Integrating Problem-based Learning, Next Generation Science Standards, Common Core Practices and Science Fair Projects

Science Fair projects are a natural end result of Problem-based Learning in science and provide a venue for students to present their work to the public. Science Fair projects incorporate almost all aspects of the Science and Engineering Practices found in the new **Next Generation Science Standards**. These projects should not be looked at as something "extra" to do but are an essential process to address both the NGSS and the **Common Core** reading and writing practices for science.

Problem-based Learning (PBL) is a key instructional approach to implement the **Common Core State Standards** and prepare students for college, career and citizenship in the 21st century. In PBL, students go through an extended process of inquiry in response to a complex question, problem, or challenge. Rigorous projects help students learn key academic content and practice 21st Century Skills (such as collaboration, communication and critical thinking).

> "If we are serious about reaching 21st Century educational goals, PBL must be at the center of 21st Century instruction. The project contains and frames the curriculum, which differs from the short "project" or activity added onto traditional instruction. PBL is *The Main Course*, not Dessert."
>
> *Problem Based Learning for the 21st Century, 2012 Buck Institute for Education*

Problem Based Learning that is rigorous, meaningful and effective:

♦ **is intended to teach significant content.** Goals for student learning are explicitly derived from content standards and key concepts at the heart of academic disciplines. *Science Fair projects also spring from core content.*

♦ **requires critical thinking, problem solving, collaboration, and various forms of communication.** To answer a Driving Question and create high-quality work, students need to do much more than remember information. They need to use higher-order thinking skills, teamwork, make their own ideas clear when speaking, be able to express themselves in various modes, and make effective presentations. These skills, competencies and habits of mind are often known as "21st century skills," because they are prerequisite for success in the 21st century workplace. *These skills are also vital to designing, conducting and presenting a successful science fair project to peers, judges and the general public.*

♦ **requires inquiry as part of the process of learning and creating something new.** Students ask questions, search for answers, and arrive at conclusions, leading them to construct something new – *just like a science fair project!*

♦ **is organized around an o*pen-ended* Driving Question.** This focuses students' work and deepens their learning by framing important issues, debates, challenges or problems. *Choosing a problem that is specific enough to investigate and makes connections to the real world is the first step to a solid science fair project.*

♦ **creates a "need to know" essential content and skills.** PBL reverses the order in which information and concepts are traditionally presented. Project Based Learning begins with the vision of an end product or presentation. This creates a context and reason to learn and understand the information and concepts. *Most science fair students create an experimental design and procedure to test their hypothesis and then learn the concepts and special skills involved in testing their hypothesis as they go.*

Compiled by Anne F. Maben, Science Consultant, UCLA Science Project 2016

♦ **allows some degree of student voice and choice.** Students learn to work independently and take responsibility when they are asked to make choices. The opportunity to make choices, and to express their learning in their own voice, also helps to increase students' educational engagement. *Science Fair projects should be linked to a student's passion for the subject. Students should be able to choose their own project and complete it on their own with little outside assistance.*

♦ **includes processes for revision and reflection.** Students learn to give and receive feedback in order to improve the quality of the products they create, and are asked to think about what and how they are learning. *Science Fair projects inherently involve reflection; re-design, re-testing and peer review to thoroughly answer a project problem.*

♦ **involves a public audience.** Students present their work to other people, beyond their classmates and teacher – in person or online. This "ups the stakes," increasing students' motivation to do high-quality work - *just as creating displays and judging does for science fair projects.*

(The above section was adapted from the Buck Institute description of PBL)

Resources/News

- **Next Generation Science Standards-Final docs**
  http://www.nextgenscience.org/next-generation-science-standards

- **CSTA Article: NGSS and CCSS – Science Fair Is Back!**
  http://www.classroomscience.org/ngss-and-ccss-science-fair-is-back

- **Common Core State Standards website**
  http://www.cde.ca.gov/re/cc/

- **Common Core Standards link**
  http://www.ocde.us/commoncoreca/Pages/default.aspx

- **LACOE Common Core workshops**
  http://www.lacoe.edu/CurriculumInstruction/CommonCore.aspx

- **UCLA Common Core Symposiums**
  http://centerx.gseis.ucla.edu/registration/common

- **Institute for Inquiry (Exploratorium)**
  http://www.exploratorium.edu/IFI/index.html

- **Inquiry-Based Learning (an online workshop)**
  http://www.thirteen.org/edonline/concept2class/inquiry/index.html

- **Open Inquiry in Scientific Research Curriculum Materials (PBL)**
  http://bml.ucdavis.edu/education/cameos/resources/open-inquiry/

- **Problem-based Learning (Buck Institute)**
  http://www.bie.org/

- **PBL "Do-it-Yourself" Toolkit**
  http://www.bie.org/diy

Downloadable Resources from pbl-online.org

• **Project Planning Forms**	http://www.pbl-online.org/ProjectPlanning/PlanningForm.htm
• **Assessment Tool Docs**	http://www.pbl-online.org/PlanTheAssessment/assessmentTools/assessmentTools.htm
• **Sample Rubrics**	http://www.pbl-online.org/PlanTheAssessment/assessmentForms/sampleRubrics.htm
• **Project Planning Tools**	http://www.pbl-online.org/ManagetheProject/ProjectPlanningTools/PlanningTools.htm