Physic and Engineering

Learning Outcome:
Critical Thinking: Students will be able to examine, critique and synthesize information in order to arrive at reasoned conclusions.

Outcome Measure:
ETS Proficiency Profile Exam

Criteria for Success (how do you judge if the students have met your standards):
75% of the students will be marginal or proficient at Level 2 Reading/Critical Thinking.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students Marginal or Proficient							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
ETS Proficiency Profile Level 2 Critical Thinking	100%	100%	75%	77%	89%	73%	73%	60%

*COVID-19 Year

Conclusions Drawn from Data:
The students are in general achieving the benchmark. However in there was a significant drop in 2019-20. This may be attributable to COVID or to the students not taking the exam particularly seriously because of not taking it in a classroom setting.

Changes to be Made Based on Data:
The variability in the data appears to be the result of relatively small sample sizes.

Rubric Used
No rubric. We use the ETS Proficiency Profile test results.

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Learning Outcome:
Oral Communication: Students will effectively communicate complicated technical information orally.

Outcome Measure:
PHY4072 Senior Project technical talk.

Criteria for Success (how do you judge if the students have met your standards):
At least 75% of students will achieve an average score of 2.5 or higher on criteria on the Oral Presentation rubric in a talk juried by department faculty.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or higher							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
Oral Presentation Rubric Scores	88%	100%	100%	100%	100%	93%	75%	100%

*COVID-19 Year

Conclusions Drawn from Data:
The students are generally achieving the benchmark.

Changes to be Made Based on Data:
In the future the department may want to analyze the data base on individual components of the Oral Presentation Rubric rather than using a single average score for each student.

Rubric Used

Physics and Engineering Oral Presentation Rubric

	Outstanding	High satisfactory	Low Satisfactory	Unsatisfactory
Command of Material	D clearly knows material D expands on PPT slides D content appropriate for audience	D knows most key facts D some expansion on slides D partial adaption for audience	D reads some, knows some D no expansion on slides D little adaption of content for audience	D reads many sentences from slides D dependent on notes D lacks adaption of content to audience
Organization	D clear and concise outline D relevant graphics and key text on slides D ±30 s of time limit	D clear outline D too much information on slides D ±60 s of time limit	D some sense of outline D too much information and detail D ±1.5 m of time limit	D no clear sense of outline D slides are paragraphed; too much detail on one slide D ±2 m of time limit
Presentation Skills	D clearly practice several times; smooth transitions D free of uhms and the like D clearly heard and used inflection for emphasis D engages audience with eye contact D engages audience with gestures	D Practiced, but transitions not smooth D few uhms D understood much of the time and some inflection D some engagement with eye contact D some engagement with gestures	D practiced, but no transitions between slides D many uhms D some difficulty hearing and little inflection D infrequent eye contact D some distracting gestures	D not practiced, doesn't anticipate content of next slide D uhms and the like detract from the presentation D cannot be heard and/or speaks in a monotone D no eye contact D frequent distracting gestures
Presentation Tools	D PPT background matched to content, legible font, graphics, seamless transitions D Appropriate graphics used.	D appropriate background, font, transitions D Some graphics used to enhance presentation.	D distracting backgrounds, transitions, fonts hard to read D graphics do not enhance presentation	D no attention to backgrounds, transitions, fonts very hard to read D distracting use of graphics

Physics and Engineering

Learning Outcome:
Written Communication: Students will effectively communicate complicated technical information in writing.

Outcome Measure:
PHY4072 and PHY4082 Senior Project Written Report.

ETS Proficiency Profile Exam

Criteria for Success (how do you judge if the students have met your standards):
PHY4072/PHY4082: At least 75% of students will achieve an average score of 2.5 or higher on criteria on the Written Report rubric.

ETS: 75% of the students will be marginal or proficient at Level 2 Writing.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

PHY4072:

	Percentage of Students at 2.5 or higher							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
Written Report Rubric	75%	N/A	100%	100%	84%	64%	100%	No Data

ETS:

	Percentage of Students Marginal or Proficient							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
ETS Proficiency Profile Level 2 Writing	100%	100%	75%	62%	94%	73%	87%	60%

*COVID-19 Year

Conclusions Drawn from Data:
The students are consistently hitting the benchmarks in both the written report and the ETS exam. The dip in the ETS exam in 2015-16 was due to small sample size (if one student had a slightly higher score the benchmark would have been met). However in there was a significant drop in 2019-20 in the ETS score. This may be attributable to COVID or to the students not taking the exam particularly seriously because of not taking it in a classroom setting.

The reports that students are writing in the senior lab have been uneven. Examining the data from 2017-18 the main areas of weakness are:

- Information literacy (multiple references and the references cited)
- A well-written conclusion
- Uncertainties and error propagation discussed in the paper.

In 2018-19 the students met the benchmarks. 2019-20 was the year of the COVID-19 outbreak and spring writing data was not gathered.

Changes to be Made Based on Data:
The department will be undergoing program review in the coming year and will look at the alignment between the ETS exam and the written report expectations. It is clear that the students are not fully understanding the expectations for the final lab report that is being used in this class.

Rubric Used
ETS: No rubric.

PHY457 Written Report Rubric:

	Outstanding	High satisfactory	Low Satisfactory	Unsatisfactory
Structural pieces	D abstract is a clear and concise summary of all relevant results and descriptions in the order emphasized in the paper.	D abstract could be made clear and/or concise with minor changes.	D abstract is missing some information and/or contains unnecessary information.	D abstract does not contain necessary information
	D introduction indicates precise subject, scope, and purpose	D introduction is missing one of the following: precise subject, scope, and purpose.	D introduction is missing two of the following: precise subject, scope, and purpose.	D introduction does not give precise subject, scope and purpose.
	D main body is a well-organized, logical and contains all necessary information without extra information.	D main body lacks some organization	D main body is missing some important pieces and/or is not well organized	D main body is not well organized, lacks logical arguments and relevant data
	D conclusion appropriately sums up, gives conclusions, and recommendations	D conclusion does two of the following: sums up, gives conclusions, and recommendations	D conclusion does one of the following: sums up, gives conclusions, and recommendations	D conclusion does provide any summation, conclusions, or recommendations
	D multiple references from reputable sources.	D most references from distinct reputable sources	D some references from reputable sources	D no bibliography, or all references from untrusted sources
	D references cited in the body of the document	D some citation of reference in body	D limited citation of references	D no citation of references
Data	D data is clearly presented in properly formatted tables, figures and graphs where appropriate.	D some data could be presented more clearly	D data is poorly presented and some key data is missing.	D several pieces of key data are missing
	D all uncertainties are shown and error propagation are carried out where appropriate.	D most uncertainties are shown and propagation of error carried out.	D many uncertainties are missing and/or propagation or error not carried out correctly	D no uncertainties of measurements are show
Grammar Spelling, and Style	D no grammatical or spelling errors	D few grammatical and spelling errors	D some grammatical and spelling errors	D many grammatical and spelling errors
	D equations well formatted, and variables introduced as needed.	D a few errors in formatting equations	D poorly formatted equations	D incorrect equations
	D appropriate style (no first person, past tense when reporting what was done)	D a few informal statements and/or tense	D several areas with are too informal and tense errors	D very informal and/or use of future tense where not appropriate
	D clear sentences and ideas are presented in a way that won't be misunderstood	D a few unclear sentences	D many complex and unclear sentences	D many sentences are unclear and have overly complex construction
	D concise and quantitative as subject matter permits	D a few unnecessary words and ideas	D frequent extra and inexact words	D many vague, inexact, many idle words
	D arguments are complete and logical	D most arguments are complete	D several arguments are difficult to follow	D arguments are incomplete, illogical, and may contain unnecessary information and specialized jargon

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Learning Outcome:
Information Literacy: Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.

Outcome Measure:
PHY4072 Senior Lab Written Technical Report.

Criteria for Success (how do you judge if the students have met your standards):
PHY4072/PHY4082: At least 75% of students will achieve an average score of 2.5 or higher on criteria on the information literacy portion of the Written Report rubric.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students at 2.5 or higher							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
Written Report Rubric IL	25%	N/A	63%	86%	53%	43%	44%	No Data

*COVID-19 Year

Conclusions Drawn from Data:
The students are not achieving the benchmark. It is clear from looking at the individual scores in the writing rubrics, that this is the weakest category for students. For example in 2018-19 100% of the students hit the overall benchmark for writing, but when information literacy is considered separately, only 44% of the students have achieved the target. In 2019-20 due to COVID-19 writing data was not gathered.

Changes to be Made Based on Data:
The department needs to work with students to clarify expectations for the use and citation of material in technical write-ups. This will be part of the curricular adjustments made as the result of program review.

Rubric Used

PHY457 Written Report Rubric:

	Outstanding	High satisfactory	Low Satisfactory	Unsatisfactory
Structural pieces	D abstract is a clear and concise summary of all relevant results and descriptions in the order emphasized in the paper.	D abstract could be made clear and/or concise with minor changes.	D abstract is missing some information and/or contains unnecessary information.	D abstract does not contain necessary information
	D introduction indicates precise subject, scope, and purpose	D introduction is missing one of the following: precise subject, scope, and purpose.	D introduction is missing two of the following: precise subject, scope, and purpose.	D introduction does not give precise subject, scope and purpose.
	D main body is a well-organized, logical and contains all necessary information without extra information.	D main body lacks some organization	D main body is missing some important pieces and/or is not well organized	D main body is not well organized, lacks logical arguments and relevant data
	D conclusion appropriately sums up, gives conclusions, and recommendations	D conclusion does two of the following: sums up, gives conclusions, and recommendations	D conclusion does one of the following: sums up, gives conclusions, and recommendations	D conclusion does provide any summation, conclusions, or recommendations
	D multiple references from reputable sources.	D most references from distinct reputable sources	D some references from reputable sources	D no bibliography, or all references from untrusted sources
	D references cited in the body of the document	D some citation of reference in body	D limited citation of references	D no citation of references
Data	D data is clearly presented in properly formatted tables, figures and graphs where appropriate.	D some data could be presented more clearly	D data is poorly presented and some key data is missing.	D several pieces of key data are missing
	D all uncertainties are shown and error propagation are carried out where appropriate.	D most uncertainties are shown and propagation of error carried out.	D many uncertainties are missing and/or propagation or error not carried out correctly	D no uncertainties of measurements are show
Grammar Spelling, and Style	D no grammatical or spelling errors	D few grammatical and spelling errors	D some grammatical and spelling errors	D many grammatical and spelling errors
	D equations well formatted, and variables introduced as needed.	D a few errors in formatting equations	D poorly formatted equations	D incorrect equations
	D appropriate style (no first person, past tense when reporting what was done)	D a few informal statements and/or tense	D several areas with are too informal and tense errors	D very informal and/or use of future tense where not appropriate
	D clear sentences and ideas are presented in a way that won't be misunderstood	D a few unclear sentences	D many complex and unclear sentences	D many sentences are unclear and have overly complex construction
	D concise and quantitative as subject matter permits	D a few unnecessary words and ideas	D frequent extra and inexact words	D many vague, inexact, many idle words
	D arguments are complete and logical	D most arguments are complete	D several arguments are difficult to follow	D arguments are incomplete, illogical, and may contain unnecessary information and specialized jargon

Physics and Engineering

Learning Outcome:
Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature.

Outcome Measure:
ETS Proficiency Profile Exam

Outcome Measure:
ETS Proficiency Profile Exam

Criteria for Success (how do you judge if the students have met your standards):
95% of the students will be marginal or proficient at Level 2 Math.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students Marginal or Proficient							
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20*
ETS Proficiency Profile Level 2 Math	100%	100%	100%	100%	100%	91%	100%	70%

*COVID-19 Year

Conclusions Drawn from Data:
The students are consistently hitting the benchmark. However in there was a significant drop in 2019-20 in the ETS score. This may be attributable to COVID or to the students not taking the exam particularly seriously because of not taking it in a classroom setting.

Changes to be Made Based on Data:
None at this time.

Rubric Used
No rubric. We use the ETS Proficiency Profile test results.