

Expectations for Student Projects (Revised by Terik Daly, 2-16-09)

Project Step	Expectations for Elementary School Students	Expectations for Middle School Students	Expectations for High School Students
Ask a question.	The student should have chosen a question that he or she can answer through performing a simple experiment.	The experiment should be simple. The student should display complete mastery of the underlying theory and the project materials should thoroughly explain why the experiment turned out the way it did. This is preferable to a more sophisticated project that the student understands poorly.	The question and experiment should be more complex than that of a middle school student, but the student should still have complete understanding of the scientific principles and theoretical aspects that relate to his or her project. A few students may be doing original research.
Do background research.	<p>The student should have referred to the following sources during the research phase:</p> <ul style="list-style-type: none"> • Books targeted at an elementary school audience • Appropriate websites • Encyclopedias (for 3rd grade students and above). 	<p>The student should have referred to the following sources during the research phase:</p> <ul style="list-style-type: none"> • Books targeted at a middle school audience • Appropriate websites • Encyclopedias <p>Middle school students should not be expected to refer to or be familiar with academic research publications.</p>	<p>The student should have referred to the following sources during the research phase:</p> <ul style="list-style-type: none"> • Books targeted at an high school audience • Appropriate websites • Encyclopedias • College textbooks <p>Some, but not all, high school students will be familiar with and cite peer reviewed journals.</p>
Construct a hypothesis. Test the hypothesis by doing an experiment.	<ul style="list-style-type: none"> • In grades K-2, the students should be able to follow basic steps to do an experiment. The student's investigation might be based just on what he or she can observe. • In grades 3-5, the student should be able to take measurements and collect accurate data. The student may be able to design his or her own simple experiment or add innovations to a known experiment. • An advanced 4th o 5th grader may understand the concept of a fair test, changing only one factor at a time. 	<p>The methodology and experimental design should be appropriate for the student's grade and discipline.</p> <ul style="list-style-type: none"> • Less sophisticated students should understand a fair test, changing only one variable at a time, but may not have understanding of independent, dependent, and controlled variables and the relationships between them. • Advanced students should be able to use data to explain what is happening in their experiments. They should understand variables, but they may have difficulty controlling more than one at a time. <p>Studies should present experimental procedures, reflecting his or her own considerations of the issues above, in a clear step-by-step format.</p>	<p>Experiment should be well designed and include several replicates. The student should understand independent, dependent, and controlled variables and use these concepts in his or her experimental design. Experimental procedures should be clearly written and easy-to-follow.</p>
Analyze the data and draw a conclusion.	In all grades, the student should have collected data in a table or written down	The student should be able to organize the data in tabular or graphical form to answer his or	Critical data analysis is essential at this level. Appropriate significance

	<p>observations. In all grades, the student should use data and observations as evidence to answer a scientific question. For grade 3 and above, the student should be able to provide a simple graph and do straightforward calculations, such as finding the average.</p>	<p>her scientific question. He or she should be able to provide a qualitative description of the relationships between independent and dependent variables.</p>	<p>tests may be used by some, but not all, students. Students should, however, use graphical and numerical methods (e.g. mean, standard deviation) during exploratory data analysis. The student's conclusion is clearly supported by his or her data.</p>
<p>Communicate the results.</p>	<ul style="list-style-type: none"> • In grades K-2, a typical student is able to write only basic information about the project. In the youngest grades, expect drawings to take the place of some or all of the text. • In grades 3-5, the student should provide written information describing each step of the scientific method that he or she performed. 	<p>The student is capable of writing clear text for all steps of the scientific method. If requested by the teacher, he or she should have written a concise abstract to summarize the project. The student should be able to design a display that organizes information in a logical sequence.</p>	<p>Use of the scientific method clearly evident. The student should be able to identify and discuss sources of error in his or her experiment. A labbook/project notebook should accompany the student's project. The display should be cogent. The student should be able to answer questions about his or her project.</p>