Project Learning Tree Alignment with VT Framework : Fields of Knowledge

Science and Technology Standards of Grades PreK-8

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Introduction:

Project Learning Tree (PLT) is an interdisciplinary supplementary environmental education program. It is available in all of the US. states, Canadian provinces, Mexico, Japan, Brazil and some European countries. In Vermont it is sponsored by the VT Department of Forests, Parks, and Recreation which also offers activities to extend PLT to examine regional and local issues. Educators can get the materials by attending a 6-hour workshop. Call (802) 241-3651 for more information.

Project Learning activities listed for students Grade 5-8 were evaluated using methodology developed by Vermont Institute for Science, Math and Technology for Vital Results, Learning Opportunities and Fields of Knowledge. This document lists the numbers of lessons used for the scoring for Fields of Knowledge and titles of some that educators seeking supplementary materials to augment specific standards might find especially helpful. The numbers and titles in this document refer to activity numbers and titles found in the PLT PreK-8 Activity Guide. Numbers and titles within single parenthesis ( ) or behind a single # sign refer to the single letter of the preceeding standard. Numbers and titles within a double parenthesis (( )) or behind a double ## sign refer specifically to the double lettered standards preceeding the notations. Ranking for alignment follows each general description of the standard and each element of the standard. Rankings were done for activities listed as appropriate for Grades 5-8 (see Project Learning Tree PreK-4 Alignment with Science Standards of VT Framework- Fields of Knowledge for activities below Grade 5).

Rating Scale:

0	Not applicable/not covered
1	Slight coverage
2-3	Moderate coverage
4-5	Complete alignment

INQUIRY, EXPERIMENTATION, AND THEORY

Scientific Method Standard 7.1: **Students use scientific methods to describe, investigate, and explain phenomena:**
Raise questions;
Generate alternative explanations-hypotheses-based on observations and prior knowledge;
Design inquiry that allows these explanations to be tested;
Deduce the expected results;
Gather and analyze data to compare the actual results to the expected outcomes; and
Make and communicate conclusions, generating new questions raised by observations and readings ***Rating = 3***

a. Ask questions about objects, organisms, and events in the world around them; ***Rating =3***
aa. Frame questions in a way that distinguishes causes and effects; identify variables that influence the situation and can be controlled; ***Rating = 3***
(2-4, 6-12, 14-17, 20-25, 27,30,31,34,36-38,41-49,51,53,54,61, 63-69,74, 76-83, 88, 89)
#2- Get in Touch With Trees

#24- Nature's Recyclers
#46- School Yard Safari
#74- People, Places, Things
#61- The Closer You Look

b. Use reliable information obtained from scientific knowledge, observation, and ***Rating = 3***
bb. Seek, record, and use information from reliable sources including scientific knowledge, observation, and experimentation ***Rating = 3***
(2-4, 21-25, 41-43, 46-48, 51, 61, 63-69, 76-81)
#3 - Peppermint Beetle
#22 - Trees as Habitats
#63 Tree Factory
#77 Trees in Trouble

c. Create hypotheses for problems, design a "fair test" of their hypothesis, collect data through observation and instrumentation and analyze data to draw conclusions; use conclusions to clarify understanding and generate new questions to be explored; ***Rating = 3***
cc. Create hypotheses to problems, design their own experiments to test their hypotheses, collect data through observation and instrumentation, and analyze data to draw conclusions; use conclusions to clarify understanding and generate new questions to be explored. ***Rating = 3***
(3, 4, 24, 41-43, 66, 67, 78, 80, 81)
#41- How Plants Grow
#81- Living With Fire

d. Use evidence to construct an explanation, including scientific principles they already know and observations they make; ***Rating = 3***
dd. Describe, explain and model, using evidence that includes scientific principles and observations; ***Rating = 3***
(#41-43, 67, 76, 78, 80)
#42- Sunlight and Shades of Green
#76- Tree Cookies

e. Explain a variety of observations and phenomena using concepts that have been learned; ***Rating = 3***
(42, 43, 66, 67, 76-81, 95)
#77- Trees in Trouble
#95- Did You Notice?

f. Use either deductive or inductive reasoning to explain observations and phenomena, or to predict answers to questions; ***Rating = 3***
(41-43, 66, 67, 76-81)
#43- Have Seeds Will Travel
#66- Bursting Buds
g. Recognize other points of view, and check their own and others' explanations against experiences, observations, and knowledge; ***Rating = 3***
gg. Propose, recognize and analyze alternative explanations; and ***Rating = 3***
(#2-7, 9-11, 15, 18, 20, 21, 36, 40, 59, 89-91)
#18- Tale of the Sun

#5- Poet-Tree
#8- Forest of S.T. Shrew
#90- The Native Way

h. Identify problems, propose and implement solutions, and evaluate products and designs; and ***Rating =3***
(#12-15, 31-332,36-38, 43-45, 51, 53, 54, 59, 95)
#12- Tree Treasures
#59- Power of Print
#95- Did You Notice

i. Work individually and in teams to collect and share information and ideas.
ii. Work individually and in teams to collect, share and present information and ideas. ***Rating = 3***
(Pertains to most PLT activities)

Investigation
Standard 7.2: Students design and conduct a variety of their own investigations and projects. These should include:

*** Questions that can be studied using the resources available;**
*** Procedures that are safe, humane, and ethical;**
*** Data that are collected and recorded in ways that others can verify;**
*** Data and results that are represented in ways that address the question at hand;**
*** Recommendations, decisions, and conclusions that are based on evidence, and that acknowledge references and contributions of others;**
*** Results that are communicated appropriately to audiences; and**
*** Reflections and defense of conclusions and recommendations from other sources, and peer review.**

Rating =3

a. Design and conduct an experiment (a "fair test");
aa. Design and conduct a controlled experiment; ***Rating =2***
(#28, 43, 44, 77, 81)
#28- Air Plants
#44- Water Wonders
#77- Trees in Trouble

b. Design and conduct a systematic observation; ***Rating = 4***
bb. Design and conduct field work;
(#21, 22, 24, 38, 44, 65, 77, 78, 80)
#21- Adopt a Tree
#80- Nothing Succeeds Like Succession
c. Complete a design of a physical structure or technological system (e.g., simple machines and measurement devices); ***Rating = 2***
cc. Completely design a physical structure or technological system (e.g., spring scales, bicycle gear shifts , timing of traffic lights); ***Rating =2***
(#53, 63, 67)
#53- On the Move

d. Complete a data study; ***Rating =3***
dd. Complete a data study based on civic, economic, or social issues; ***Rating =3***

(#4, 24, 35, 38, 40, 48, 57, 66, 67, 73,)
#38- Every Drop Counts
#57- Democracy in Action
e. Plan and manage a schedule; or \
ee. Design a resource or system management plan; or
(#21, 50, 79, 65, 69)
#21- Adopt a Tree
#50- 400-acre Wood
f. Complete a pure mathematics investigation ***Rating = 0***
ff. Illustrate mathematical models of a physical phenomenon. ***Rating = 0***
(None found)

g. Complete research;
(#21, 23, 28, 41-44, 47, 48, 70, 73, 77, 78) ***Rating = 0***
#28- Air Plants
#48- Field, Forest, and Stream

THEORY

Standard 7.3: Students understand the nature of mathematical, scientific, and technological theory. ***Rating = 2***

a. Show understanding that concepts form the foundation for theories; ***Rating = 2***
aa. Explain theories based upon observations, concepts, principles, and historical perspective; ***Rating = 2***
(#9, 10, 27, 41, 42, 44, 45, 69, 77, 79, 80. 81, 88,)
#27- Every Tree For Itself
#79 Tree Life Cycle

b. Look for evidence that explains why things happen; and Rating =
bb. Determine the validity of a theory by examining the principles on which it was founded, the constraints that apply to its application, and the body of physical evidence that supports it. ***Rating = 3***
(#4, 21-24, 28, 37,38, 40-48, 61, 63-68, 76-81
#40- Then and Now
#42- Sunlight and Shades of Green
c. Modify explanations when new observations are made or new knowledge is gained.***Rating = 2***
cc. Show understanding that new theories develop when phenomena are observed that are not fully explained by old theories. ***Rating = 2***
(#4, 11, 41-43, 80, 81 , 88, 89)
#43- Have Seeds Will Travel
#80- Nothing Succeeds Like Succession

History of Science, Mathematics, and Technology

Standard 7..4: Students understand the history of science. mathematics, and technology. ***Rating = 2***

a. Investigate contributions made to science, technology, and mathematics by many different kinds of people, and explain their importance. ***Rating = 1***

aa. Examine important contributions made to the advancement of science, technology, and mathematics, and respond to their impact on past, present, and future understanding. ***Rating = 2***
(# 17, 34, 89-91, 93)
#17- People of the Forest
#34- Who works in this Forest?
#91- In the Good Old Days

Roles and Responsibilities
Standard 7.5: Students analyze the roles and responsibilities of scientists, mathematicians, and technologists in social, economic, cultural, and political systems. ***Rating = 2***

a. Explain how discoveries or inventions can help or hurt people (e.g., the environmental impact of energy consumption). ***Rating = 3***
aa. Analyze the roles and responsibilities of scientists, mathematicians, and technologists in relation to ongoing research and discoveries that impact society (e.g.), the dangers and benefits of nuclear energy). ***Rating = 2***
(34, 36, 45, 47, 58, 73, 75, 82, 83, 85 89, 90, 91,95)
#75- Tipi Talk
#89- Trees for Many Reasons

SYSTEMS

Analysis
Standard 7.11: Students analyze and understand living and non-living systems (e.g., biological, chemical, electrical, mechanical, optical) as collections of interrelated parts and interconnected systems. ***Rating = 3***

a. Demonstrate understanding that systems are made of interrelated parts that influence one another; ***Rating = 3***
aa. Demonstrate understanding that systems are connected to other systems, and that one system affects how others work; ***Rating = 3***
(#17, 22-25, 30, 41-49, 51, 53, 58, 63, 79-83)
#24- Nature's Recyclers
#30- Three Cheers for Trees
#45-- Web of Life
#63- Tree Factory

b. Demonstrate understanding that systems include inputs, processes and outputs; and***Rating = 3***
bb. Demonstrate understanding that systems are effectively designed when specifications and constraints are understood; and ***Rating = 2***
(*#22-24, 41-49, 58, 63, 79-83)*
#23- The Fallen Log
#44- Water Wonders
#79- Tree Life Cycle

c. Use physical and mathematical models to show how, in a system, inputs affect outputs ***Rating = 0***
cc. Use physical and mathematical models to express how systems behave given a set of inputs or outputs. ***Rating = 2***
(#78, 80, 81)
#81- Living With Fire

SPACE, TIME, AND MATTER

Matter, Motion, Forces, and Energy Standard 7.12: Students understand forces and motion, the properties and composition of matter, and energy sources and transformations.
This is evident when students: ***Rating = 1***

a. Sort objects and materials according to observations of similarities and differences of properties (e.g., size, weight, color, shape, temperature); ***Rating = 2***
aa. Observe and measure characteristic properties of matter (e.g., boiling point, melting point, density, buoyancy, simple chemical reactions), and use them to distinguish one substance from another. ***Rating = 2***
(#2, 6, 7, 10-12, 20, 25, 37, 42, 64, 66-68, 76, 83)
#6- Picture This!
#12- Tree Treasures
#20- Environmental Exchange Box
#64- Looking At Leaves

b. Observe and describe changes of states of matter (e.g., in water):
bb. Provide examples of substances reacting chemically to form new substances with different characteristics, and describe and model the phenomenon with reference to elements and compounds; ***Rating = 1***
(#28, 42, 44, 51,78, 81)
#44- Water Wonders *#51- Make Your Own Paper*

c. Observe and describe the behavior of gases in containers (e.g., pumps, balloons); ***Rating = 1***
cc. Explain the relationships between pressure, volume, and the amount of gas (e.g.) soda bottles, auto tires); ***Rating = 0***
(#28, #81)
#28- Air Plants *#81- Living With Fire*

d. Apply forces to objects (e.g., inertia, gravity, friction, push and pull), and observe the objects in motion; ***Rating = 2***
dd. Observe and demonstrate a qualitative understanding of the relationship between mass, the magnitude of an applied net force, and the resulting change in speed and direction;
(#43, 44, 81)
#43- Have Seeds Will Travel

e. Identify and describe several common forms of energy (e.g., light, heat, and sound) and provide examples of sources, as well as some characteristics of the
transmission (e.g., light travels in straight lines until it is reflected, refracted, or absorbed); and ***Rating = 1***

ee. Identify and describe common forms of energy (e.g., light, heat, sound, electricity, electromagnetic waves), and their attributes, sources, and transmission characteristics (e.g., radiation, convection, conduction of heat); ***Rating = 0***
(#4, 14, 15, 28, 53, 81)
#4- Sounds Around #53- On the Move

f. Observe and record the effects of electric charge (e.g., charges repel, batteries); investigate magnetic and non-magnetic materials, and materials that are conductors and non-conductors of electricity. ***Rating = 0***
ff. Investigate the relationship between electricity and magnetism (e.g., in electric motors).
(None)

THE LIVING WORLD

Organisms, Evolution, and Interdependence

Standard 7.13: **Students understand the characteristics of organisms, see patterns of similarity and differences among living organisms, understand the role of evolution, and recognize the interdependence of all systems that support life,**

a. Identify characteristics of organisms (e.g., needs, environments that meet them; structures, especially senses; variation and behaviors, inherited and learned)
aa. Identify, model, and explain the structure and function (e.g., cells, tissues, organs, systems, of organisms (e.g., plants, animals, fungi). **Rating =4**
(2-4, 6-11, 21-25 ,27 31, 41, 43, 45, 46-49, 61, 62-68, 76-81,88, 89)
#11- Can It Be Real?
#31- Plant a Tree
#49 Tropical Treehouse
#88- Life on the Edge

b. Categorize living organisms (e.g., plants; fruits, vegetables); **Rating= 3**
bb. Identify and use anatomical structures to classify organisms (e.g., plants, animals, fungi); **Rating =3**
(#2,3, 10, 11, 16, 22, 24, 28, 41, 43, 45-49, 64-69, 76)
#10- Charting Diversity
#16- Pass the Plants, Please
##68- Name That Tree

c. Describe and show examples of the interdependence of all systems that support life (e.g., family, community, food chains, populations life cycles, effects on the environment), and apply them to local systems; and **Rating= 4**
cc. Describe, model, and explain the principles of the interdependence of all systems that support life (e.g., food chains, webs, life cycles, energy levels, populations, oxygen-carbon dioxide cycles, and apply them to local, regional and global systems; and **Rating=3**
(#7-11, 20, 22-24, 41-49, 51, 61, 63, 77-81, 83, 88, 90)
#8 The Forest of S.T. Shrew
#9- Planet of Plenty
#22- Trees as Habitats
#44- Water Wonders

#79- Tree Life Cycle

d. Provide examples of change over time (e.g., extinctions, changes in organisms). **Rating= 3**
dd. Describe evolution in terms of diversity and adaptation, variation, extinction, and natural selection. **Rating=2**
(*#9-11, 21,-24, 44, 48, 54, 63, 76-81, 88, 91)*
#23- The Fallen Log
#78- Signs of Fall
#88- Life on the Edge

The Human Body

Standard 6.2: **Students demonstrate understanding of the human body- heredity, body systems, and individual development- and understand the impact of the environment on the human body.** ***Rating= 1***

a. Recognize that there are many similarities between parents and their children, some inherited and some learned; **Rating= 0**
aa. Describe how genetic information is passed through reproduction (e.g., genes, traits, chromosomes); **Rating= 0**
(None)

b. Identify the parts of the human body, and demonstrate understanding of how the parts work together to perform functions that satisfy common needs;
bb. Demonstrate an understanding of the human body systems for obtaining and providing energy, defense, reproduction, hormones, immunity, and coordination of physical functions;
(None)

c. Identify and describe environmental factors that can influence human health (e.g., exposure to microbes, pollution); and **Rating=2**
cc. Provide examples of how the health of human beings is affected by their genetic makeup and environmental factors (e.g., exposure to microbes, pollution); and **Rating=2**
(#36-38, 44,)
#36- Pollution Search

d. Identify the pattern of human development.
dd. Identify and explain the human body's pattern of development.
(None)

THE UNIVERSE, EARTH, AND THE ENVIRONMENT

Theories, Systems, and Forces

Standard 7.15: **Students demonstrate understanding of the earth and its environment, the solar system, and the universe in terms of the systems that characterize them,**

the forces that affect and shape them over time, and the theories that currently explain their evolution . ***Rating=3***

a. Identify and record evidence of change over time (e.g., erosion, weathering, fossilization): **Rating=3**
aa. Identify, record, and model evidence of change over time (e.g., earth's history: biological, geological); **Rating=3**
(21-24, 40-44, 47, 48, 54, 67, 79-81, 88, 91, 95)
#40- Then and Now
#79- Tree Life Cycle
#95- Did You Notice?

b. Identify and record patterns and forces that shape the earth (e.g., geological, atmospheric); **Rating=3**
bb. Identify evidence of, model, and explain the patterns and forces that shape the earth (e.g., atmospheric, geological); **Rating=2**
(#7, 14, 42, 44, 48, 49, 76)
#7- Habitat Penpals
#48- Field, Forest, and Stream
#54- I'd Like to Visit a Place Where---

c. Identify and record the interrelated parts of earth systems (seasons, time, weather, etc.); **Rating= 3**
cc. Identify, record, model, and explain the interrelated parts and connections between earth systems (e.g., crustal plates and land forms; atmosphere, water cycle, weather and oceans); **Rating=2**
(*#21-24, 41, 42, 44, 47-49, 61, 69, 76-81, 88, 89)*
#29- Rain Reasons
#44- Water Wonders
#78- Signs of Fall

d. Identify and record characteristics of our solar system (e.g., nine planets, order from sun, and movement of planets in relationship to the sun and moon; calendar); and
dd. Identify, record, model, and explain the relationship of our solar system to the universe (day, year, season, sun, stars, galaxies, gravity, energy, orbits, planet characteristics); and
(None)

e. Analyze and explain natural resource management (e.g., properties and uses of earth materials: rocks, soils, water, fish, wildlife, plants, trees, and gases).
ee. analyze and explain natural resource management and demonstrate an understanding of the ecological interactions and interdependence between humans and their resource demands on environmental systems (e.g., waste disposal, energy, recycling, pollution reduction). **Rating= 4**
(#12-16, 20, 30, 32, 34, 37, 38, 44, 49, 51, 53, 81-83, 89, 93,)
#37- Talking Trash-Not!
#82- Resource-Go-Round
#89- Trees for Many Reasons

ff. Explain how modern views of the universe emerged (e.g., scientific theories, improved

instrumentation.
(None)

DESIGN AND TECHNOLOGY

Natural Resources
Standard 7.16: Students understand how natural resources are extracted, distributed, processed, and disposed of. ***Rating= 3***

a. Recognize that steps need to be followed in extracting natural resources;
aa. Identify the steps that need to be followed in extracting natural resources; **Rating=4**
(#12-15, 32, 34, 36, 37, 38, 51, 53, 69, 82)
#32- A Forest of Many Uses
#51- Make Your Own Paper
#69- The Forest For the Trees

b. Identify the most appropriate materials for particular constructions; **Rating=3**
bb. Select and use materials based on their properties, and how they interact with other materials; **Rating =2**
(#12-15, 51, 82)
#14- Renewable or Not?
#82- Resource-Go-Round

c. Recognize that there are differences between natural and synthetic materials. **Rating=3**
cc. Compare and evaluate products made of either natural or synthetic materials or a combination of the two; **Rating=3**
(#12-15, 20, 51, 82, 83)
#13- We All Need Trees
#20- Environmental Exchange Box
#83- Reduce, Reuse, Recycle

d. Show that some materials can be reused and recycled, while others will be disposed of in landfills; and **Rating=4**
dd. Demonstrate the ways that some materials can be reused, while others will be disposed in landfills; and **Rating=4**
(#12-15, 24, 36-38, 51, 82, 83)
#15- A Few of My Favorite Things
#36- Pollution Search
#83- Reduce, Reuse, Recycle

e. Identify how and why natural resources are unevenly distributed throughout the world and how they are distributed through transportation. **Rating=4**
(#13, 15, 49, 52, 53, 82)
#52- A Look at Aluminum
#53- On the Move

Technological Systems
Standard 7.17: Students apply knowledge and understanding of technological systems to respond to a variety of issues. ***Rating=3***

a. Recognize the basic inputs of all technological systems;
aa. Apply the basic processes involved within each technological system (e.g., construction, power and transportation, communication, and manufacturing); and ***Rating=2***
(#37, 38, 51, 53, 81, 82)
#37- Talking Trash, Not!
#53- On The Move

b. Describe the processes involved within each technological system **Rating=3**
(e.g., construction, power and transportation, communication, and manufacturing);
bb. Use the basic inputs of all technological systems;
(#15, 28, 37, 38, 51, 53, 74, 82, 83, 93)
#38- Every Drop Counts
#51- Make Your Own Paper
#82- Resource-Go-Round

c. Identify the outputs for each technological system; and **Rating=3**
(*#12-16, 36, 37, 51, 53, 82, 93)*
#12- Tree Treasures
#53- On The Move

d. Evaluate technological outputs, and recognize the changes necessary to improve the system.
dd. Evaluate technological outputs, and demonstrate the changes necessary to improve the system.
Rating=3
(#14, 36, 37, 51, 53, 82, 93, 95)
#36- Pollution Search
#82- Resource-Go-Round
#93- Paper Civilizations

Outputs and Impacts
Standard 7.18: Students understand that people control the outputs and impacts of our expanding technological activities in the areas of communication, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology.
Rating=3

a. Understand that technology is a human endeavor. **Rating=4**
aa. Demonstrate an understanding that people are able to share, compile, use and misuse technology;
(#34, 38, 51, 53, 82, 90, 93)
#34- Who Works in This Forest?
#90- The Native Way

b. Use tools to extend their capabilities; and **Rating=3**
bb. Demonstrate how people create and use tools to observe, measure, create, and control;

(#4, 48, 51, 67, 76, 81)
#48- Field, Forest, and Stream
#67- How Big Is Your Tree?

c. Use tools and machines in a safe manner. **Rating=1**
(#51, 81)
#51- Make Your Own Paper
#81- Living With Fire

d. Identify the positive and negative consequences of technology (e.g., nuclear power for generating electricity). **Rating=3**
((*#13, 14, 36-40, 49, 50-56, 70,-73, 82,-85, 88, 93,-95)*

#71- Watch on Wetlands
#85- Air To Drive

Designing Solutions
Standard 7.19: Students use technological/engineering processes to design solutions to problems. Rating=2

a. Recognize that there are several steps in planning solutions to technological problems; **Rating=3**
aa. Create a design solution:
Build on specifications, with an understanding of the constraints (e.g., cost, weight, environment), tolerances that affect performance; Include mathematical and / or
mechanical models of their design; Include steps and sequences for efficiently building a prototype that conforms to the specification; Test the prototype; and use the results to modify the design.
Rating=2
(#14, 36, 51, 53, 67, 82, 83, 89,93)
#36- Pollution Search
#53- On the Move
#89- Trees For Many Reasons

b. Recognize that several steps are usually involved in making things. **Rating=3**
bb. Understand that the sequence in which these steps occur is critical to the efficiency and effectiveness of a solution. **Rating=2**
(#12, 13, 34, 51, 53, 67, 82, 83, 93)
#82- Resource-Go-Round
#93- Paper Civilizations