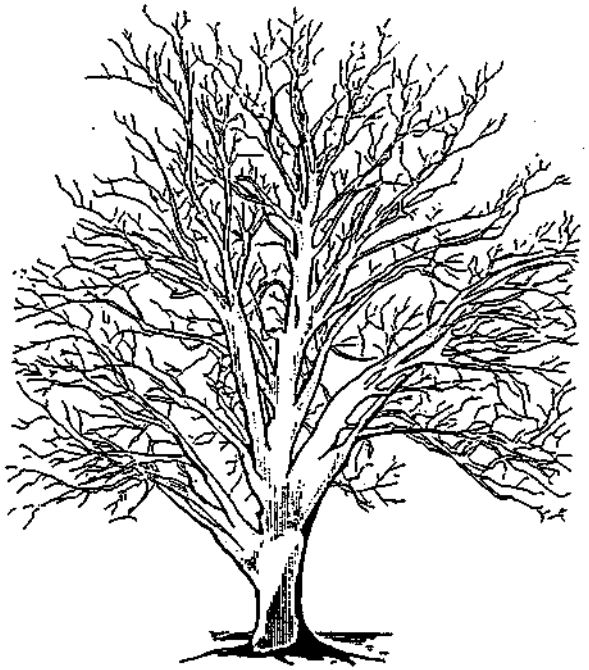
Monroe Township Schools



Curriculum Management System

Science

Talented and Gifted

Grade 7

July 2009

*** For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 2220.**

Board Approved: September 2009

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MONROE TOWNSHIP SCHOOL DISTRICT

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Acknowledgments

The following individuals are acknowledged for their assistance in the preparation of this Curriculum Management System:

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Monroe Township Schools

Mission and Goals

Mission

The mission of the Monroe Township School District, a unique multi-generational community, is to collaboratively develop and facilitate programs that pursue educational excellence and foster character, responsibility, and life-long learning in a safe, stimulating, and challenging environment to empower all individuals to become productive citizens of a dynamic, global society.

Goals

To have an environment that is conducive to learning for all individuals.

To have learning opportunities that are challenging and comprehensive in order to stimulate the intellectual, physical, social and emotional development of the learner.

To procure and manage a variety of resources to meet the needs of all learners.

To have inviting up-to-date, multifunctional facilities that both accommodate the community and are utilized to maximum potential.

To have a system of communication that will effectively connect all facets of the community with the Monroe Township School District.

To have a staff that is highly qualified, motivated, and stable and that is held accountable to deliver a safe, outstanding, and superior education to all individuals.

INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

Philosophy

Monroe Township Schools are committed to providing all students with a quality education resulting in life-long learners who can succeed in a global society. The Gifted and Talented Science Program for grades 5 through 8, is predicated on that belief and is guided by the National and State Curriculum Content Standards for Science. This rigorous program will extend the students' conceptual understanding of current science curriculum and will be based on inquiry and discovery approaches to authentic, real-life projects. The program will engage the student in a variety of learning activities designed to develop the ability to reason and solve complex problems and communicate effectively.

The primary beliefs of this philosophy are:

- To provide experiences that will foster and develop scientific inquiry.
- To allow students to construct their own understanding of science.
- To understand and utilize the scientific process.
- To promote an awareness of the availability and diversity of the scientific profession.
- To apply safety practices in scientific exploration.
- To integrate technology and other tools throughout the scientific process.

This curriculum guide is designed to be a resource for staff members and to provide guidance in the planning, delivery, and assessment of science instruction for gifted and talented students in grades 5 - 8.

Educational Goals

1. The students will nurture the creative spirit and develop a framework for creative problem solving while further enhancing the Core Curriculum Content Standards.
2. The students will utilize a cooperative and teamed approached to solving problems.
3. The students will construct meaning from their observations and investigations.
4. The students will communicate ideas by identifying a problem, developing a solution, and sharing with others.
5. The students will link science to other interdisciplinary and cross curricular studies.
6. The students will share the design and implementation of their authentic investigations at Science TAG Family Night.

New Jersey State Department of Education
Core Curriculum Content Standards

The New Jersey Core Curriculum Content Standards for Science were revised in 2004. The Cumulative Progress Indicators (CPI's) referenced in this curriculum guide refer to these standards and may be found in the Curriculum folder on the district servers. A complete copy of the Core Curriculum Content Standards for Science may also be found at:

http://education.state.nj.us/cccs/? standard matrix;c=5

Science: Talented and Gifted Grade 7

Scope and Sequence

Quarter I - Process
Science is a way of thinking about and investigating the world in which we all live. I. Exploration of scientific process a. Identify and make predictions that can be addressed by conducting investigations. b. Explain the importance of sequence in the scientific process. c. Distinguish the difference between control and variables d. Recognize the value of replication in a science investigation and that very similar results are expected e. Maintain accurate records of observations through the use of illustrations and text. f. Develop a clearly written abstract for a scientific research paper.
Quarter II – Exploration & Investigation
Science is a way of thinking about and investigating the world in which we all live. II. Experimental design a. Observe the natural world through a scientific point of view. b. Develop strategies and skills for information-gathering and problem-solving, using appropriate tools and technologies. c. Compose a testable science question in the field of life science and make predictions that can be addressed by conducting investigations. d. Devise an investigation that will answer the scientific question. e. Compile a list of needed materials. f. Conduct experiment and record data g. Demonstrate the ability to properly set up and safely manipulate laboratory equipment

Quarter III – Exploration & Investigation

Science seeks to explain the natural world. Its explanations and connections are interpreted and tested using evidence from the living world.

III. Experimental analysis

a. Organize data into charts, tables, and graphs.

b. Evaluate strengths and weaknesses of data

c. Gather, evaluate and represent evidence using scientific tools, technologies, and computational strategies.

d. Interpret experimental evidence as it applies to the real world and draw reasonable conclusions

e. Reflect upon experiment and determine ways it can be revised.

f. Show that experimental results can lead to new questions and further investigations

Quarter IV - Communication

Science literacy involves communication of experimental results.

IV. Communication of results

a. Engage in discussion in order to process and learn from others' ideas, observations, and experiences.

b. Apply scientific findings to real life scenarios

c. Demonstrate scientific literacy through the creation of a visual presentation of scientific process to the community

d. Critique the work of others through scientific evaluation.

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **7th Grade** **Talented & Gifted Science**	**Big Idea: Science is a way of thinking about and investigating the world in which we live.** **Topic: Exploration of Scientific Process** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 1: The student will be able to analyze and explain the purpose of the scientific process through observation and practice.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
5 C l a s s e s	1.1 Identify scientific questions as testable. 1.2 Explain the importance of sequence in the scientific process. 1.3 Distinguish between controls and variables. 1.4 Recognize the value of replication in a scientific experiment which the expectation of similar resutls. 1.5 Maintain accurate records of scientific observations through the use of illustation and text. 1.6 Develop a cearly written reasearch paper abstract.	**Essential Questions:** • What makes a question scientific? • How does the design of the experiment your support the question? • What makes data valid and reliable? • How can results be communicated to others? **Enduring Understandings:** • Scientific claims must be verified by independent investigations. • Standardized procedures and measurements allow scientists to more accurately describe the physical world. **Sample Experiment** **Question:** Does the temperature at which unpopped popcorn is stored effect the average diameter of the kernels after they are popped. **Experimental Set-up:** Store popcorn at various temperatures, suggestions: put one in the freezer and one in the refrigerator, the control will be the popcorn stored at room temperature. *See link in additional resources for a complete guide to performing the experiment.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** Guide students through the steps of scientific process. Model how to create a testable hypothesis, design an experiment, collect data, analyze data, and draw conclusions. Students will maintain a scientist log and refection journal for future reference. The website below can be used as a guide to understanding the process of science: http://www.societyforscience.org/isef/primer/scientific_method.asp

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			Disuss the impotance of a well organized scientific journal article, which is a scientists way to communicate experimental findings to the world. Show students examples of published experiments from an assortment of scientifc journals. Highlight and draw attention to the the internal organization of the paper and state that papers the students will write will reflect this very same format. Discuss the relevance of a clearly written abstract as the core of a scientifc research a paper. The abstact will let the reader preview the paper, providing the problem of the experiment, the procedure, and the final results, conclusions, and implications prior to the body of the paper. Instruct students on how to write an scientific abstract using the following website as a guide: http://research.berkeley.edu/ucday/abstract.html **Assessment Models:** Student will assume the role of a food scientist working for a prominent food company. Students will record all components of the popcorn experiment, including identification of the scientific question, student created hypothesis, accurate initial and final observations, individual data (kernel diameter) collected during experimentation, analysis of results, and conclusions about the effect of

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<tr><td></td><td></td><td></td><td>temperature on un-popped kernels. Students will justify the validity and reliability of results and the possible need for replication through classroom discussion. Students will define the real world application of their experimental conclusions. Students will communicate and compare results through writing of research paper abstract that they will share through an informal peer discussion seminar.
Students will answer a series of questions analyzing the scientific method:
• What the importance of identification of a scientific question and creation of a testable hypothesis?
• Why is it necessary to incorporate a control into an experiment?
• Why is the accurate collection of data essential to a good experiment?
• Under what circumstances might it be necessary to repeat your experiment?
• How can you apply the information you have learned to the real world?
Both the refection journal and the scientist log will be reviewed and evaluated for strengths and weaknesses by both teacher and student using teacher created rubric. The rubric will also assess</td></tr>
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			student understanding of the scientific method as a process and how to compose an abstract. *(Analysis, Synthesis, & Evaluation)* **Additional Resources:** The effect of temperature on popcorn experiment: http://www.popweaver.com/popcorn101/science/science_proj_3.html Alternate experiment involving popcorn brands**:** http://www.mercer.edu/camps/message/summer2001/summer2001-popcorn.htm

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: 7th Grade Talented & Gifted Science	**Big Idea: Science is a way of thinking about and investigating the world in which we live.** **Topic: Experimental Design** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will development problem solving, decision-making, and inquiry skills. **Goal 2: The student will be able to design and conduct a controlled experiment based upon the scientific process and individual interest.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
8 C l a s s e s	2.1 Observe the natural world through a scientific point of view. 2.2 Compose a testable science question in the field of life science and make predictions that can be addressed by conducting investigations. 2.3 Devise an investigation that will answer the scientific question. 2.4 Compile a list of required materials. 2.5 Conduct experiment and record data. 2.6 Demonstrate the ability to properly set up and safely manipulate laboratory equipment .	**Essential Questions:** • What are real life applications of the scientific process? • What makes a guess educated? • What makes life worth studying? • What make something "alive"? • What distinguishes a good experiment from a bad experiment? • How do you measure the unquantifiable? **Enduring Understandings:** • Living things are optimal for scientific investigation, because they have both characteristics the share and individuality that makes them unique. • Scientific questions can be grounded upon biological and environmental observations. • Experiments must be carefully designed and carried out in order to confirm or deny original hypothesis. **Sample Experiment:** Testable question: How does temperature affect the water uptake of celery plants? Variable: Temperature of water Control: Size of celery plant and amount of water (all other	**Learning Activities:** Lead students through a series of observation and discussion activities to assist in individual identification of testable question. Teacher will provide a list of themes which students can use as the backbone of their investigation. Through discussion and informal forum, students with teacher guidance will determine which topics would be feasible to experiment upon provided our limitations and constraints in the classroom. The focus of the experiment must be limited to those issues which fall under life science, suggested topics are listed below: Encourage students to analyze outside the box themes/questions that interest them. Challenge students to create probing questions that provoke a high degree of inquiry. • Environment • Cells • Classification • Plants • Animals • Bacteria (archaebacteria and eubacteria) • Fungi • Genetics

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<tr><td></td><td></td><td>enivromental factors must also remain constant) Water uptake over time
<u>Sample Questions:</u>
• List other environmental conditions that must be controlled?
• Identify the types of instruments invovled in data collection.
• Develop a plan to collect your data including experimental set up</td><td>• Cellular processes (cellular respiration, photosynthesis, osmosis, diffusion, endocytosis, exocytosis)
• Reproduction (mitosis and meiosis)
• Heredity (traits and inheritance)

Assessment Models:
Students will assume the role of an intern for a research lab. Students will submit a well designed experiment proposal that could possibly be the next investigation this lab will perform. It is very important that all components of proper experimental design are present in order to be considered. The following will be used as a checklist and incorporated into a rubric.
• Record of observations leading up to scientific question.
• Educated guess or hypothesis
• Detailed list of materials required
• Detailed experimental plan, including control, variable and time required to complete experiment
• Type of data collected and method of data collection</td></tr>
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Suggested days of Instruction	Curriculum Management System Subject/Grade Level: 7th Grade Talented & Gifted Science	**Big Idea: Science is a way of thinking about and investigating the world in which we live.** **Topic: Experimental Design** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will development problem solving, decision-making, and inquiry skills. **Goal 2: The student will be able to design and conduct a controlled experiment based upon the scientific process and individual interest.**	
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			All the following will be written in scientist log and submitted for review using teacher made rubric. *(Analysis, Synthesis, & Evaluation)* **Additional Resources:** Examples of life science questions that can be tested using the scientific process. http://school.discoveryeducation.com/sciencefaircentral/Getting-Started/idea-finder.html Additional life science experiment ideas: http://www.ars.usda.gov/is/kids/fair/story.htm Scientist notebook: http://www.esiponline.org/classroom/foundations/writing/notebook.html Assessment Rubric: http://www.exemplars.com/resources/rubrics/science.html

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Suggested days of Instruction	Curriculum Management System Subject/Grade Level: 7th Grade Talented & Gifted Science	**Big Idea: Science seeks to explain the natural world. Its explanations and connections are interpreted and tested using evidence from the living world.** **Topic: Experimental analysis** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 3: The student will be able to analyze and evaluate data and formulate a conclusion based upon experimental results.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
6 Classes	3.1 Organize data into charts, tables, and graphs. 3.2 Evaluate strengths and weaknesses of data. 3.3 Gather, evaluate and represent evidence using scientific tools, technologies, and computational strategies. 3.4 Interpret experimental evidence as it applies to the real world and draw reasonable conclusions 3.5 Reflect upon experiment and determine ways the experiment can be revised. 3.6 Show that experimental results can lead to new questions and further investigations	**Essential Questions:** • How does my data relate to my hypothesis? • What is the relationship between the independent and dependent variables? • What can be learned from looking at the data? • How can you show change? **Enduring Understandings:** • Experimental results can either confirm or deny original hypothesis. • Scientific reasoning is used to support scientific conclusions. • Scientific inquiry involves forming explanations and connecting these explanations to scientific knowledge and theory. • Science is a practice in which an established body of knowledge is continually revised, refined, and extended. **Sample Experiment Continued:** Remaining with the celery experiment described above use the questions below to help guide students through analysis: • How can we organize the results from the experiment?	**Learning Activities:** Students will be given a variety of options for organizing their data such as charts, graphs and tables. Students will be instructed how to write a scientific research paper. The proper format will include the following: a title, abstract, introduction, methods, results, discussion and works cited. Lead, guide and support students as they organize the components of their experiment into the correct research paper format outlined above. Utilize the website listed below in additional resources as a guide for proper paper design. **Assessment Models:** The students will now carry out their investigation as outlined in the submitted proposal. Once students have collected all of their data, they will create visual aids such as graphs, charts, tables to help interpret and analyze their experimental findings. All sources of information including student observations, data collected, sketches and journal notes will be included and considered. The students will use this information to decide whether or not the data supports or rejects the original hypothesis. The students will be responsible for

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: 7th Grade Talented & Gifted Science	**Big Idea: Science seeks to explain the natural world. Its explanations and connections are interpreted and tested using evidence from the living world.** **Topic: Experimental analysis** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 3: The student will be able to analyze and evaluate data and formulate a conclusion based upon experimental results.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		• What is the best way this data can be portrayed visually? • If you were to do this experiment again, what improvements would you make and why? • How can this new information be applied to the real world?	arranging these components into the form of a research paper including a well written abstract as practiced in Quarter I assessment. The following will be used as a checklist and incorporated into a rubric: • Clearly written abstract • Collection of accurate data • Maintaining detailed records in your scientist notebook which may include evidence of multiple trials • Completion of visual aids (graphs, tables, charts etc…) • Conclusion with supporting evidence • Detailed reflection of experiment *(Analysis, Synthesis, & Evaluation)* **Additional Resources:** Writing a research paper: http://umech.mit.edu/freeman/6.021J/2000/writing.pdf Create a graph: http://nces.ed.gov/nceskids/createAgraph/

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **7th Grade** **Talented & Gifted Science**	**Big Idea: Science seeks to explain the natural world. Its explanations and connections are interpreted and tested using evidence from the living world.** **Topic: Experimental analysis** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 3: The student will be able to analyze and evaluate data and formulate a conclusion based upon experimental results.**	
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			Scientist Notebook: http://www.esiponline.org/classroom/foundations/writing/notebook.html Assessment Rubric: http://www.exemplars.com/resources/rubrics/science.html

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **7th Grade** **Talented & Gifted Science**	**Big Idea: Science literacy involves communication of experimental results.** **Topic: Communication of Results** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 4: The student will be able to summarize and portray experimental findings to others.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 C l a s s e s	4.1 Engage in discussion in order to process and learn from others' ideas, observations, and experiences. 4.2 Apply scientific findings to real life scenarios 4.3 Demonstrate scientific literacy through the creating of a visual presentation of scientific findings. 4.4 Critique the work of others through scientific evaluation.	**Essential Questions:** • How can my results be best justified and explained to others? • What makes communication successful? • Why is knowledge so powerful? **Enduring Understandings:** • Scientific inquiry involves communicating and justifying explanations. • Science involves practicing productive social interactions with peers. **Sample Experiment Continued:** Analyze and discuss the various ways the celery experiment conclusions can be conveyed to others in a meaningful and effective manner. Ask students: • Why is it important to talk about our scientific explanations with others? • How can we model the results in a way that would be interesting for our audience? • Why would society care about the conclusions of the experiment?	**Learning Activities:** Discuss various presentation techniques through the use of the Internet and teacher examples. Use the website below to aid in student creation of display board design: http://mset.rst2.edu/portfolios/l/lautz_s/Science%20Fair%20Handbook/displayboard.html Students will take part in a Family TAG night in which they will communicate the results of their science investigations through participation in a science fair. Students will create a visual display (display board) that indicates the scientific steps they followed in order to answer their scientific questions. As parents and community members engage in a gallery walk, the students will demonstrate scientific literacy by required orally discussing their scientific findings and by responding to attendee's questions. **Assessment Models:** The students will become the teacher and evaluate the experiments of their previous competitors. Students will decide how their classmate's experiments measure up according to the scientific

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: 7th Grade Talented & Gifted Science	**Big Idea: Science literacy involves communication of experimental results.** **Topic: Communication of Results** **Overarching Goals:** (1) Students will understand the core concepts and principles of science, using measurement and observation tools to categorize, represent, and interpret the naturally designed world. (2) Students will utilize the conceptual, mathematical, physical, and computational tools that need to be applied when evaluating scientific claims. (3) Students will justify that the growth of scientific knowledge is dependent upon the critique, revision, and communication governed by a core set of norms and values. (4) Students will develop problem solving, decision making, and inquiry skills. **Goal 4: The student will be able to summarize and portray experimental findings to others.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
			community. The students will create a rubric based upon their knowledge of the scientific process. The rubric must include all components essential to a scientifically sound experiment. After the rubric is created, the student will use that rubric as a tool to assess the experiment that they have be assigned. Both the rubric they have created and the final analysis of experiment will be reviewed for a concluding evaluation. *(Analysis, Synthesis, & Evaluation)* **Additional Resources:** Rubric creation: http://rubistar.4teachers.org/index.php Assessment Rubric: http://www.exemplars.com/resources/rubrics/science.html

	Scientific Tools and Technologies	Scientific Procedures and Reasoning Strategies	Scientific Communication/Using Data	Scientific Concepts and Related Content
Novice	• Did not use appropriate scientific tools or technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing).	• No evidence of a strategy or procedure, or used a strategy that did not bring about successful completion of task/ investigation. • No evidence of scientific reasoning used. • There were so many errors in the process of investigation that the task could not be completed.	• No explanation, or the explanation could not be understood, or was unrelated to the task/ investigation. • Did not use, or inappropriately used scientific representations and notation (e.g. symbols, diagrams, graphs, tables, etc.). • No conclusion stated, or no data recorded.	• No use, or mostly inappropriate use, of scientific terminology. • No mention or inappropriate references to relevant scientific concepts, principles, or theories (big ideas). • Some evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Apprentice	• Attempted to use appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing) but some information was inaccurate or incomplete.	• Used a strategy that was somewhat useful, leading to partial completion of the task/investigation. • Some evidence of scientific reasoning used. • Attempted but could not completely carry out testing a question, recording all data and stating conclusions.	• An incomplete explanation or explanation not clearly presented (e.g., out of sequence, missing step). • Attempted to use appropriate scientific representations and notations, but were incomplete (e.g., no labels on chart). • Conclusions not supported or were only partly supported by data.	• Used some relevant scientific terminology. • Minimal reference to relevant scientific concepts, principles, or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.

	Scientific Tools and Technologies	Scientific Procedures and Reasoning Strategies	Scientific Communication/Using Data	Scientific Concepts and Related Content
Practitioner	• Effectively used some appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data, with only minor errors.	• Used a strategy that led to completion of the investigation/task. • Recorded all data. • Used effective scientific reasoning. • Framed or used testable questions, conducted experiment, and supported results	• A clear explanation was presented. • Effectively used scientific representations and notations to organize and display information. • Appropriately used data to support conclusions.	• Appropriately used scientific terminology. • Provided evidence of understanding of relevant scientific concepts, principles or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Expert	• Accurately and proficiently used all appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data.	• Used a sophisticated strategy and revised strategy where appropriate to complete the task. • Employed refined and complex reasoning and demonstrated understanding of cause and effect. • Applied scientific method accurately: (framed testable questions, designed experiment, gathered and recorded data, analyzed data, and verified results).	• Provided clear, effective explanation detailing how the task was carried out. The reader does not need to infer how and why decisions were made. • Precisely and appropriately used multiple scientific representations and notations to organize and display information. • Interpretation of data supported conclusions, and raised new questions or was applied to new contexts. • Disagreements with data resolved when appropriate.	• Precisely and appropriately used scientific terminology. • Provided evidence of indepth, sophisticated understanding of relevant scientific concepts, principles or theories (big ideas). • Revised prior misconceptions when appropriate. • Observable characteristics and properties of objects, organisms, and/or materials used went beyond the task/investigation to make other connections or extend thinking.

Science Fair *Experimental Projects*

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Problem *(Double Points)* **(x2)**	States the problem as a question that is vague, or as a statement, or addresses an issue to which the student already knows the answer. Shows limited or no connection to a valid scientific or mathematical concept.	States problem as a question, and represents a genuine learning opportunity for the student. Generally addresses a valid scientific or mathematical concept.	States problem as a question, provides evidence that it comes from the student's personal interests or experiences, and represents a genuine learning opportunity for the student. Specifically addresses a valid scientific or mathematical concept, or has a beneficial application to some aspect of society.
Preliminary Research	Uses limited sources from only one type of information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews), or uses some resources that are not reputable sources. Fails to connect the research to the problem, or material is copied rather than written in the student's own words.	Uses three or more reputable sources, cited correctly. Cites more than one type of information resource. Makes a general connection between the research and the problem in the student's own words.	Uses five or more reputable sources, cited correctly. Cites at least four types of information resources. Makes a clear connection between each source and the problem in the student's own words.
Hypothesis *(Double Points)* **(x2)**	Hypothesis is either not testable or does not connect to the stated problem, or shows no connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, addresses the stated problem, and shows some connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, and clearly addresses the stated problem. Shows a direct connection to their preliminary research.
Procedure & Materials	Experiment is not relevant to the hypothesis or is only performed once. The procedures outlined are seriously incomplete or not sequential, or materials list is missing or incomplete.	Experiment is adequate to test the hypothesis, but may leave some unanswered questions. Performs experiment one or more times. Procedures are outlined in a step-by-step fashion, but there may be 1 or 2 gaps that require explanation. Major materials are listed.	Experiment is a well-constructed test of the hypothesis and is performed several times. Procedures are outlined in a step-by-step fashion that could be followed by anyone without additional explanations. All relevant materials are listed.
Results *(Double Points)* **(x2)**	Does not summarize data clearly. The relationship between the variables is unclear or not discussed. Makes no predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Mentions at least one relationship between the variables and gives some analysis of trends/patterns. May attempt predictions about what might happen to the results if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Discusses relationships between the variables and thoroughly analyzes trends/patterns. Makes well-reasoned predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.
Conclusions	Conclusion does not answer the problem, or does not refer back to the hypothesis, or contradicts the evidence collected.	Conclusion addresses the problem, states if the hypothesis was supported or rejected, and gives some explanation why.	Conclusion completely answers all aspects of the problem, states if the hypothesis was supported or rejected, and clearly cites evidence to explain why.
Visual Quality of Display	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)

Science Fair *Experimental Projects*
(6th through 8th Grade)
Judge's Score Sheet for School Site Science Fairs

Teacher: *Period:*

Problem *(Double Points)* **(x2)**																	
Preliminary Research																	
Hypothesis *(Double Points)* **(x2)**																	
Procedure & Materials																	
Results *(Double Points)* **(x2)**																	
Conclusions																	
Visual Quality of Display																	
Total Score																	
Student(s):																	
Project:																	

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

Sample Abstract Template

Title (Times New Roman, 14, bold, Center)

First initial, last name (Times New Roman, 12, Center)

School/Institution ... , Address..., Country,... (Times New Roman, 12, Center)

Background/importance of research topic (very brief!): An introductory description of the science of the project and/or the significance of the research.

Purpose/hypothesis (thesis or statement of problem): An introductory statement (thesis) explaining the reason for the research, or a statement of the problem or hypothesis.

Procedures/Data/Observations: Summary of procedures, emphasizing key points or steps, and the data you observed. Include results that made you revise procedures along the way.

Conclusions/Applications: What was learned about the hypothesis and what does it mean to the world?

Experiment Format

Scientist(s): _____ Date: _____

Title: _____ Team: _____

Use this format if your project is an experiment!

NOTE: You can do everything on this page BEFOREHAND. This page is your work plan!

Part 1. Purpose: _____**Approved**

Based on your observation and research, what scientific question/phenomena do you seek to explain?

- Your question must be testable

Part 2. Hypothesis: _____**Approved**

Develop a working hypothesis to explain how or why things happen in the manner observed.

- Use "If..., then..., because...," format
- If [what I will do], then [prediction of what will happen], because [give a reason for your prediction]

Part 3. Variables: _____**Approved**

A. **Independent variable**. The one factor intentionally changed, the manipulated variable

B. **Dependent variable**. The responding variable. It is measured it to support or refute the hypothesis.

C. **Constants** (also called controlled variables). These are factors that are intentionally kept the same, to keep my experiment consistent.

Part 4. Procedure: _____**Approved**

This is what I will do

- Tell all steps, in order, in such a way that another person could repeat your experiment exactly (like a recipe)
- Specify times and amounts, if necessary
- Specify the number of trials for each step

Part 5. Materials: _____**Approved**

Here is what I will need

- Include quantities needed
- Use metric units

Experiment Format (continued)

NOTE: Do this page <u>WHILE YOU PERFORM YOUR EXPERIMENT</u>, except prepare the blank data table ahead of time. Fill in the data table as you perform the experiment.

Part 6. Lab Set-Up: _____**Approved**

This is a labeled sketch of your experiment

- Sketch large enough that your drawing can be easily understood
- Use enough detail for your drawing to be understood
- Label the important parts of your drawing
- If necessary, note the sequence ('before' and 'after', for example)

Part 7. Data Table: _____**Approved**

Data are the bits of information you measure during your experiment

- Keep track of the data on a neat, organized table
- Name the measured variables, and give units
- Give totals or averages where appropriate
- Count or measure accurately

Part 8. Observations:

Use complete sentences to describe what you noticed during your experiment

- Give specific, relevant details
- Avoid opinions, feelings or generalizations

Experiment Format (continued)

NOTE: Do this page AFTER you have performed your experiment. It's fun to actually do the test, but the learning comes in reflecting afterwards about what happened.

Part 9. Visual Aids: _____**Approved**

- Make appropriate visual aids such as bar graphs or line graphs
- Doing so will help you to recognize patterns and relationships among the data

Part 10. Analysis: _____**Approved**

Use words to tell what the data mean

- Use complete sentences that show the main ideas of the data
- Describe any trends or patterns
- Use scientific and math vocabulary wherever it is appropriate

Part 11. Conclusion: _____**Approved**

Did my data support my hypothesis?

- Use "The data supported/didn't support [choose one] my hypothesis"
- Don't say "I was right", "I was wrong", or "This proves..." (one experiment doesn't prove anything!
- If the data are unclear, state that more research is needed, and say what you should do next

Part 12. Big Idea: _____**Approved**

What did I learn?

- How is what I learned related to a larger idea in science?
- How is what I learned related to something else I know about the world?

Part 13. Reflection: _____**Approved**

What do I think about my experiment?

- Did anything happen that you didn't expect?
- Were there any possible sources of error in your data?
- This is the section to put in any feelings or questions you have about what you did

Part 14. Next Testable Question: _____**Approved**

What related experiment would I try next?

- Your question must be related to this experiment in some way
- Your question must be testable

Part 15. Abstract:

A brief overview of your experiment. (See Template)

- Include scientist(s) name(s) and school/institution.
- Include your purpose, hypothesis, summary of your procedure, relevant data and conclusion.

Science: Talented and Gifted Grade 7

COURSE BENCHMARKS

1. **The student will be able to analyze and explain the purpose of the scientific process through observation and practice.**

2. **The student will be able to design and conduct a controlled experiment based upon the scientific process and individual interest.**

3. **The student will be able to analyze and evaluate data and formulate a conclusion based upon experimental results.**

4. **The student will be able to summarize and portray experimental findings to others.**