person meetings certainly help. (05/17/2021)

Assessment Method: Students performed the Angular Measurement experiment on campus and submitted a written lab report. Their goal was to learn this method to estimate the size of distant objects and then compare with the actual size by measuring it directly across the object, to then find the percent error and present the analysis.

BIO103:HUMAN BIOLOGY

Semester Assessed: 2021 Spring

The students were able to develop hypotheses, analyze results, based on activity and pulse rate, and draw conclusions as well as plotting graphs to demonstrate understanding of oxygen saturation. (06/02/2021)

**

Semester Assessed: 2021 Spring

The majority of students were able to construct a testable hypothesis based on a the given problem. Students were also effective in collecting the correct forms of data. Some students did struggle with the organization of data into graphs and therefore were not effective in drawing appropriate conclusions based on the data that was collected. Next semester, more time will be spent on organizing and analyzing data. (06/01/2021)

Assessment Method: Virtual Laboratory Experiment

**

Semester Assessed: 2012 Fall

Action/Modification: In the future, we will be planning normal course delivery methods and assessments for BIO103. The method used during this assessment cycle most likely will be changed or modified by the next cycle. (05/27/2021)

Action Type: minor course update

Overall, students had the greatest success in formulating a hypothesis. Most students met or exceeded this indicator The data table was given to them, so the student just needed to fill in the information. This does not accurately demonstrate the students own ability to organize data, so although most scored high in this indicator, it is not a true evaluation of their skill. In science labs, typically students are given the table to complete as they are conducting an experiment to organize data. This part of the lab needs to be re-worked to fit the rubric or the rubric needs to be re-worked to fit the scientific method more appropriately. If students seemed to analyze the results correctly, those same students tended to be able to draw appropriate conclusions from their results.

This lab was modified to fit the online modality due to COVID-19. BIO103 is typically taught either face-to-face or hybrid so students have a more authentic ability to explore the scientific method. In normal circumstances, students have worked with the scientific method in previous labs so they have practiced the skills associated with ISLO3 prior to the rubric assessment. Unfortunately since of the unprecedented times, students may not have had as much exposure as in prior assessments. (05/27/2021)

Assessment Method: A lab simulation created by Carolyn Rounds was used during this assessment period. The simulation mirrored the actual lab performed in class. The lab handout needed to be modified slightly to match the simulation. Both the simulation and handout were shared with all BIO103 faculty to be used during the Spring 2021 semester.

**

Semester Assessed: 2021 Spring

Action/Modification: The increased use of scientific method development in lab activities could lead to more students exceeding expectations (05/21/2021)

Action Type: no action needed

Students were generally able to to apply the scientific method in an appropriate manner for the level of the course. The development of the skills tested here comes after continued repetition and practice. For an introductory science class the students performed well in the expression of their skills (05/21/2021)

**

Semester Assessed: 2021 Spring

Action Type: no action needed

I noticed some students had difficulty in following the steps of the scientific method. It may be related to the fact that we covered the scientific method during the second week of classes and assessed ISLO 3 during week 12. Another important factor is that we are not doing one of the labs in which students directly apply the scientific, due to being fully remote because of the COVID19 pandemic. Therefore, students had one less opportunity to apply scientific reasoning. That emphasizes the need to hold in-person labs as soon as it is safe to do so.

Even though scientific reasoning is part of most lab activities, I am under the impression that labs in which we follow the steps of the scientific method are better in terms of promoting the development of scientific reasoning skills. (04/27/2021)

Assessment Method: Due to being fully remote, we used an experiment simulation from which students would obtain data to fill out a worksheet. The worksheet required students to formulate hypotheses, organize and present the data obtained through the simulation and draw conclusions.

**

Semester Assessed: 2021 Spring

Action Type: minor course update

Many students reported to me that they did not know what a bar graph was. (04/26/2021)

Assessment Method: Students watched a power point presentation of a lab experiment. They recorded the data obtained and then constructed a Bar graph to analyze the results.

**

Semester Assessed: 2021 Spring

Action/Modification: I believe it may be helpful to separate the lab atlas portion of the lab from the simulation for online purposes . The amount in the lab seemed to discourage students and overwhelm them. Separation may be useful in dividing the workload and building the foundation of knowledge with more feedback for the simulation. (04/17/2021)

Action Type: completed

Those students that attempted the assignment had a good grasp of the main content of the respiratory assignment. They almost all came to the appropriate conclusions though they did reach out throughout the assignment asking for assistance in utilizing the virtual simulation and working through the lab atlas. The results of the analysis of those that completed lab indicate that they understood the scientific method and how to apply it through earlier teaching modules. They struggle slightly with graph making but are learning through this class the process of analysis and conclusion formation. (04/17/2021)

BIO104:ENVIRONMENTAL BIOLOGY

Semester Assessed: 2021 Spring

Action/Modification: Future labs will again all be in-person, allowing me more time to introduce an additional lab addressing the use of the Scientific Method. (04/16/2021)

Action Type: minor course update

Students did not do well on the formulation of a hypothesis . I believe this is a direct result of the need for remote learning this semester.

Thus, while I did cover the scientific method in the remote lecture part of the course, they had very little time conducting actual experiments. As a result of the limited in-person labs, the students did only 1 lab where they had to formulate a hypothesis. They did much better on analyzing the data they did get because I asked them to construct a graph which they had experience with in high school. (04/16/2021)

Assessment Method: First, the students did a lab where they learned how to conduct 6 different chemical tests on a water sample. Then, on a subsequent lab, they were taken to 3 different locations (stream, swamp, and the river). They started out by individually proposing a hypothesis predicting which location would have the higher level of dissolved carbon dioxide in the water. They then, working as a team, conducted the 6 chemical tests, including the dissolved carbon dioxide test. They recorded their results at each location for the 6 chemical tests. They then individually graphed the results for the dissolved carbon dioxide and and wrote a conclusion.

Action/Modification: Future labs will again all be in-person, allowing me more time to introduce an additional lab addressing the use of the Scientific Method. (04/16/2021)

BIO105:GENERAL BIOLOGY I

Semester Assessed: 2020 Fall

Action Type: no action needed

- The faculty involved in this assessment met online 1/7/2021 to discuss our findings as a group. We each summarized our own findings, identified common trends, and provided possible explanations for our trends and/or findings. It was a challenge to write this narrative without the BIO105 data on hand, so I waited to get that data to complete this narrative.

- Overall, most students met or exceeded expectations for Indicators #1: Hypothesis Development and #4: Drawing Conclusions. Explanations for this outcome included that these tasks have been reinforced more than the others throughout the semester.

- Overall students seemed to struggle the most with indicators #2: Data Organization and #3: Analyze Results. To assess indicator #2, students were asked to identify a tool they could use to organize the data they planned to collect. Many students cited an analysis tool, such as a graph, rather than an organizational tool. Although graphs can also be used to organize data, graphs are usually created for analysis after the data is organized within a table. A possible explanation that came up is that perhaps using a data table is not emphasized enough as a tool used for organization, rather it is often already created for students or is of lesser importance in the lesson because more time is needed to explain graphing, which seems to be more of a challenge for our students. To assess indicator #3, students were asked to create a graphical representation of given data along with identifying independent and dependent variables. Possible explanations noted for the indicator #3 outcome is that the that students were asked to use 3 variables in their hypothesis, but the graph only needed two of these, which might have caused confusion for students. Also, with remote learning we did not have the laboratory time in which students have in-person instructional time to create a graph. Another possibility is that many of the lab simulations used this semester did not require student to create graphs from scratch. In our discussion, indicator #3 was noted by most faculty as being the most challenging for students.

- It seems unexpected that students did not perform well for indicator #3: Analyze Results yet performed well for #4: Draw Conclusions. It would seem that these two indicators should be directly correlated. However, the data given to students was not large, which made it easy for students to use the data given to draw conclusions rather than using the graph they created. This is problematic because we would like for students to use the graphs they create to draw conclusions, and not solely rely on the data table.

- Another thing that was mentioned, is that lack of engagement might have negatively impacted scores. The assessment was completed during the last two weeks of the semester, when students might have already checked out. A recommendation would be to conduct the assessment earlier in the semester.

- The preliminary data collected from IR seems to support most of our discussion. Fall 2020 BIO 105 students performed better at indicators #1 and #4, with more students meeting or exceeding expectations with indicator #1 (83.9% vs 75.8%). Students struggled the most with indicators #2 and #3. Only 58.1% of students met or exceeded expectations for indicator #2, and it was slightly higher for indicator #3 with 62.9%. During our conversation, indicator #3 was cited to be the most challenging for students. After looking at the IR data, #2 was the most challenging, however, the difference was small.

- Looking back at the previous BIO105 assessment (Fall 2017-2018), Fall 2020 BIO105 students show large improvements in all indicators. In Fall 2017, 49.1% of students met/exceeded expectations for indicator #1, 47.9% for indicator #2, 40.2% for indicator #3 and 44% of indicator #4. Whereas in this

assessment, 83.9% of students met/exceeded expectations, 58.1% for indicator #2, 62.9% for indicator #3 and 75.8% for indicator #4. However, there are important variables that must be taken into consideration. First, this assessment was done with remote asynchronous courses, whereas in 2017, students were in person. Also, the tool used in 2017 was in a different format.

- In conclusion, no action was recommended as Fall 2020 was not a true representation of an actual semester.

Assessment Method: Ecology related case study broken into two parts on Blackboard. Part 1 provided background information and asked for hypothesis and data organization development. Once part 1 was completed, Part 2 was accessible and provided the same background information with data requiring students to analyze the data and to draw conclusions. The case study was completed late in the semester within the last module, as a outside classwork. Students were given 3 – 5 days to complete the two parts, with each part being completed in one sitting. Faculty made the assessment worth points on their grade, but the type of grade varied from being part of the final exam, to a quiz or assignment grade.

**

Semester Assessed: 2020 Fall

Action/Modification: Difficult to draw conclusions due to the switch to remote learning. A more reliable result may be collected by assessing the students in the beginning of the course as well as at the end to track student progress towards learning targets over the length of the semester. (01/06/2021)

Action Type: further analysis

Results were mixed. Students demonstrated success with creating a hypothesis and drawing conclusions. They struggled with designing an experiment and graphing the data. These shortcomings may be do to the switch to remote learning and the loss of in person laboratory time. (01/06/2021)

Assessment Method: Graded Assignment given in the last week of the course.

**

Semester Assessed: 2020 Fall

Action Type: further analysis

I think in many ways, students struggled with the change to a purely online course. Those students who took advantage of hours office for extra help, as well as those who engaged in forming an online, student led, study group, tended to do better. (01/04/2021)

BIO106:GENERAL BIOLOGY II

Semester Assessed: 2021 Spring

Action Type: no action needed

ISLO grading notes and student feedback: There was positive feedback about this assignment. It was meaningful and relevant to many of the students.

Student work was graded using DCC ISLO 3 – Scientific Reasoning Rubric, and the following results were noted.

Part I: Hypothesis/Goals/Purpose

- 73% (43/59)met expectations (scored 3 or 4)
- 27% (16/59) did not meet expectations (scored 0, 1 or 2)
- Average score: 3.13
- Students who did not meet the expectations did the following
- Some students did not identify the variables correctly and couldn't write the hypothesis correctly.
- Some students looked ahead at the results and made a hypothesis that way. The hypothesis was written in the past tense. Some students looked at the data first and were highly specific with their hypothesis (medical histories). Maybe in the future, we should give Part I of the assessment as an adaptive release.

§Part II: Data Organization

- 90% (53/59)met expectations (scored 3 or 4)
- 10% (6/59) did not meet expectations (scored 0, 1 or 2)
- Average score: 3.5
- As we already gave tables to organize data, most of them could get 3's and 4's. (we do this in a regular lab as well) Requiring students to create their own data-collection tables is a good way to ensure that students have a deeper understanding of the experiment/ study.
- Most were able to extensively expand the data to include the medical histories in detail.

§Part III: Analyze Results

- 76% (45/59)met expectations (scored 3 or 4)
- 24% (14/59) did not meet expectations (scored 0, 1 or 2)

- Average score: 3.03
- Students used both line graphs and bar graphs.
- Some of the students reveres the axes (independent vs. dependent variables).
- When they had a very compact scale- the students were not able to analyze the trend and did not see a difference between the groups.
- A few of the students analyzed the medical histories rather than the graph. (we asked them to do both)
- Some students did not have the software application in their devices needed for creating graphs and refused to create them by hand.

§Part IV: Draw Conclusions

- 73% (43/59)met expectations (scored 3 or 4)
- 27% (16/59) did not meet expectations (scored 0, 1 or 2)
- Average score: 3.13
- Some of them did not make the conclusion relate to THEIR hypothesis but rather restated their data analysis.
- As some of them did the graphs wrong, they were not able to see correct trends to make a reasonable conclusion. Some missed discussing risk factors in conclusion.

Research Questions.

1. What impact have curricular or pedagogical changes in BIO 106 General Biology II course, in general, had on student outcomes regarding ISLO3.

Due to the COVID-19 pandemic, all labs were conducted online via simulations or as post-lab activities. Students were not receiving face-to-face teaching and access to laboratory facilities. We used online simulations provided by a vendor, "Labster," video labs, and post-lab activities to achieve our curriculum goals.

§Indicator II: Data Organization

In this assessment project, students did not conduct physical experimentation and manual collection of data.

Instead, we provided students with data as medical records and gave a primary data collection table format. These may be the reasons for better performance by students for indicator II than all other indicators.

§Indicator III: Analyze Results

We could not implement all graphing and analysis we do in a regular semester; this might have contributed to the lesser performance for Indicator III compared to all other indicators.

"Labster" simulations we used for online instruction did not make students create their own graphs, so we may have to look at other vendors with more options to meet our goals if we have to continue with on-line instruction for labs.

Some students did not have the technology needed to successfully complete this part.

General thought:

Overall the virtual laboratory tools and related activities were as equally effective as traditional laboratories in increasing student knowledge and understanding. The main drawback is that they do not provide hands-on experience of individual techniques or training in the use of equipment. Students also miss the experience of analyzing and interpreting incorrect or uncharacteristic data and learning by making mistakes.

To be successful in an online environment, students need the technology to access the resources. I think college should make laptops installed with essential software a requirement for college education. College should also provide financial support options such as borrowing a loan or receiving an outside scholarship, or getting it via financial aid to cover the cost.

2. Are there differences between the student outcomes in courses in which the ISLO is introduced (BIO 105 - General Biology - I) and those in which it is reinforced (BIO 106 - General Biology - II)? What do comparisons between those courses reveal about efforts to scaffold scientific reasoning

Overall, BIO 106 student performance was better than BIO 105 students. In BIO 106, students reviewed the scientific method during the semester by doing worksheets and practicing experiment scenario questions. Although we could not do all assigned labs in full rigor, we covered most of them with available resources. This might have contributed to the overall better performance.

Initial comparison with BIO 105 data shows that performance level has decreased for the first indicator - The Purpose and Hypothesis. This may be because there was more than one independent variable in the study, and students were also asked to determine the risk factors that affect the likelihood of hypertension. Some students might have got confused and investigated only the risk facts.

For indicator IV, the decrease may be because we could not do all assigned labs, as usual, this semester. Lack of practice may be a contributing factor. We need to explore more possibilities to implement all regular BIO 106 labs in remote learning.

As we review the curriculum, it is essential to continually check how we introduce lab-based practical experiments to students through online delivery, especially when online instructional modality is becoming more acceptable in lab-based courses. We should integrate virtual laboratory tools in traditional laboratory sessions within curricula to continue using the skills we developed during covid times.

Assessment Method: I. Assessment Tool: (planning, design ,delivery)

All BIO106 classes offered labs through remote modalities during the current assessment cycle so that we couldn't use the usu al labs for assessment. We developed a new assessment tool based on a free McGraw Hill lab simulation. We couldn't assign th e original simulation as it was running in Adobe Flash, which expired last year. A PowerPoint was created with needed information and was used as a substitute for simulation. Students did not collect physical data by doing lab experimentation; instead, the data was provided in the form of medical records. Students were asked to collect needed data from them.

Using the assessment tool, students were asked to study "The Effect of Age and Gender on Blood Pressure applying the scientif ic method and determine the risk factors that affect the likelihood of hypertension. We implemented the assessment activity via Blackboard during the 10th wee k of the course after covering the topic of the cardiovascular system. Students were given two weeks to complete the task.

BIO115:ANATOMY & PHYSIOLOGY FOR PAR

Semester Assessed: 2020 Fall

Action Type: completed

The students were assessed on their third scientific reasoning assignment. It was based on the Muscle Physiology lab.

A fairly successful performance by majority of the students.

Data representation could have been better. If the labs were face-to-face, and with the opportunity for immediate feedback, this portion could have been better too. (12/16/2020)

Assessment Method: Assessed on a lab report relating to a PowerPoint simulated lab on Muscle Physiology.

BIO131:ANATOMY AND PHYSIOLOGY I

Semester Assessed: 2021 Spring

Action Type: completed

Overall a good understanding and application of scientific reasoning were demonstrated by the student s.

Graphing of data and analysis of data by some students could have been better. (05/07/2021)

Assessment Method: A lab report on a simulated lab on Muscle Physiology was used for the assessment.

Faculty member will enter information about assessment method when reporting results.

BIO132:ANATOMY AND PHYSIOLOGY II

Semester Assessed: 2021 Spring

Action Type: minor course update

21 of 27 students submitted reports (78%).

Assignment: Lab Report with rubric and suggested readings given (Topic: : Design an experiment to test for the enzymatic digestion of starch to its monomer(s)

Class average for

Hypothesis: 2.5

Data Organization: 3.3

Analyze Results 2.9

Conclusions 3.2

A '4' rating reflects recognition that the experiment had two parts; 1) to demonstrate with one reagent the presence of starch AND 2) to demonstrate enzymatic digestion to a different molecular end-product using a different reagent. Descriptions in all categories were detailed giving explanations of variables that were needed to test their hypothesis.

Students given a '3' rating adequately described the first part of the experiment (it was NOT starch) but failed to refer to positive proof (it IS glucose). Explanations concentrated only on the main purpose of testing enzyme effect on starch but didn't include variables affecting enzyme activity,

Many students described in generalities instead of details -e.g., sugar instead of the specific molecule, glucose.

Writing style:

a) Students today are used to text and Twitter messaging where brevity is emphasized. Many papers were written without paragraphs or written in bulleted form. Students should discouraged in this format and essay writing should be emphasized.

b) Most lab manuals are not good models for scientific writing because in manual Methods sections students see long lists of materials to be used. To encourage procedural explanation and discourage list-making, more time should be spent showing primary science journals as role models. Time, however, is at a premium in A&P where labs are still two hours.

Reading comprehension:

The biggest difficulty is the inability (or refusal) to pay attention and/or following directions. Instructions to students were quite clear yet those scoring below '3' failed to follow them. (05/15/2021)

Assessment Method: Lab Report:

Student instructions: Design an experiment to test for the enzymatic digestion of starch to its monomer(s). A rubric and suggested references were given (Digestive Physiology Lab, text chapters 23, 24., Blackboard posted lab videos, study guides, tutorials.

BIO231:HUMAN ANATOMY & PHYSIOLOGY I

Semester Assessed: 2020 Fall

Action Type: further analysis

Most students appeared to be successful in stating hypotheses and organizing their data (either meeting or exceeding expectations). However, many students struggled with describing their results/creating clear graphs and with giving clear, detailed explanations of their conclusions. (12/22/2020)

Assessment Method: Assessment method was a Lab Report that was written at the end of the semester based on an experiment that students had performed earlier in the semester and already collected data for in a virtual lab simulation. Students had been working in small groups analyzing the results of other experiments throughout the semester by co-authoring Lab Write-ups (mini lab reports) on select experiments, with each student's role in the section that they were responsible for writing shifting with each Lab Write-up until they had an opportunity to author every section of the Lab Write-up at least once. For this reason, students were given the option to work with their same group to co-author their lab report, or to work individually. Of the 23 students assessed, 10 opted to write their Lab Report with their group. Groups were made up of 2 or 3 students. Each group member chose the sections of the report that they would directly author from a set of options prepared by myself, but all group members were aware that they would be responsible for giving each other feedback on the sections they did not write, and for making any suggested changes. For that reason, all group Lab Reports earned a single grade even though the report was co-authored. Since students had had several opportunities to practice giving feedback and making recommended changes with their group all semester, I feel that the final outcome of each Lab Report accurately reflects the ability to meet the criteria of this ISLO attained by all group members who contributed to the Lab Report.

MLT106:IMMUNOHEMATOLOGY/SEROLOGY

Semester Assessed: 2020 Fall

Action Type: no action needed

This was a unique semester, considering that due to COVID-restrictions, students had the opportunity to perform less than half of the hands-on laboratory activities that they would complete in a normal semester. This limited the number of times that the students could "practice" skills and the organization of collected data. That being said, 22/23 (95.6%) of the students met or exceeded expectations associated with purpose and data organization. In addition, 20/23

(87%) of the students met or exceeded the anaysis and conclusion components of this ISLO. Perhaps this overall result indicates that there was sufficient opportunities with this abbreviated lab schedule and new/additional lab activities can be incorporated into a "normal" semester to increase the breadth of student experiences. (01/26/2021)

Assessment Method: Each student (n = 23) was provided with an unknown red blood cell suspension and serum sample. They were instructed to perform the following technical tests:

Red Blood Cell Suspension Sample

- Forward typing
- Rh typing
- Direct Antiglobulin testing
- Crossmatch with serum

Serum Sample

- Reverse typing
- Antibody screening
- Antibody panel

All student work was recorded on a "Grouping, Screening, Compatibility Worksheet" with conclusions recorded on an exam sheet. Students were also asked to state the purpose of performing the individual technical tests and the clinical significance of the identified antibody.

This assessment activity was completed late in the semester.

PHS111:WEATHER AND CLIMATE

Semester Assessed: 2020 Fall

Action Type: minor course update

This assessment was done for a fully remote laboratory class. I used a combination of assignments to meet all of the rubric specifications instead of a single assignment. Several students did not submit more than half of the laboratory assignments, so I left those students' assessments blank. (02/18/2021)

Assessment Method: Atmospheric Moisture and Atmospheric Stability laboratory assignments were used from "Exercises for Weather and Climate" by Carbone, 9th Ed.

PHY121:GENERAL PHYSICS I

Semester Assessed: 2020 Fall

Action Type: completed

The rubric average for 21 students assessed was 2.75. Overall, considering this was a on-campus lab semester during a pandemic, with sections divided into two groups and having to complete more than one kind of experiment per meeting, a 2.75 out of 4 is acceptable for an introductory lab-based physics course. The drawing conclusions aspect of the rubric scored the least, averaging 2.5 out of 4, but again, these students are being introduced to labs, and this aspect should become better in the lab-based courses that follow. (12/28/2020)

Assessment Method: Free Fall lab was used for this assessment.

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Semester Assessed: 2020 Fall

Action Type: no action needed

Students in general did okay demonstrating this institutional student learning outcome in their lab report. Some students are not checking comments to learn from their mistakes in this online format. This does not mean the teaching resources are lacking but that some students are new to online learning and had difficulty demonstrating their knowledge of this ISLO. (11/24/2020)

Assessment Method: Lab report was submitted and evaluated according to the rubric for this ISLO.

PHY151:CALCULUS-BASED PHYSICS I

Semester Assessed: 2021 Spring

Action Type: completed

While there were a number of students who dropped the course or never submitted the lab that was used to assess this course, students on average demonstrated that they can form a purpose statement. They on average can write a conclusion based on the evidence. In the past this has been about the same result for the purpose statement and conclusions so students did not get worse at this in the online platform. In general what did suffer was the students ability to collect/organize and display data. In the past, we worked with students quiet a bit in the lab setting in small groups and one on one to help them organize and

display data and calculations they do in the lab so it is readable and that it will help them make their conclusions. I think these numbers are lower this semester because with COVID personal one on one instruction is not possible. Also the social distancing makes it harder for a teacher to see a students work in progress and provide timely feedback on how to improve or get better. This is a first semester/first year course so it is expected that students will get more introduction to this skill as they take more engineering and science courses. It is important that if we wish to continue offering lab based courses that we work with students more on how to develop these skills even if the support we have offered in the past is not possible. (04/19/2021)

PHY152:CALCULUS-BASED PHYSICS II

Semester Assessed: 2021 Spring

Action Type: deferred

It was determined by the program chair and faculty teaching this course that this group of students would not be a good collection of data and that students in the Spring will be used as a data set for this ISLO. The assessment of this ISLO was to be deferred to the Spring 2021 to collect data. (11/24/2020)

Assessment Method: Lab report

Appendix E: Results by Dutchess and Putnam County High Schools

		3.1 Hypothesis/Goals/Purpose				3.2 Data Organization				3.3 Analyze Results				3.4 Draw Conclusions			
HS Name (only Dutchess/Putnam)	**# students**	**% earn 4**	**% earn 3**	**% earn 2**	**% earn 1**	**% earn 4**	**% earn 3**	**% earn 2**	**% earn 1**	**% earn 4**	**% earn 3**	**% earn 2**	**% earn 1**	**% earn 4**	**% earn 3**	**% earn 2**	**% earn 1**
Arlington Senior High School	76	32.9%	50.0%	14.5%	2.6%	31.6%	42.1%	19.7%	6.6%	27.6%	39.5%	26.3%	6.6%	32.9%	34.2%	19.7%	13.2%
Beacon High School	21	38.1%	38.1%	14.3%	9.5%	23.8%	52.4%	19.0%	4.8%	19.0%	57.1%	19.0%	4.8%	23.8%	38.1%	28.6%	9.5%
Brewster High School	1	100.0%				100.0%				100.0%				100.0%			
Carmel High School	9	44.4%	33.3%		22.2%	44.4%	11.1%	22.2%	22.2%	44.4%	33.3%	11.1%	11.1%	33.3%	33.3%	22.2%	11.1%
Dover Jr-Sr High School	14	42.9%	35.7%	7.1%	14.3%	21.4%	50.0%	7.1%	21.4%	14.3%	28.6%	21.4%	35.7%	28.6%	14.3%	35.7%	21.4%
Dutchess BOCES Career & Tech	1		100.0%				100.0%						100.0%				100.0%
Faith Christian Academy	3	66.7%	33.3%			33.3%	66.7%			33.3%	33.3%	33.3%		66.7%		33.3%	
Franklin D Roosevelt HS	41	41.5%	24.4%	22.0%	12.2%	36.6%	36.6%	17.1%	9.8%	36.6%	26.8%	22.0%	14.6%	29.3%	24.4%	29.3%	17.1%
Haldane High School	3	66.7%	33.3%			66.7%	33.3%			33.3%	66.7%			33.3%	66.7%		
John Jay Senior High School	68	45.6%	26.5%	22.1%	5.9%	32.4%	33.8%	23.5%	10.3%	20.6%	41.2%	22.1%	16.2%	30.9%	32.4%	22.1%	14.7%
Mahopac High School	8	37.5%	50.0%	12.5%		37.5%	25.0%	25.0%	12.5%	25.0%	25.0%	25.0%	25.0%	12.5%	37.5%	25.0%	25.0%
Maplebrook School	1	100.0%				100.0%				100.0%				100.0%			
Millbrook High School	8	50.0%	37.5%	12.5%		37.5%	50.0%	12.5%		25.0%	62.5%		12.5%	50.0%	25.0%	12.5%	12.5%
Oakwood Friends School	1			100.0%		100.0%						100.0%		100.0%			
Our Lady Of Lourdes HS	6	50.0%	50.0%			66.7%	33.3%			66.7%	16.7%	16.7%		66.7%	33.3%		
Pawling High School	7	28.6%	42.9%	14.3%	14.3%	42.9%	28.6%	14.3%	14.3%	28.6%	28.6%	28.6%	14.3%	14.3%	28.6%	28.6%	28.6%
Poughkeepsie Day School	1	100.0%				100.0%				100.0%				100.0%			
Poughkeepsie High School	16	25.0%	43.8%	18.8%	12.5%	25.0%	37.5%	25.0%	12.5%	18.8%	43.8%	6.3%	31.3%	12.5%	31.3%	31.3%	25.0%
Red Hook Central High School	2	100.0%					100.0%			50.0%	50.0%			100.0%			
Rhinebeck Central School	5	60.0%	20.0%		20.0%	20.0%	60.0%	20.0%		20.0%	40.0%	20.0%	20.0%	20.0%	40.0%	20.0%	20.0%
Roy C Ketcham Senior HS	50	38.0%	36.0%	14.0%	12.0%	32.0%	44.0%	14.0%	10.0%	28.0%	38.0%	26.0%	8.0%	28.0%	28.0%	34.0%	10.0%
Spackenkill High School	10	50.0%	50.0%			20.0%	30.0%	50.0%		30.0%	60.0%		10.0%	50.0%	30.0%	10.0%	10.0%
Stissing Mountain Jr-Sr HS	4	50.0%	25.0%	25.0%		50.0%	50.0%			25.0%	50.0%		25.0%	25.0%	75.0%		
Tabernacle Christian Academy	3	66.7%	33.3%			33.3%	33.3%	33.3%		33.3%	66.7%			66.7%	33.3%		
Upton Lake Christian School	2	50.0%		50.0%			100.0%				100.0%			50.0%	50.0%		
Webutuck High School	4	50.0%	25.0%	25.0%		50.0%	50.0%			25.0%	25.0%		50.0%	25.0%	50.0%	25.0%	