

Department of Physics
University of North Carolina, Wilmington
Learning Outcome Assessment Instruments: Laboratory Science

Goals: This instrument is designed to be one tool for use in assessing Student Learning Outcomes, by means of an analysis of student performance in a laboratory setting. It is *not* an assessment of student performance associated with any one course of study. The items to be assessed, although they may certainly reflect the student's course preparation, more generally reflect the student's acquisition of critical skills and competencies that the Department considers core objectives of the undergraduate physics curriculum. Those learning outcome objectives that are to be assessed by this instrument are as follows:

1. **Laboratory Skills:** Students will demonstrate an understanding of scientific methodology and experimental techniques. Students should display effective technical and/or analytic abilities in the categories listed below. The assessment instrument will rate the student's competence with one or more of these skills, as appropriate.
 - a. **Data Collection** – Students appropriately collect experimental data to address their research questions.
 - b. **Data Analysis** – Students effectively analyze and interpret data to answer the research questions posed.
 - c. **Uncertainty Analysis** – Students are able to identify and quantify sources of uncertainty in their results.
 - d. **Technical Skills** – Students demonstrate technical proficiency in undertaking and completing technical projects.
2. **Collaborative Skills:** Students collaborate effectively with other students to address research questions.
3. **Communication Skills:** Students prepare written reports demonstrating fluency with the conventions and requirements of written scientific communication.

Scoring: The students will be assessed on each of the three major categories according to a 1–4 scale, broadly interpreted as follows:

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|---|---|
| 1 = competence in the category not demonstrated | 3 = average degree of competence in the category demonstrated |
| 2 = minimal competence in the category demonstrated | 4 = exceptional degree of competence in the category demonstrated |

Laboratory Science Scoring Rubric

Name _____ Date _____

Competence Level		1	2	3	4
Laboratory Skills	Data Collection Score _____	Student does not seem to understand or appropriately use the scientific method. He or she does not collect adequate amounts or types of data to answer research questions.	Student's use of the scientific method to organize data acquisition is limited, and he or she fails to acquire sufficient data to fully address research questions.	Student displays reasonably good understanding and use of the scientific method to collect appropriate data for addressing extant research questions.	Student understands and maximally utilizes the scientific method to collect the appropriate data to fully address all research questions posed.
	Data Analysis Score _____	Student fails to use appropriate mathematical tools most of the time. His or her interpretations of data and responses to identified research questions are generally incorrect and inconclusive.	Student's ability to use appropriate mathematical tools to analyze and interpret data is limited, resulting in some incorrect and/or incomplete conclusions regarding research questions.	Student generally uses appropriate mathematical tools to analyze data, interpreting analyzed data so as to correctly address the most important research questions.	Student effectively uses the most appropriate mathematical tools to analyze data and fully address the identified research questions. Student correctly interprets analyzed data so as to draw accurate conclusions regarding these questions.
	Uncertainty Analysis Score _____	Student generally fails to either correctly identify or to quantify sources of experimental uncertainty.	Student only sporadically able to identify and quantify sources of experimental uncertainty.	Student generally correctly identifies sources of uncertainty in experimental results, but sometimes fails to correctly quantify them.	Student correctly identifies and quantifies sources of uncertainty in experimental results.
	Technical Skills Score _____	Student's technical abilities are either severely lacking or non-existent, fatally compromising the success of their project.	Student's technical abilities are somewhat limited, undermining the success of their project.	Student demonstrates reasonably good technical ability in undertaking and completing project.	Student displays excellent technical skills in undertaking and completing project.
Collaborative Skills Score _____		Student does not productively and efficiently work with others. Student fails to adequately communicate and coordinate his or her activities with those of others.	Student demonstrates marginal productivity and efficiency in his or her working relations with others. Student's ability to communicate and coordinate with others is limited.	Student demonstrates reasonably good productivity and efficiency in working with other students. Student communicates and coordinates his or her activities with a fairly high standard of effectiveness.	Student works productively and efficiently with other students. Student communicates clearly with co-workers on group projects and effectively coordinates his or her activities with others in the group.
Communication Skills Score _____		Student does not understand appropriate formats for scientific laboratory reporting. Student fails to adequately use text, tables, and graphics to communicate scientific results.	Student's understanding of appropriate formats for scientific laboratory reporting is incomplete and often inappropriate. Student's use of text, tables, and graphics to communicate scientific results is barely adequate.	Student shows reasonably good understanding of the appropriate format for scientific laboratory reporting. Student's use of text, tables, and graphics to communicate scientific results is fairly effective.	Student demonstrates good understanding of the appropriate format for scientific laboratory reporting. Student very effectively uses text, tables, and graphics to communicate scientific results.