Unit 15: The Industrial Research Lab

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **1 Week**
Status: **Published**

Brief Summary of Unit

Students will explore historical and contemporary research labs, including those by Edison and Bell Labs and the pharmaceutical industry.

Standards

LA.RI.11-12.2	Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
LA.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RI.11-12.5	Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.
LA.RI.11-12.6	Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness or beauty of the text.
LA.RI.11-12.10b	By the end of grade 12, read and comprehend literary nonfiction at grade level text-complexity or above.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
TECH.8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
TECH.8.1.12.D.5	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
TECH.8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
TECH.8.2.8.D.5	Explain the impact of resource selection and the production process in the development of a common or technological product or system.
TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
TECH.8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
TECH.8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish

	for review.
TECH.8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
TECH.8.2.12.B.5	Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Transfer

Essential Questions

- How does research relate to the design loop?
- What is the goal of a research lab?
- What skills are necessary for research and design and which interests you?

Essential Understandings

- corporations are responsible for innovations in many fields, both historically and today, and that these corporations are relevant to the local economy.
- different engineering disciplines are involved with different types of work.
- math, science and communication are integral to development of inventions and innovations.

Students Will Know

- career specialization exists in engineering, with a common knowledge base.
- engineers and scientists are involved with research and development.
- how research laboratories develop inventions and innovations.

- key vocabulary: research, patent, pharmaceutical, manufacturing, hypothesis, scientific method, product pipeline.
- pharmacological research is part of the local economy.
- the first research laboratory was in Edison New Jersey and developed the light bulb, that Bell Labs in Murray Hill, N. J. developed the transistor which is the basis of the integrated circuit.
- the process used in developing an invention.
- the skills and knowledge required of research engineers and scientists vary by discipline, but include commonalities: higher level math, science, and communication skills.

Students Will Be Skilled At

Evidence/Performance Tasks

- complete writing prompts. Examples: The selection of presentation techniques is critical to communication to people… (a) "I am most interested in _____engineering because…. " (b) Research laboratories have in important role in meeting societies needs….
- demonstrate the ability to utilize the design loop as a problem solving tool.
- demonstrate understanding on written quizzes and tests about subject materials.
- develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric
- make timelines of a historical invention and a contemporary invention.
- meaningfully address the essential and guiding questions of this unit of study.
- meaningfully participate in guided question and answer sessions, group and individual discussions, show an understanding of the purpose of the unit lesson(s) and their key terms and concepts.
- use software (i.e. SMART) to create a presentation about the evolution of an invention that is the product of a research laboratory.
- use unit vocabulary in the presentation.

Learning Plan

- Conduct formative assessments throughout the process using class discussion, student writing and practice quizzes.
- Preview the essential questions and connect to learning throughout the unit.
- Provide guidance and rubrics for the development of a digital portfolio.
- Provide lecture and opportunities for discussion about guiding questions.
- Students and teacher will score summative assessment using a rubric specific to the research problem.
- Students will complete a writing prompt.
- Students will complete unit test or quiz.
- Students will research (library, internet, and/or interview) and report and/or create a

presentation of the development of an invention.

- Students will research careers and evaluate their personal interest.
- Teacher will demonstrate and involve students in presentation techniques using SMART technology and PowerPoint.
- Visit (or tour on-line) a corporate research facility like Edison's West Orange Laboratory, Alcatel-Lucent/Bell Labs or a pharmaceutical facility.

Materials

- CAD (Computer-aided Design) and other software programs
- DVDs
- Email and e-board
- Robotics lab equipped with MATLAB, PSpice, power supplies, logic testers, various electrical components, drill press and tools.
- SmartBoard use for presentation and interactive lessons
- Virtual Field Trips
- Web sites

Suggested Strategies for Modifications

- additional time on task
- alternative outcome options
- assessment based on individual development in the area of study
- audio tape of instruction
- cooperative learning groups
- handouts of notes, procedures, processes, diagrams, etc.
- images and visual aids
- one-to-one instruction and assistance
- preferential seating
- reading material modified to student level
- revised techniques, use of tools and media in hands-on activity
- study partners
- testing materials appropriate to student level