



EAT-A-RAINBOW GARDEN

Fresh Foods for Nebraska Families

This exemplar showcases how interdisciplinary instruction might be designed within an elementary classroom. This **PROJECT-BASED LEARNING (PBL) PLAN** highlights the interdisciplinary nature of issues impacting local communities and is designed to engage students in authentic problem solving practices while addressing grade-level content.

In this unit, students gather and analyze data to communicate ideas related to the following question: "How can we grow a variety of edible plants that would provide a balanced nutritious meal for a family?" Nebraska Science Standards serve as the basis for the PBL plan. Additionally, the plan intentionally integrates mathematics, ELA, social studies, health, and fine arts, and it also integrates the Nebraska Career Readiness standards.



This unit was developed in collaboration with the North Central Comprehensive Center at McREL International.

EAT-A-RAINBOW GARDEN

Fresh Foods for Nebraska Families

Grade 3 Content Area: Science

Integrated Content Areas: Mathematics, English Language Arts, Social Studies, Health, Fine Arts

Problem

Even though Nebraska is an agricultural state, we have students, families, and community members who do not have access to affordable nutritious foods.

Driving Question

How can we grow a variety of edible plants that would provide a balanced nutritious meal for a family?

Project overview

Student garden teams address this Nebraska problem by designing and constructing container gardens and growing nutritionally-balanced, edible plants based on their knowledge of eat-a-rainbow nutritional meal planning and the engineering design process. Collaborating with community and agricultural experts and advisors, students will investigate and collect data on plant structures and life cycles; plant pollinators, pests, and pest predators; and gardening design. As the harvesting of food nears, students will organize a school or community event to share their Eat-a-Rainbow Garden design solutions with community audiences (e.g., interested families and community members, school food services, food task forces, community garden organizers, government representatives, and school district leadership) who would benefit from understanding the problem and seeing models of viable solutions. The event will provide an opportunity for community participants to sample or acquire harvested food, and to learn from invited expert speakers such as local gardening and agricultural experts.

Introductory Event

Show students a random collection of actual samples or photos of foods produced by Nebraska farmers and popular unhealthy foods. Ask the students a series of questions to find out what they know about the foods. To organize their thinking about the problem, create a KND chart to record, "What do we KNOW? What do we NEED to know? What can we DO?" Students may respond using pair-share discussions, full class discussion, or written responses through an integrated experience such as a gallery walk. Sample questions to ask include: What is your favorite food? What foods have you eaten today? What have you eaten this week? Which foods are healthy to eat? Which foods can be grown on a farm or in a garden?



Ask students to re-examine the foods and identify which are grown in Nebraska, and in their community. Excerpts from the Nebraska Agriculture Facts brochure (http://www.nda.nebraska.gov/publications/ne_ag_facts_brochure.pdf) can be read to self-assess their responses. Post photos of foods grown in Nebraska within the classroom for future reference and inspiration.

Gather background information about the students' experiences with growing foods by asking them to respond to questions such as: Who has farmers in their family? Who has family members who work with farmers? Who has a food garden at home? What happens to most food grown in Nebraska? How much food do you think stays in the state and how much is transported to locations outside the state?

Through additional questioning, highlight their responses to questions that will help them identify the problem of this project-based learning (PBL): Even though Nebraska is an agricultural state, we have students, families and community members who do not have access to affordable nutritious foods.

After identifying the problem, ask students to discuss or write 2-3 solution statements to the problem—what do they think could be done to solve the problem? Then work together to transform one or more solutions into driving questions that could guide student investigations and solution designs. Guide students to the driving question that is similar to the question of this PBL: How can we grow a variety of edible plants that would provide a balanced nutritious meal for a family? Post the identified problem and driving question in the room.

Key Knowledge and Understanding

PRIMARY SUBJECT

Nebraska Science Standards:

SC.3.7.2 Gather and analyze data to communicate an understanding of the interdependent relations in ecosystems.

- SC.3.7.2.c Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.*

SC.3.9.3 Gather and analyze data to communicate an understanding of inheritance and variation of traits through life cycles and environmental influences.

- SC.3.9.3.a Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- SC.3.9.3.b Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

* Cross Cutting Concepts are underlined.



SECONDARY SUBJECTS

<p>Mathematics</p> 	<p>Grade 3 standards in number, geometry, and data can be reinforced during the garden's modeling design, actual construction, and data collection of plant growth factors. Process standards should also be reinforced as students use problem-solving skills, model and represent mathematical problems, communicate mathematical ideas, and make mathematical connections.</p>
<p>English Language Arts</p> 	<p>Standards in reading comprehension are demonstrated as students read text about Nebraska's agricultural practices, eat-a-rainbow healthy eating plan, and the science concepts, using this text-evidence to support their arguments for the project decisions. Students will write as both scientists and as project educators for a specific community audience, supporting writing standards. Speaking and listening are required throughout the project as students conduct survey interviews; collaborate in teams to design, build, and maintain the garden; share individual and team insights with the class; and present their garden solutions to a targeted community audience.</p>
<p>Social studies</p> 	<p>Application of a cluster of standards are natural components of this project. Students practice civic participation as they focus on solving a local problem in collaboration with the community. They can explore the economics and trade markets of the farming/gardening/food industries locally, nationally, and globally. Students can apply their knowledge of maps to create a map diagram of their garden. An understanding of local ecosystems, human culture and interactions, and history would help students understand Nebraska's global role in food production as well as potential reasons for the stated problem of this project.</p>
<p>Health</p> 	<p>A keystone of this project is student understanding and application of the eat-a-rainbow healthy eating plan. Nebraska Health Standards 1 and 3 are supported as they gather information about healthy eating and promote good health by planning their garden and sharing their knowledge and solutions to the problem with the others in the community.</p>
<p>Fine arts</p> 	<p>Visual arts standards are reinforced through the visual design of the garden containers and the community presentations. Media, dance, music, and theater standards could be integrated into the community presentations as well as represent stand-alone productions that educate the audience on targeted aspects of the problem or solution.</p>



Career Readiness Skills

	<p>Critical thinking: Students will conduct research, gather input, and analyze information.</p> <p>Prompt students to dig deeper, to go beyond initial question responses. Ask “why” and prompt for pro and con reasons. Ex: Justify decision making for the eat-a-rainbow garden solution. Develop a rationale for garden design and related improvements.</p>		<p>Creativity and innovation: Students will recognize different ways to approach a learning opportunity.</p> <p>Provide opportunities for students to brainstorm individually and with others; consider “what if” situations. Ex: Design the container garden: Produce a unique, engaging presentation of the problem and solution for selected audiences.</p>
	<p>Problem solving: Students will identify possible solutions to a problem (brainstorm possible solutions, create a pros/cons list, articulate solutions).</p> <p>Prompt students to use data (evidence) for decision making. Ex: Identify garden design limitations; design the garden within constraints (budget, space, etc.); identify and address challenges to design and plant growth.</p>		<p>Collaboration and teamwork: Students will contribute to team-oriented projects, problem-solving activities, and assignments.</p> <p>Prompt students to listen to the ideas of others, contribute to team effort, and follow through with tasks. Ex: Contribute to design and care of the garden in garden teams.</p>

Products

<p>Team Products</p>	<ul style="list-style-type: none"> • Presentation of potential container garden designs with pros and cons for each • Team garden design with justification of design choice and management tasks • Container garden with seeds/young plants planted, as designed in approved plan • Plants growing and maturing in container garden • Creative team presentation to the public about the problem, driving question, garden design solution, and eat-a-rainbow meal benefits
<p>Individual Products</p>	<ul style="list-style-type: none"> • Personalized KND (KNOW, NEED to know, What to DO) chart • Written justification for eat-a-rainbow garden as a viable solution • Model describing and comparing the stages of a plant's life cycle • Individual contribution to the team plan for a specific container garden design • Completion of individual tasks for designing and managing garden • Model comparing several garden plant and animal life cycles • Individual contribution to team presentation and public event



Community Connections

Expert mentors and advisors are individuals who can provide content and design expertise through on-site visits, video conferences, field trips, phone calls, emails.

- Local farmers, grocery store employees, master gardeners, plant nurseries, nutritionists/health practitioners, school or district food services

Product stakeholders are individuals who would benefit from understanding the solution to the problem and learning how to participate in this solution or design their own.

- Students, school community, families, school food services, food task forces, community garden organizers, community government representatives, school board, school district leadership

Resources

On-site individuals and facilities:

- School administrators and building engineers to serve as advisors for common space use and event planning
- Classroom, indoor common space, or outdoor space for container gardens

Equipment, technology:

- Variety of containers (See "Container gardens" in Web Resources)
- Gardening tools
- Internet access

Community:

- See Community Connections section above
- Community site and permissions for community event to showcase Eat-a-Rainbow Gardens, as appropriate

Materials:

- Items for making and decorating the garden containers, gardening, creating presentations, and the community showcase event

Other:



Reflection

Science/project notebook: Used throughout project for planning, content exploration, reflecting	Team discussion: Enhances productive oral communication, teamwork throughout design and implementation process
Survey: Provides an initial assessment of community knowledge about problem and solution	Whole class discussion: Promotes student interest, clarifies action steps and understanding of science concepts throughout design and implementation process
Task management chart: Identifies roles and schedule for task completion. Ex: Garden design, construction tasks, garden care, and management tasks	Other:



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Learning Guide

Problem

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Driving Question

How can we grow a variety of edible plants that would provide a balanced nutritious meal for a family?

Time

3-6 weeks from introducing the problem to harvesting the food and presenting garden solutions to the targeted audience. The length of time to complete this project will vary based on school-designated curriculum for targeted concepts and on the plants selected to grow.

- Two to three weeks of 45-minute classes to cover all concept instruction and the engineering design process of the garden
- Additional weeks to allow plants to grow, mature, and be harvested

1 class = 45 minutes

Learning outcome/target codes

Codes identify the targeted project-based learning components.



Content knowledge



Engineering design process



Interdisciplinary connections



College and career readiness skills



Learning Outcomes/ Targets	Checkpoints/ Formative Assessments	Instructional Strategies for All Learners	Final Product
ASK. What is the problem? 			
<ul style="list-style-type: none"> Identify what you know and need to understand to answer the driving question. Design a solution for the stated problem. 	<p>Individual KND entries and the class chart. Highlighted personal entries and high-interest entries.</p> <p>(Use a science notebook for planning notes, investigations and data.)</p>	<ul style="list-style-type: none"> Create a KND chart to address the question: What do we KNOW? What do we NEED to know? What can we DO? <p>1 class</p>	KND chart
EXPLORE. What do I need to know? What are some solution ideas? What have others done? 			
 Explain Nebraska's role in food production.  Describe the "eat-a-rainbow" healthy eating plan and its benefits.	<p>Draw, label, and describe a rainbow meal that</p> <ul style="list-style-type: none"> the student would like to grow and eat. could be made from Nebraska-grown foods. 	<p>Read and write grade-appropriate summaries or concept maps after reading documents such as:</p> <ul style="list-style-type: none"> Nebraska Ag Facts Brochure. www.nda.nebraska.gov/publications/ne_ag_facts_brochure.pdf Better bites: Eat a rainbow. https://www.wholekidsfoundation.org/downloads/better-bites/better-bites-eat-a-rainbow.pdf Fruits and vegetables [Eat-a-rainbow infographic]. http://www.precisionnutrition.com/color-chart Talk with local nutrition and farming experts. <p>2 classes</p>	<p>A written justification that explains reasons for constructing an eat-a-rainbow garden as the local solution for the problem of family access to affordable healthy foods</p> <p>A model describing and comparing the stages of a plant's life cycle.</p>



Learning Outcomes/ Targets	Checkpoints/ Formative Assessments	Instructional Strategies for All Learners	Final Product
 <p>Design and conduct a survey</p> <ul style="list-style-type: none"> • Design a survey to inform the problem. • Administer the survey. • Organize the survey data. • Analyze the survey data to identify patterns and increase understanding of the problem. 	<p>Survey results organized into tables or charts, with a grade-appropriate summary and analysis</p>	<ul style="list-style-type: none"> • Create and give a survey to students and agreed-upon members of the school and community to gather information about what they eat, what they know about nutrition (eating rainbow), gardening, Nebraska farming. <p>2 classes</p> <ul style="list-style-type: none"> • Organize and analyze the data by using grade-appropriate mathematical skills. <p>1 class</p>	
 <p>Compare and contrast the structures and functions of plants.</p>  <p>Create a model describing and comparing the stages of a plant's life cycle.</p>	<p>Drawings or photos with labels and descriptions of observed plant structures and life cycles</p>	<ul style="list-style-type: none"> • Observe and document plant structures, their functions, and life cycle stages by <ul style="list-style-type: none"> ◊ Growing several plants from seed in plastic bags or clear containers ◊ Observing plants around school grounds ◊ Reading grade-appropriate books that increase student knowledge on plant structure, function, and growth ◊ Watching videos about plants ◊ Talking with local farming and gardening experts • Develop a model describing and comparing the stages of a plant's life cycle. SC.3.9.3.a <p>Five classes - Time varies with school-designated curriculum.</p>	



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 Evaluate the project designs and identify the limitations of each design.  Use problem-solving skills to narrow design options based on limitations.	Team presentations of top 2-3 container garden designs that fit the design limitations for the project Team presentations should include a rationale for their design choices.	<ul style="list-style-type: none"> In garden teams, research designs and materials for container gardens and gather photos and descriptions of the top 2-3 choices. Problem-solve which options are possible based on materials, space and funds. Search web for images using: "gutter container gardens," "student container gardens," "easy container gardens," "easy green plant walls," "creative container gardens" 2 classes	Presentation of potential container garden designs with pros and cons for each option

DESIGN. Choose the best solution plan. Gather materials. 

   Collaborate as a team to design the garden plan.   Collaborate as a team to determine roles in managing the garden.	Team design of garden that includes a description of container and planting materials, eat-a-rainbow plant selection and growing requirements, division of tasks for construction and garden management.	<ul style="list-style-type: none"> Teams will consider all teacher-accepted design options from class, choose one design model, and create a unique plan for constructing and managing the eat-a-rainbow gardens. Plans require teacher approval. 2 classes	Written team plan for a choice of container garden that includes container materials and design, choice of plants that support the eat-a-rainbow meal plan, planting supplies, plant growth requirements, task management chart for construction of and care for garden, materials for planting and data collection
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CREATE. Follow your plan. Make your solution. 			
 Collaborate as a team to create the garden from the design plan.	Team project-design tasks completed, garden construction task chart completed, plant care task chart in use	<ul style="list-style-type: none"> Teams will gather materials and tools, construct and decorate the garden containers, plant seeds in conditions determined by the design plan. Create plant care task chart. 2-4 classes	Container garden with seeds planted, as designed in approved plan
EXPLORE while plants grow. 			
 Create models of plant pollinator life cycles that describe their impact on Nebraska crops and/or garden plants.  Create models of native and invasive plant consumer life cycles that describe their impact on Nebraska crops and/or garden plants.  Compare the similarities and differences in these plant life cycles.	Models comparing life cycles of animal pollinators, plant eaters, and plants, and highlighting similarities and differences. SC.3.9.3.a	<ul style="list-style-type: none"> Research the life cycles and impacts of <ul style="list-style-type: none"> local plant pollinators for Nebraska farm crops and gardens native and invasive plant eaters (e.g., aphids) and predators of plant eaters (e.g., ladybugs, spiders) through readings, videos, photographs, diagrams, local experts. Explore outdoors to find and observe animal pollinators, plant eaters, and garden predators, identifying their life-stage characteristics. Explore and participate in citizen science projects such as Budburst, Lost Ladybug Project, The Great Sunflower Project. 3-6 classes. Time varies with school-designated curriculum and topic choices.	Model comparing several garden plant and animal life cycles



Learning Outcomes/ Targets	Checkpoints/ Formative Assessments	Instructional Strategies for All Learners	Final Product
TEST. Try out your solution. 			
 <p>Collect and analyze data on plant growth and factors that affect plant growth.</p> <p>Collect data for a project-relevant citizen science project. (Demonstration of knowledge and skills is dependent upon project.)</p>	<p>Data tables, graphs, drawings with measurements and labels that demonstrate:</p> <ul style="list-style-type: none"> An evidence-based argument explaining how plant growth is affected by different habitat conditions in other team gardens. SC.3.7.2.c Similarities and differences in structures and traits of plants that are the same species and on parent/offspring plants. SC.3.9.3.b 	<ul style="list-style-type: none"> Collect data by using grade-appropriate measurement tools and mathematical skills to monitor growth of plant characteristics and variables such as size and shape of plant stems and leaves, amount of water added, air temperature, soil features, plant life-stage transitions (phenology). Compare team data from the garden's different plant species. Compare data from same species of plants grown by other teams in different conditions. Go outside to observe and gather data from plants on school grounds or in the neighborhood. Compare traits of mature plants with their seedlings. Compare traits of different plant species. <p>2-8 weeks. Time is dependent upon growth and harvesting times of selected plants, and varies with school-designated curriculum and topic choices.</p>	<p>Plants growing and maturing in container garden</p>



Learning Outcomes/ Targets	Checkpoints/ Formative Assessments	Instructional Strategies for All Learners	Final Product
IMPROVE. How did the solution work? What would make it work better? 			
   <p>Collaborate to evaluate and make improvements to the garden design, data collection, and management strategies.</p>	<p>Labeled drawings, photos, videos or data tables that describe and defend design and plant care changes.</p> <p>Updated KND chart</p>	<ul style="list-style-type: none"> Observe plants, collect and analyze data on plant growth and maturation to determine if the conditions are optimal. Discuss pros and cons for any design changes in the containers or plants to test effects on growth. (e.g., depth of seed planting, water, soil, temperature, light). Come to a team agreement on changes and implement them. Invite local gardeners and farmers to discuss and advise teams on ideas for improving their designs and yield. Revisit KND chart to determine what questions have been answered and add what has been learned. <p>2 classes</p>	



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SHARE. Share your solution with others. 			
 <p>Create and present the team's design process, results, and explanations in a format appropriate for a particular audience and event setting.</p>	<p>Creative and accurate presentation that includes written and/or spoken text, using grade-appropriate language arts skills. The presentation should describe</p> <ul style="list-style-type: none"> • problem and driving question, • design selection and construction of the Eat-a-Rainbow Garden • goals, benefits, and challenges of the process • nutritional benefits of eat-a-rainbow meal planning 	<ul style="list-style-type: none"> • Create a presentation of the project to educate others about the steps and benefits of designing and constructing an Eat-a-Rainbow Garden, and the nutritional benefits of eat-a-rainbow meal planning. The presentations could be formatted as a paper brochure, news article, video, photo journal, 3D models, or slides. • Plan an event for people who would benefit from this information. <ul style="list-style-type: none"> ◊ Educational event opportunities could be on-site school visits, farmers market, TV station or radio interviews, district website, neighborhood gatherings, presentations at gardening centers. ◊ Possible guests include other students, school families, community members, district leadership, local farmers and gardeners. <p>3 classes. Time varies with presentation formats and type of event planned.</p>	<p>Creative team presentation to educate others about the problem, driving question, garden design solution, and eat-a-rainbow meal benefits</p> <p>Public event to taste and share harvested food, and present what students learned</p>



Web Resources

NUTRITION:

- Better bites: Eat a rainbow. Retrieved from <https://www.wholekidsfoundation.org/downloads/better-bites/better-bites-eat-a-rainbow.pdf>
- Fruits and vegetables [Eat a rainbow infographic]. Retrieved from <http://www.precisionnutrition.com/color-chart>
- Eat right. Academy of Nutrition and Dietetics. Retrieved from <http://www.eatright.org/resources/for-gradeschooler>

NEBRASKA SCHOOL GARDENING:

- Douglas County school garden toolkit. Retrieved from <http://www.douglascounty-ne.gov/gardens/images/stories/schoolgardens/SchoolGardenToolkit2012.pdf>
- Community Crops. <https://communitycrops.org/gardens/youth-garden-program/>
- Five Nebraska schools receive school greenhouse to cafeteria grants. Retrieved from <http://krvn.com/uncategorized/five-nebraska-schools-receive-school-greenhouse-to-cafeteria-grants/>
- Rinne, Tim. TEDx: Growing food, growing community -- the example of the Hawley Hamlet. Retrieved from <https://www.youtube.com/watch?v=J0Gap9tYpF8>
- School greenhouse to cafeteria grant, Center for Rural Affairs. Retrieved from <http://www.cfra.org/news/160614/apply-our-school-greenhouse-cafeteria-facilitation-program>
- The Farm to School census: Nebraska districts. Retrieved from Retrieved from <https://farmtoschoolcensus.fns.usda.gov/find-your-school-district/nebraska>
- Youth gardening and school gardens, University of Nebraska—Lincoln. Retrieved from <http://outdoorlearning.unl.edu/youth-gardening-school-gardens>

SCHOOL GARDEN EDUCATIONAL MATERIALS AND LESSONS:

- Garden ABCs. Retrieved from www.gardenabcs.com
- Kids Gardening. Retrieved from www.kidsgardening.org/
- Learning Gardens. Retrieved from <https://thekitchencommunity.org/learning-gardens>
- National Farm to School Network. Retrieved from www.farmtoschool.org
- Growing Gardens. Retrieved from www.growinggardens.org

GARDEN RESOURCES:

- Backyard gardening: Grow your own food, improve your health. Retrieved from <http://www.health.harvard.edu/blog/backyard-gardening-grow-your-own-food-improve-your-health-201206294984>
- Hansen, Zoe. TEDx: Building Community One Garden at a Time. Retrieved from <https://www.youtube.com/watch?v=4oYlo3YvdPc>
- If they grow it, they eat it. 7 tips for pre-school edible gardens. Retrieved from <http://www.csgn.org/sites/csgn.org/files/wgf-resource-guide-preschool-garden-grants.pdf>
- Ritz, Stephen. TEDx: Green Bronx Machine -- growing our way into a new economy. Retrieved from <https://www.youtube.com/watch?v=lcSL2yN39JM>



GARDEN ANIMALS:

- Top ten garden pests. Retrieved from <http://www.rodalorganiclife.com/garden/top-ten-garden-insect-pests>
- Ten insects you should actually want around your plants. Retrieved from <http://www.rodalorganiclife.com/garden/10-insects-you-should-actually-want-around-your-plants>
- Insect life cycles. Real school gardens. Retrieved from http://www.realschoolgardens.org/Libraries/Documents/Insect_Life_Cycles_-_Metamorphosis_5th_grade_ff_1.sflb.ashx
- The helpful garden: Insect life cycle cards. Retrieved from <http://thehelpfulgarden.blogspot.com/2012/03/butterfly-life-cycle-matching-activity.html>

CONTAINER GARDENS:

- Search web images for materials and design ideas for container gardens. Key words: "gutter container gardens," "student container gardens," "easy container gardens," "easy green plant walls," "creative container gardens."
- Milk crate urban garden. Retrieved from <https://www.fastcompany.com/3030121/this-modular-urban-farm-to-pop-up-on-vacant-lots-and-then-move-on>

NEBRASKA FARMING AND FOOD SECURITY:

- Feeding the world from Nebraska's research technology. Video and article retrieved from http://sdn.unl.edu/neb_researchtech
- Nebraska agriculture fact card. Retrieved from <http://www.nda.nebraska.gov/facts.pdf>
- Nebraska agriculture facts brochure. Retrieved from http://www.nda.nebraska.gov/publications/ne_ag_facts_brochure.pdf
- Nebraska Appleseed. Retrieved from <https://neappleseed.org/blog/tag/food-security>
- Nebraska Food Cooperative. Retrieved from <https://www.nebraskafood.org>
- Thierolf, Andrew. (May 2012) The Nebraska Sandhills Food Desert: Causes, identification and actions towards a resolution. University of Nebraska-Lincoln. Retrieved from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1010&context=arch_crp_theses
- USDA's National Agricultural Statistics Service, Northern Plains Regional Field Office. Retrieved from https://www.nass.usda.gov/Statistics_by_State/Nebraska/

ATTRIBUTIONS

The general framework for this PBL plan was adapted from the Buck Institute for Education's project-based learning approach and planning forms (Buck Institute for Education. Retrieved from http://www.bie.org/objects/cat/planning_forms).

The KND strategy for investigating the problem was adapted from the problem-based learning approach (Stepien, W., Gallagher, S. & Workman, D. (1993). Retrieved from https://www.researchgate.net/publication/232553524_ProblemBased_Learning_for_Traditional_and_Interdisciplinary_Classrooms).





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