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| DMPS Scientific Research I Curriculum Guide | 2014-15 | |
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**Unit 1: Exploring an Issue or Problem (6 weeks)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Common Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| Skillful researching techniques depend upon developing expert questioning skills and asking “deep”, critical and higher-order thinking questions. | * Ethics & copyright * Tools for collaboration * Designing quality research questions * Searching for information * Determining relevancy of information * Determining authority and accuracy of information * Note-taking & citing sources | Identify questions and concepts that guide scientific investigations.  Understand about scientific inquiry. | I can identify resources that can be used to generate research ideas.  I can conduct and organize preliminary research in order to develop sufficient background knowledge around a research topic.  I can brainstorm ideas that lead to the development of creative aspects to an issue or solutions to a problem.  I can describe background research methods that will give you reliable resources and avoid plagiarism.  I can write higher-level questions using a “thinking taxonomy” to build my own high level inquiry-based question. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates demonstrate strategies for lifelong learning.*  *Graduates possess technological and information literacy.*  *Graduates exhibit creative, innovative and entrepreneurial thinking.* |

**Unit 2: Designing Research & Experiments (6 weeks)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Common Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| The research design of an experiment determines both whether the experiment is likely to succeed and the reliability of its results. | * Writing quality hypotheses * Principles of experimental design * Qualitative vs. quantitative data | Design and conduct scientific investigations. | I can list the main components of an experimental design.  I can explain the importance of doing background research on independent and dependent variables.  I can describe how constants are different from the control.  I can write a testable hypothesis.  I can identify at what point – during the process of designing an experiment – the researcher should write the hypothesis.  I can explain the importance of a prediction in/with a hypothesis. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates demonstrate proficiency in science, including life, earth and physical science.*  *Graduates demonstrate critical thinking and problem solving skills.* |

***Suggested Text:*** STEM Student Research Handbook – NSTA Press

**Unit 3: Proposing Ideas for Research (6 weeks)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| Scientists must clearly communicate ideas about their research intentions with clarity and detail with the purpose of soliciting support of their idea. | * Conducting pre-trial experiments * Basics of scientific writing * Identification of design limitations * Ethics in research | Communicate and defend scientific procedures and explanations.  Design and conduct scientific investigations. | I can explain the purpose of writing a research proposal.  I can defend the need for a detailed methods section in a proposal.  I can describe how pre-trials might apply to a research project.  I can analyze the disagreements that scientists and editors have about various aspects of scientific writing.  I can identify aspects of a proposal that require an “ethical eye” to ensure proper procedures and protocols are used. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates will exercise sound reasoning in making complex choices.*  *Graduates will exhibit creative, innovative and entrepreneurial thinking.* |

**Unit 4: Gathering, Analyzing & Representing Data (12 weeks)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Common Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| The accurate gathering, analyzing and representing of data collected during an experiment is crucial to the usefulness and potential impact of an investigation. | * Use of laboratory notebooks * Data collection issues for groups * Proper recording of observations and data * Graph types and their use * Causation vs. correlation * Basics in research/experimental statistics | Design and conduct scientific investigations.  Use technology and mathematics to improve investigations and communications  Think critically and logically to make the relationships between evidence and explanations  Use mathematics in all aspects of scientific inquiry | I can explain the importance of keeping an accurate laboratory notebook.  I can explain the pros and cons of paper vs. online laboratory notebooks.  I can determine which types of graphical representations should be used for a set of data.  I can construct a variety of graphical representations of sets of data.  I can find trends, patterns and highlights in a set of data.  I can determine which inferential statistics apply to a set of data.  I can determine whether or not differences in data are statistically significant. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates demonstrate proficiency in science, including life, earth and physical science.*  *Graduates demonstrate critical thinking and problem solving skills.*  *Graduates possess technological and information literacy.* |

**Unit 5: Presenting Research Findings (6 weeks)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| The effective communication of information accumulated from the experiment must be practiced by the researcher in order to benefit others. | * How to write a research paper (sections required) * Submitting a paper * Aspects of oral presentations * Scientific poster creation | Communicate and defend scientific procedures and explanations | I can explain why documentation is important.  I can list the documentation guidelines that apply to documentation styles.  I can list and describe the characteristics of a quality STEM research paper.  I can write a high level, quality STEM research paper.  I can identify the qualities of an effective oral presentation.  I can explain the components of a scientific poster.  I can perform an oral presentation of a STEM research project, which may include a scientific poster. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates possess technological and information literacy.*  *Graduates demonstrate proficiency in reading, writing, speaking and listening.* |

**Unit 6: Understanding Laboratory Dynamics & Etiquette (To be included in all units)**

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| **Content Standards** | **Content Objectives** | **Iowa Core Statements** | **Student-Centered Learning Targets** | **Common Assessments** | **Graduate Ends** |
| Like any complex social organization, research laboratories have their own customs and rules. Performing effectively and efficiently in the organization means a researcher must understand his/her role and how his/her work “fits in” with the work of others in the organization. | * Advanced laboratory safety * Structure of lab/group meetings * Lab routines * Effective use of lab spaces and equipment * Interacting with other researchers using common lab space(s) | Communicate and defend scientific procedures and explanations  Formulate and revise scientific explanations and models using logic and evidence  Design and conduct a scientific investigation. | I can list and explain safety procedures for the spaces and equipment used in an STEM research experiment.  I can positively contribute to the discussions during a lab group meeting.  I can set up a lab area in a way that maximizes efficiency and safety.  I can interact positively with others in my STEM research lab space, including peers and adults. | *Common rubrics and scoring guidelines to be developed for project-based assessments.* | *Graduates learn from and work with individuals representing diverse cultures and religions in a spirit of mutual respect in school, work and community.*  *Graduates exercise sound reasoning in making complex choices.* |