

Assessment of Applied Scientific Research Projects in iCons Program Course:

“Team Discovery Lab in Renewable Energy (iCons 3 Renewable Energy)”

V4_9-1-2014

Preamble: The mission of iCons is to produce the next generation of leaders in science and technology with the attitudes, knowledge, and skills needed to solve the inherently multi-faceted problems facing our world. Application of key attitudes, knowledge, and skills in the context of laboratory science constitutes a crucial element of the iCons Program. The rubric below will be used to assess the quality of student-team lab work in the field of Renewable Energy.

Curricular and Pedagogical Context: To place this assessment in proper context, we note that most or all of these students are juniors in some STEM major in science, engineering, and/or public health at UMass Amherst. As such, we take the measure of “exemplary” to mean that their iCons work is as good as, or better than, top-level, junior-level lab work in their respective majors. Because of the variability of lab work among the many STEM majors, you as the evaluator may use exemplary, junior-level lab work in your major as a yard stick with which to measure the iCons work.

We also wish to remind each evaluator of the essential goal-areas of iCons:

1. Problem-based: Science/Engineering applied to societal problems
2. Interdisciplinary: Science/Engineering performed in multi-disciplinary teams
3. Student-driven: Science/Engineering investigations led by students
4. Reflective: Deep-learning on process of, and next-steps in, Science/Engineering

As such, we include questions in the rubric below to assess each of these areas, over and above what might be considered high-quality science/engineering. We especially wish to remind the evaluators that the areas of study, questions, and experimental designs reported by student teams were *conceived by the students themselves* with little-to-no input from faculty or TAs.

A. TO WHAT EXTENT ARE YOU AN EXPERT IN ANY OF THE DISCIPLINES COVERED IN THIS STUDY?			
-----1-----	-----2-----	-----3-----	-----4-----
Not at all	Teach in class	Very familiar	This is my research

B. HOW WOULD YOU RATE THE DISCIPLINARY RIGOR AND ACCURACY IN THIS STUDY??			
-----1-----	-----2-----	-----3-----	-----4-----
Don't know/ not applicable	Gross inaccuracies	Often correct	Almost always correct

1. QUESTION	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate question formulation.	Poses a clear question that is answerable and grounded in observation.
2. SIGNIFICANCE:	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate discussion of significance.	Explains how the study will advance scientific knowledge, and provides context by explaining how the question connects to societal problems.
3. HYPOTHESIS:	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate hypothesis formulation.	Offers an educated guess that is testable and falsifiable.
4. EXPERIMENTAL DESIGN	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate experimental design.	Articulates a logical, detailed, and replicable methodology, including properties to be varied, properties to be held constant, and appropriate application of controls.
5. DATA COLLECTION	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate data collection.	Thorough collection of data that calibrates and crosschecks to improve accuracy, reduce error, and ensure representativeness.
6. ANALYSIS	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate data analysis.	Demonstrates correct application of statistics, regression, and relevant energy theory.

7. INTERPRETATION	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate interpretation of results.	Draws conclusions that are justified, avoids extrapolation, and accounts for experimental error.
8. SCIENTIFIC IMPACT	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate discussion of scientific impacts.	The study provides a preliminary answer to the scientific question posed. Also, the study outlines next steps in scientific inquiry needed to definitively answer the question posed.
9. SOCIETAL IMPACT	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Inadequate discussion of societal impacts.	The study articulates technical progress towards solving the motivating societal problem. Also, the study outlines next steps needed to solve the motivating societal problem.
10. INNOVATION/CREATIVITY	
1-----2-----3-----4-----5	
<i>Not particularly innovative</i>	<i>Exemplary</i>
Minimal innovation in the study.	Substantial innovations in areas including the Question, Hypothesis, Experimental Design, Analyses, Interpretations, etc.
11. INTERDISCIPLINARITY	
1-----2-----3-----4-----5	
<i>Not particularly interdisciplinary</i>	<i>Exemplary</i>
Inadequate discussion of impacts.	Substantial interdisciplinarity in areas including the Question, Hypothesis, Experimental Design, Analyses, Interpretations, etc.
12. REPORTING CLARITY AND THOROUGHNESS	
1-----2-----3-----4-----5	
<i>Not acceptable</i>	<i>Exemplary</i>
Poorly written across the board.	Concise, flows logically, good grammar, and understandable to a broad technical audience.