CAL MARITIME

IW
AC

Annual Learning Results
Institution Wide SLO (D): Scientific Reasoning
2015

Prepared by The Institution-Wide Assessment Committee
Point Persons: Cynthia Trevisan & Steven Runyon

1. Executive Summary:

In the Academic Year 2014-2015 the IWAC conducted an assessment of the institution-wide student learning objective D, Scientific Reasoning. Data was gathered from assessments done by faculty in their courses for departmental review. Data was gathered primarily from the Science and Math department as its faculty teaches scientific reasoning to every major on campus. These courses are mostly taken by lower-division students. Assessment scores were aggregated by major, graduation year, gender, and the assessment artifact used.

Results:

The benchmark was that 70% of students receive scores of 4 or above on a 6-point rubric.

1. When aggregated by major, all majors meet the goal except FET. FET is close to the benchmark and had the smallest set of data, so this could be a statistical deficiency.
2. When aggregated by class (graduation year), all classes meet desired outcome. Upper class students had better performance.
3. When aggregated by gender, both genders meet desired outcome with little difference.
4. When aggregated by artifact (course where data comes from) the percentage of students that meet the outcome varies widely.

Recommendations:

1. The IWAC believes that the FET data should be refined with further assessment over the next year. If the benchmark is still not met (or no new data is available), the department should have conversations about how to raise their scores and/or increase participation.

2. The IWAC recommends that more data be gathered for the next Quantitative Reasoning IW-SLO assessment cycle. The data would be improved by including more upper-division courses, and by using more standardized rubrics. However, every new data point will be gathered by faculty volunteers, so care must be taken to keep the burden light to maximize participation.

2. Closing the Loop: Status of Proposed Action Items

	Next Step #1
a) "Next Steps"	There were no proposed action items prior to this assessment cycle.
b) Status of Next Steps	

3. What do We Want Students to Learn?

	Evidence #1
a) ISLO -D	Scientific Reasoning
b) Learning Criteria: (specific qualities desired in student work)	Apply scientific inquiry to understand the natural world
c) Standards for Success	Desired outcome: 70% of students receive scores of 4 or above on a 6-point rubric. Required outcome: Consistent "acceptable" score averages, even when disaggregated by course level and type.

4. What Evidence do We Use to Assess Their Learning?

a) Evidence: Describe summative evidence you analyze & the size of the sample	9 Courses, each course contributed one or more quantitative exam problem to be assessed. There were a total of 362 problems assessed from 9 courses.
b) Assessment Tool/Method	Rubrics used to score all problems. Students were scored by their instructors, in most cases using artifacts gathered for departmental assessment. A 6-point rubric developed by the IWAC committee was used by instructors. The rubric is shown in Section 2.
c) Assessment Process	1. Faculty chose an assignment 2. Faculty uses the "Analytical Rubric" to generate numerical score. 3. Faculty recorded each score on an Assessment Score Sheet. 4. Data analyzed using a spreadsheet.

5. How Well Are They Learning? (And SO WHAT?)

a) Results of Student Learning	1. When aggregated by major, all majors meet goal except FET. FET is close to the benchmark and had the smallest set of data, so this could be a statistical deficiency. 2. When aggregated by class, all classes meet desired outcome. Upper class students had better performance. 3. When aggregated by gender, both genders meet desired outcome with little difference. 4. When aggregated by artifact (course where data comes from) the percentage of students that meet the outcome varies widely.
b) Achieving Standards: Did your program achieve its standards for success?	Overall Yes. The only group of students that did not meet the benchmark is the FET major. Other majors (BA, GSMA, ME, MET, MT), all classes (2014-2015), and all genders meet benchmark.
c) Discussion of Results for Program Improvement	Results are good. Before suggesting improvements we should see if low-performing major's results are due to the small sample size, seek additional data.
d) Participants in Discussing/Reviewing Results	Cynthia Trevisan, Steven Runyon, Julie Chisholm, Colin Dewey, Dianne Meredith, Graham Benton, and Nipoli Kamdar
e) Communication of Results	This report will be housed in the IWAC database and made available through Cal Maritime's website on IWAC-SLOs, 2014-2015, currently housed in the WASC Accreditation site.

5. Now What? (Plan to Improve Our Program)

	Proposed Change #1	Proposed Change #2	
a) Proposed Changes	Seek more data, that can be compared easily	Seek FET data to complete this set, verify results	
b) Rationale for Proposed Changes	Small number of courses represented. Some assessment on a 6 point scale, some on a 5 point scale.	Small number of courses represented.	
c) Proposed Completion Date	End of next 4 year IWAC cycle starting 2016-2017	Summer 2015	
d) Stakeholders Involved	Core Faculty	FET Faculty	
e) Vetting to Stakeholders	IWAC	Mike Holden	
f) Shepherding Changes	IWAC	Mike Holden	
g) Budget Integration	n/a	n/a	
h) Incorporating Changes			
i) Improvement Target Goals	Statistically valid sample sizes in all groups aggregated.	Gather departmental assessment data from FET courses if it exists. If benchmark is not met, meet with faculty to discuss improvements.	
j) Evidence of effectiveness	Number of students sampled	Number of students sampled, benchmark results with new data.	

6. Reflection on Assessment Process

	Reflection #1	Reflection #2	
a) Strengths	Using assessment data generated for departmental review was efficient use of faculty time.	Having faculty assess material from their own classes is efficient and requires no technical knowledge from the IWAC committee.	
b) Modifications	Strive for more participation, particularly in upper division courses.	Difficult to achieve uniform norming of assessment without burdening faculty.	

7. What do We Want Students to Learn?

a) ISLO-D	Apply scientific inquiry to understand the natural world

Section 2: Description of Rubrics and Scoring Analysis

Scientific Reasoning was assessed using data from 9 courses, for a total of 362 assessment scores in the data set. The assessment was performed by the instructors and reported to the IWAC committee using a rubric designed by the IWAC committee (shown below). The committee would like to thank the faculty who submitted data.

Rubric for Assessing Scientific Reasoning Student Learning Outcomes :
Apply scientific inquiry to understand the natural world.

	Initial (1-2)	Emerging (3-4)	Exemplary (5-6)
An understanding of scientific theories, principles and models in order to analyze problems in science and how they apply to the natural world.	Demonstrates little or no understanding of what information and assumptions are needed to perform the analysis. Unable to identify correct scientific principles, or employs principles that are not appropriate to the problem at hand. Approach is not directed to the objective of the analysis. Unable to organize the analysis.	Demonstrates basic understanding of what information and assumptions are relevant to the analysis. Approach and information gathering appears essentially effective, but somewhat unfocused. Understands in a broad sense the scientific principles that drive the system, but only partially applies them to the problem at hand.	Demonstrates high level of understanding of what information and assumptions are relevant to the analysis. Gathers information in an appropriate form and focuses the analysis on the desired result. Understands and clearly applies the correct scientific principles driving the system, and their relevance to the analysis of problems.

Overall Pass/Fail Numbers:

Pass-Fail Percentages by:												
Major	BA-BS	FET-BS	GSMA-BA	ME-BS	MT-BS	MET-BS						
	75.8%	61.8%	73.1%	45.5%	47.7%	74.7%						
N	33	68	26	66	86	83						
Artifact	CHE100-SP14	CHE110-SP15	CHE205-SP14	CHE205-SP15	MSC105-SP15	MSC205-SP15	PHY100-SP15	PHY200-SP15-1	PHY200-SP15-2	PHY200L-SP15	PHY200L-FA14	PHY205-SP15
	86.1%	60.0%	71.4%	58.8%	75.0%	63.6%	34.4%	60.0%	65.0%	100%	100%	29.3%
N	36	15	35	17	20	22	64	60	20	16	16	41
Class	2014	2015	2016	2017	2018	2019						
	80.0%	77.8%	70.8%	53.4%	70.7%	100%						
N	5	9	65	223	58	2						
Gender	M	F										
	61.4%	54.9%										
N	311	51										
Ethnicity	Am Ind	Asian	Black	Hisp	Pac Isl	Two +	Unknow	White				
	100%	37.9%	33.3%	58.1%	0%	64.7%	72.7%	62.9%				
N	1	29	3	62	1	34	22	210				
Overall	60.5%											
N	362											

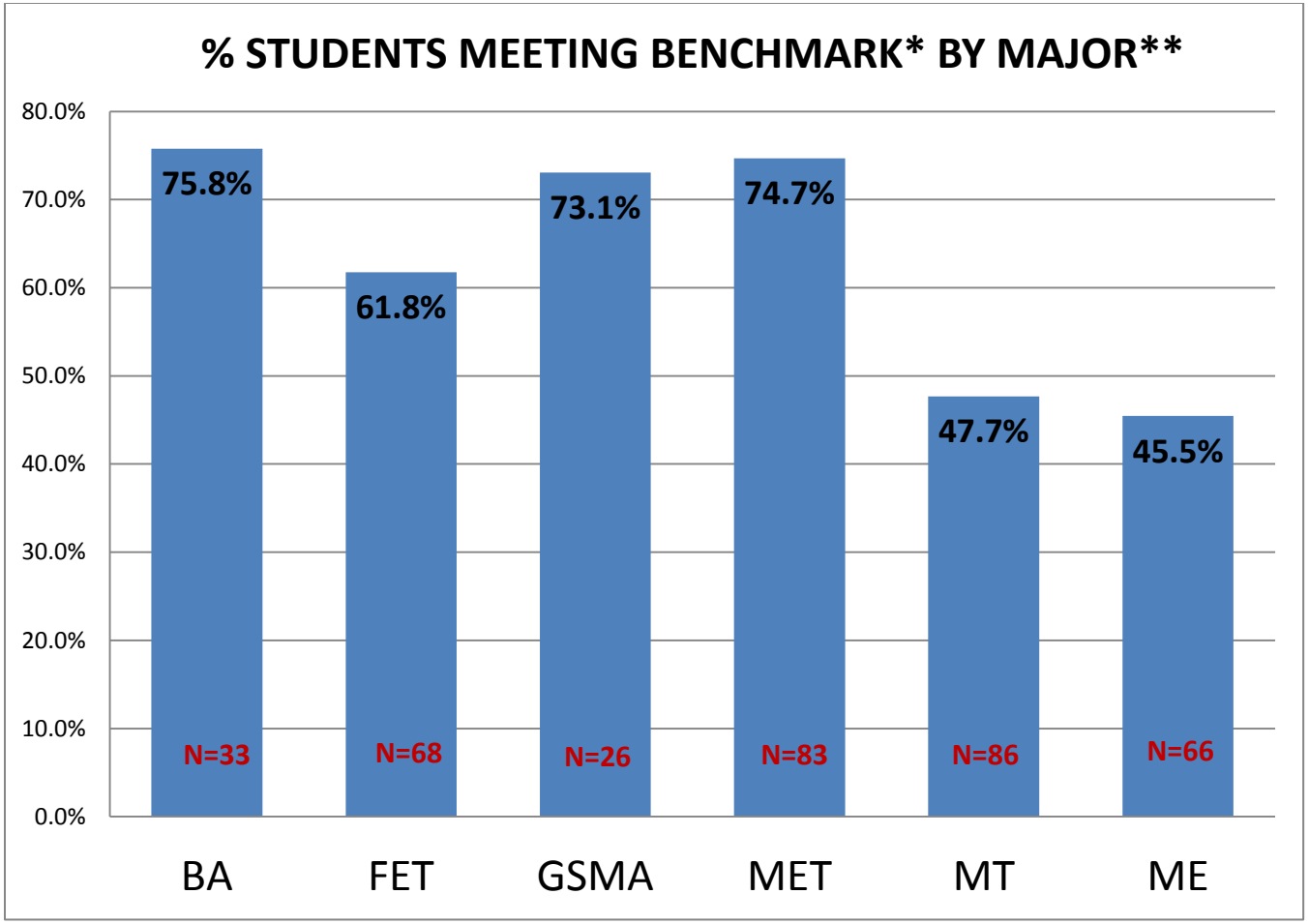
Rubric Score Distribution Aggregated Data

Major	1	2	3	4	5	6
All Majors	30	55	58	86	77	56
BA-BS	2	4	2	16	4	5
FET-BS	7	9	10	14	13	15
GSMA-BA	2	2	3	11	5	3
ME-BS	4	12	20	7	11	12
MT-BS	9	25	11	21	10	10
MET-BS	6	3	12	17	34	11

Artifact	1	2	3	4	5	6
CHE100-SP14	0	3	2	23	0	8
CHE110-SP15	1	4	1	1	6	2
CHE205-SP14	1	7	2	8	8	9
CHE205-SP15	3	1	3	5	2	3
MSC105-SP15	0	1	4	7	6	2
MSC205-SP15	4	3	1	6	3	5
PHYS100-SP15	9	24	9	11	8	3
PHYS200-1	4	1	19	20	14	2
PHYS20O-2	1	3	3	4	4	5
PHYS200L-SP15	0	0	0	0	11	5
PHYS200L-FA14	0	0	0	0	11	5
PHYS205	7	8	14	1	4	7

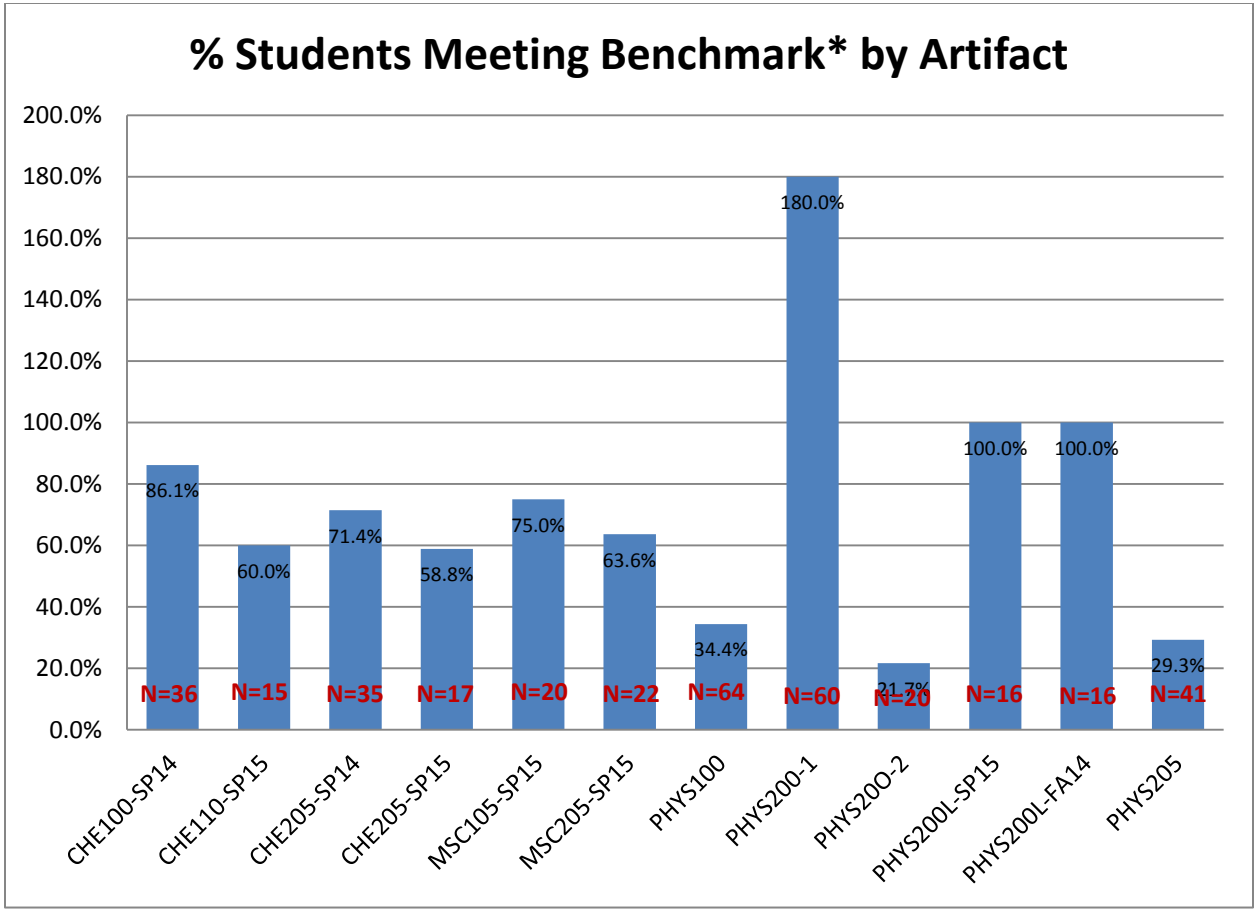
Class	1	2	3	4	5	6
2014	0	1	0	3	1	0
2015	0	0	2	6	0	1
2016	4	10	5	21	9	16
2017	22	37	45	44	47	28
2018	4	7	6	11	19	11
2019	0	0	0	1	1	0

Gender	1	2	3	4	5	6
M	28	43	49	75	68	48
F	2	12	9	11	9	8

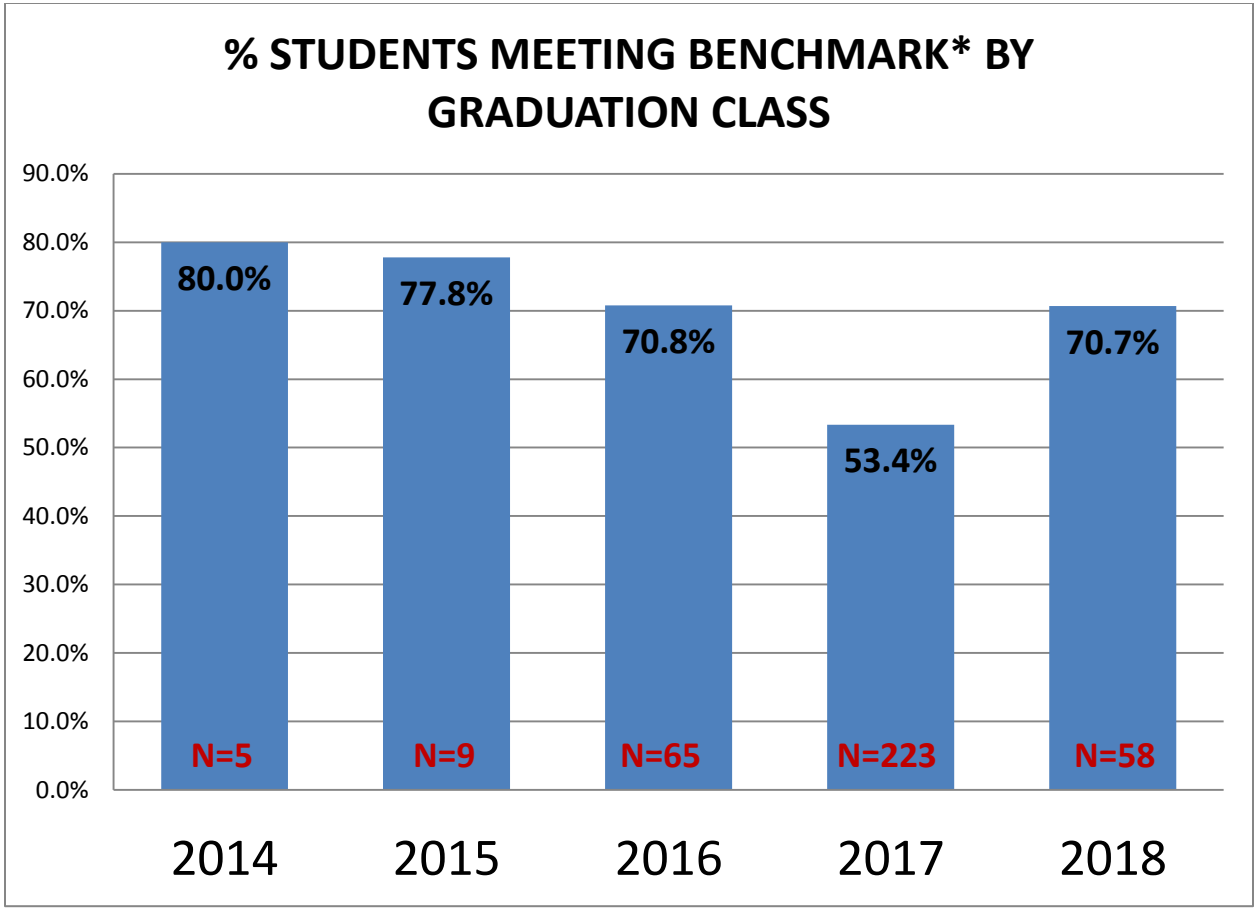


*Benchmark is defined as achieving a rubric score of 4 or better. Values represent the percent of total students within each major that meet this benchmark.

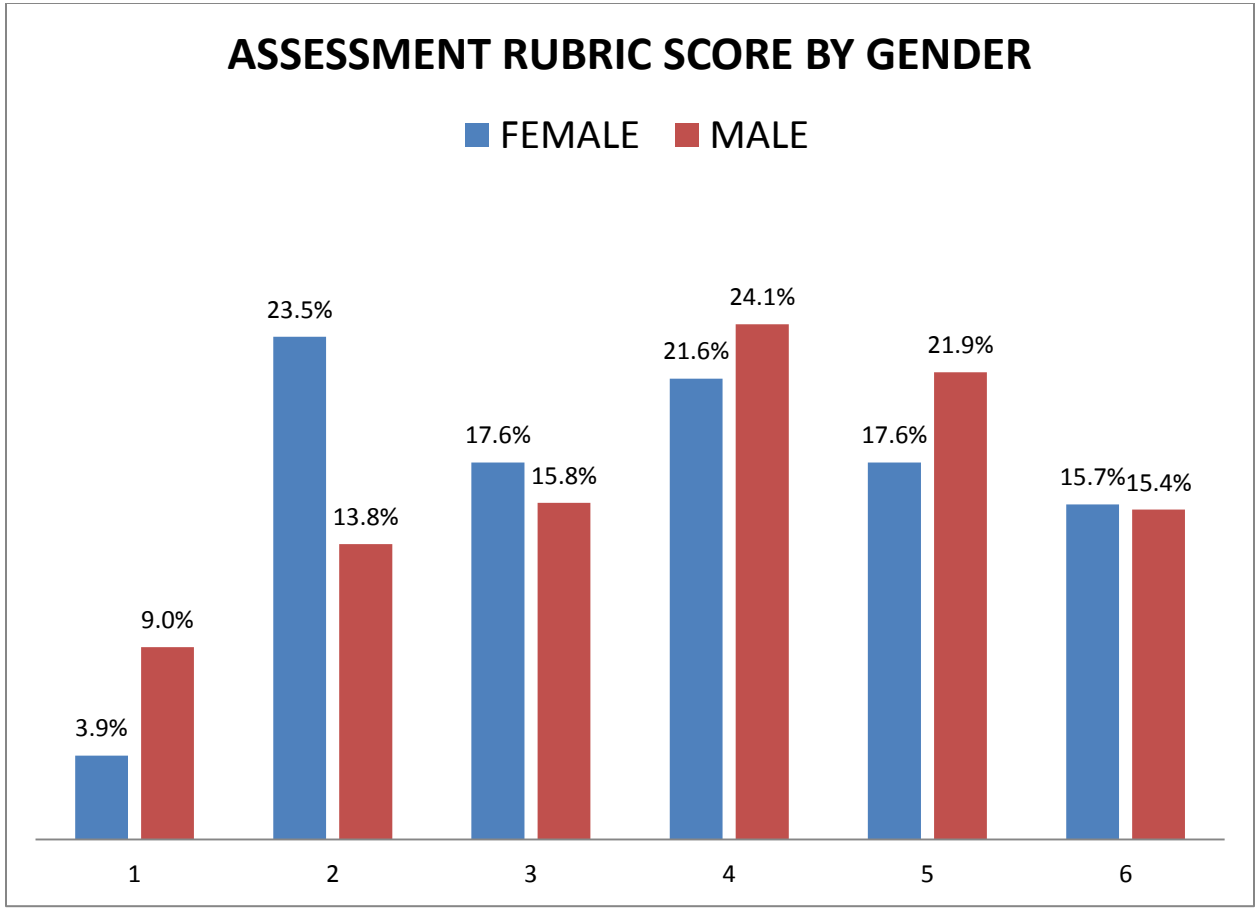
**BA = Business Administration; FET = Facilities Engineering Technology; GSMA = Global Studies and Maritime Affairs; MET = Marine Engineering Technology; MT = Marine Transportation; ME = Mechanical Engineering

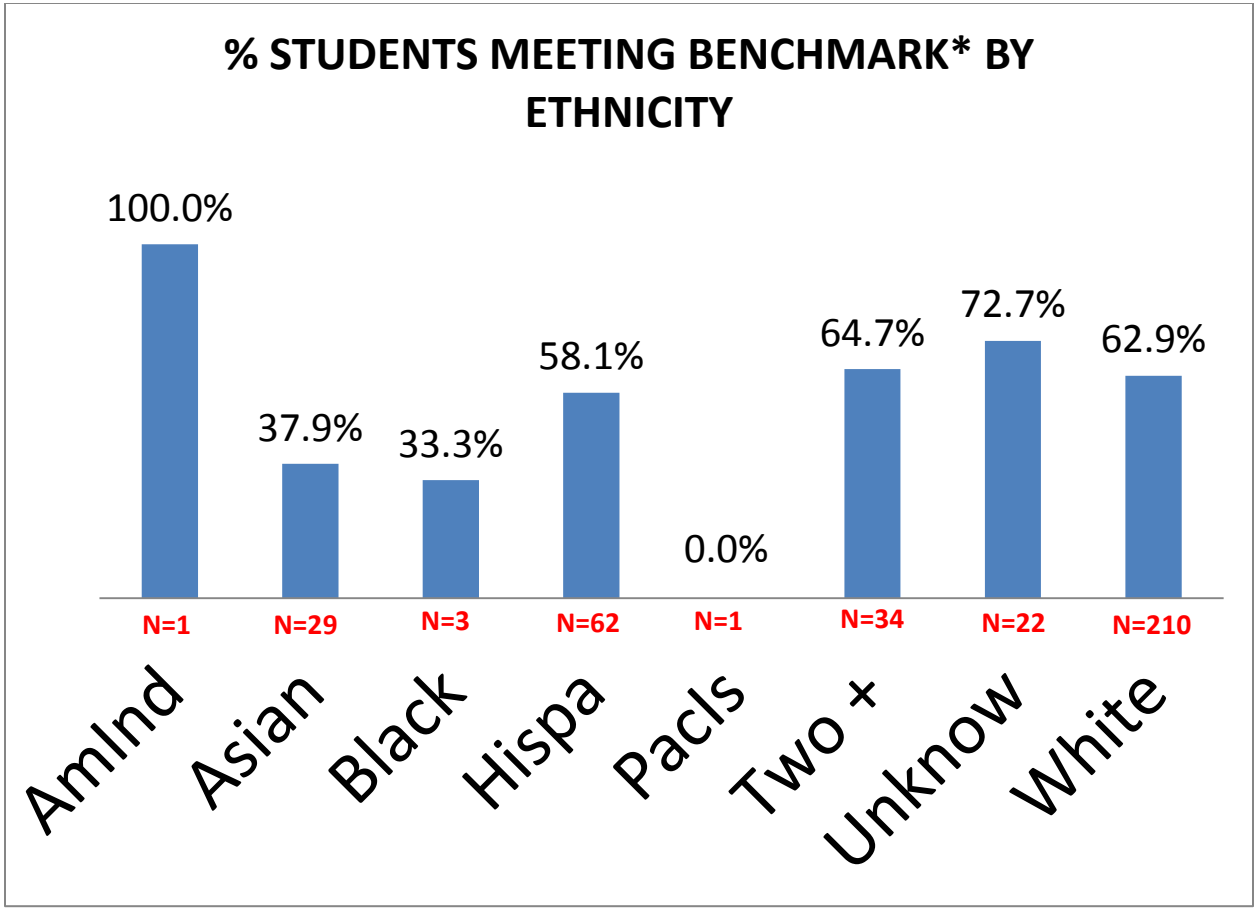


*Benchmark is defined as achieving a rubric score of 4 or better. Values represent the percent of total students within each course assessed that meet this benchmark.



*Benchmark is defined as achieving a rubric score of 4 or better. Values represent the percent of total students within each graduating class assessed that meet this benchmark.


ASSESSMENT RUBRIC SCORE BY GENDER
FEMALE
MALE
3.9%
9.0%
23.5%
13.8%
17.6%
15.8%
21.6%
24.1%
17.6%
21.9%
15.7%
15.4%
1
2
3
4
5
6



*Benchmark is defined as achieving a rubric score of 4 or better. Values represent the percent of total students within each ethnic group assessed that meet this benchmark. AmInd = American Indian; PacIs = Pacific Islander.