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Using Children's Literature as a Model for Problem-Based Learning

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Abstract

Problem-Based Learning (or PBL) is a teaching style that pairs beautifully with science and social studies. PBL allows students to drive their learning, providing autonomy to choose topics or issues that interest them. It scaffolds the development of desirable 21st century skills: collaboration, critical thinking, communication, creativity, flexibility, and higher levels of cognitive thinking. Using a specific approach to PBL can assist teachers and students in understanding the process and knowing where their work is taking them. This article will share using the children's book *Spring after Spring: How Rachel Carson Inspired the Environmental Movement* by Stephanie Roth Sisson (2018) and Design Thinking as a guide for implementing Problem-Based Learning with your elementary level learners.

Key Words: Children's Literature, Problem-Based Learning, Design Thinking, Elementary Science Education, Environmental Education

Introduction

Stepping outside, whether it is your schoolyard, your backyard, or the forest of a nearby state park, an observer cannot help but hear a variety of sounds in the immediate vicinity. We may hear the rustle of the wind in the autumn leaves as they begin to turn brilliant shades as our days shorten. We may hear the tinkling of a nearby fountain or the babble of a small creek as it

dances over mossy rocks. Inevitably, we hear the strains of wildlife that surrounds us: the scritching of a blue-tailed skink (five-lined skink to our science friends) in the leaves as it scurries out of sight beneath the playground fence, the call of songbirds as they gather at a nearby feeder, the nearly deafening whir-whir of summer cicadas, or our favorite, the cheereep cheereep of spring peepers (chorus frogs).

Figure 1
Twin Falls

Note: Young girl documents her hike to Twin Falls at Rock Island State Park in Middle Tennessee.

Nearly 60 years ago, however, this was **not** the case. The chorus of insects, birds, frogs, and other animals was becoming quieter, and no one seemed to notice. No one but Rachel Carson. The purpose of our article will be to share an award-winning children's book about the life and work of Rachel Carson. We will also describe Problem-Based Learning (PBL) and provide a rationale for using PBL. Ultimately, we will share how Sisson's book, *Spring after Spring*, provides both an excellent model and inspiration for implementing PBL into the elementary classroom.

Spring after Spring: How Rachel Carson Inspired the Environmental Movement by Stephanie Roth Sisson (2018) is a beautifully illustrated children's book that details the life of environmental activist, Rachel Carson. The book begins with Rachel as a child, eager to greet the spring! As a child, Rachel spent a great deal of time outdoors listening to birdsong, noting

migration patterns of birds, and the transformations that reflect the changing seasons. Rachel had plans to become a writer but fell in love with science. As an adult, Rachel noted that the voices of springtime animals were becoming quieter and quieter. It was this early love of nature, and in particular, the chorus of spring, that made Rachel aware of its absence several decades later. Her observations and research led her to discover the connection between pesticides and a decrease in wildlife. She shared her findings with a plea for people to consider their impact on the environment in her book *Silent Spring*. Even though Rachel passed away two years after her book was published, her work raised awareness across the nation and resulted in the creation of the Environmental Protection Agency ("The origins of EPA", n.d.) and shortly thereafter Earth Day.

Spring after Spring (2018) was selected by the National Science Teaching Association as an Outstanding Science Trade Book (2019) and a Best STEM Book (2019) for 2019. Additionally, the National Council for the Social Studies selected Sisson's book as a Notable Social Studies Trade Book for Young People (K-2) (2019). This award-winning book is a perfect way to set the stage for Problem-Based Learning outside of the classroom. Rachel Carson was both a scientist and journalist. But she was **not** an ecologist. Carson used her observation skills to identify a problem and her research skills to collect data and consider possible solutions. It was her love of journalism that helped her communicate her findings and solutions to the community at large through the writing of her book, *Silent Spring*. Parents, teachers, and learners can use Sisson's book as a springboard to discovering or identifying a problem in their own neighborhoods and to use PBL to identify viable solutions.

Problem-Based Learning (or PBL) is a teaching style and learning style that pairs beautifully with science and social studies. PBL places learners in the driver's seats of their own education. This is best described by Tan (2003) when he wrote "in PBL, learners are given the opportunity to find knowledge for themselves and to deliberate with others" (p. 22). PBL doesn't happen in isolation; it requires collaboration and group work. During the process of working with others, learners have an opportunity to "refine and restructure" their knowledge as they identify an issue or problem and work toward finding a solution.

Problem-Based Learning can be a powerful tool in shifting learning from lower levels of cognition (remembering and understanding) to higher levels (apply, analyze, evaluate, and create) (Krathwohl, 2002). It also allows students to drive their learning, providing autonomy to choose topics or issues that interest them. PBL scaffolds the development of desirable 21st century skills: collaboration, critical thinking, communication, creativity, flexibility, and higher levels of cognitive thinking (Dede, 2010; Lapek 2018). Additionally, PBL can mirror supporting Next Generation Science Standards' (NGSS) shift toward learning focusing on solving problems ("Problems with Problems", n.d.).

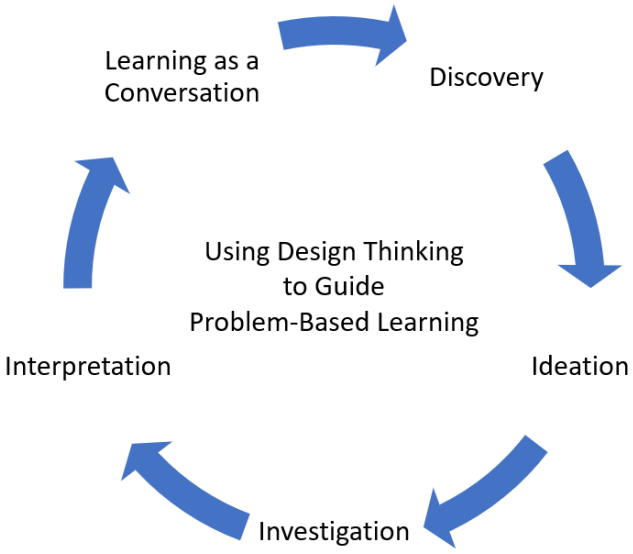
Implementing PBL into your classroom can be stressful for both the teacher and the student. As teachers we must be willing to learn alongside our students and to be flexible with students' choices for projects and outcomes. Our students may also feel trepidatious when considering an open-ended assignment. Much of their school experiences may have been teacher-directed learnings or closed-ended assignments. Many students find security or comfort in knowing exactly what is expected. This is not the case for PBL as the process will result in new ideas and

solutions so flexibility is a must. Having this much 'freedom' can be overwhelming; we have discovered that students and teachers find PBL to be less stressful when a methodology is employed.

There are several methods for engaging in PBL. Similar to a scientific method, using a specific approach to PBL can assist teachers and students in understanding the process and knowing where their work is taking them. Design Thinking (IDEO, 2011) is a process or set of steps teachers and learners can use to guide Problem-Based Learning. These steps include Discovery, Ideation, Investigation, Interpretation, and Conversation (See Figure 2).

Discovery provides students with an opportunity to identify a common problem or issue in need of a resolution. Ideation requires the generation of ideas. This is a stage in which learners brainstorm, often wildly and with abandon, a variety of ideas or solutions for the problem identified in the Discovery stage. It is important to remind learners that during this stage we do not need to concern ourselves with spelling or grammar conventions, plausibility, time constraints, or other judgements that may prevent or inhibit creativity. This step does require, however, identification of the most fruitful of ideas shared. These ideas will shape the remaining three steps.

Figure 2
The Design Thinking Process



Note: Design thinking is a great way for teachers and students to guide their Problem-Based Learning experiences. Oftentimes, reflecting on the processes of PBL and suggesting solutions leads to asking about and researching new issues.

The Investigation stage requires the group to come to a consensus on a plan of action. This plan may include researching what others have done before as well as conducting our own research via inquiry, experimentation, interviews, or other investigative methods. It is best if this step is documented carefully as it provides a roadmap for all group members to follow. Interpretation requires the identification of patterns and insights from observations, interviews, and other data

or information collected previously. This stage allows for the composting of ideas from curious bits of information into rich and relevant stories that provide meaning and possible solutions to the issue at hand.

Learning as a Conversation is the final step in the Design Thinking phase. This stage makes room for learners to, again, come to a consensus, but this time on their investigation as well as to succinctly share this information with a larger group (e.g., their classroom, school, or even community). This is not only an opportunity to share what we have learned but to consider and, if appropriate, integrate the feedback from our audience.

Below we will share possible activities and questions to help teachers and students begin the Design Thinking process. It is important to remember that with PBL, neither the students nor the teacher know the direction the process will take them. This is an open-ended, real-world process that requires critically thinking about and observing the world around us. The following suggestions and activities are just suggestions to help you begin the process and guide you through the stages. What your students identify and choose to pursue will be driven by their collective interests, the amount of time they have, the support they receive from their teachers and schools, how collaborative their classroom environment is, students' ability to self-monitor, and a willingness on both the teacher's and students' parts to be comfortable with unknown outcomes.

Discovery

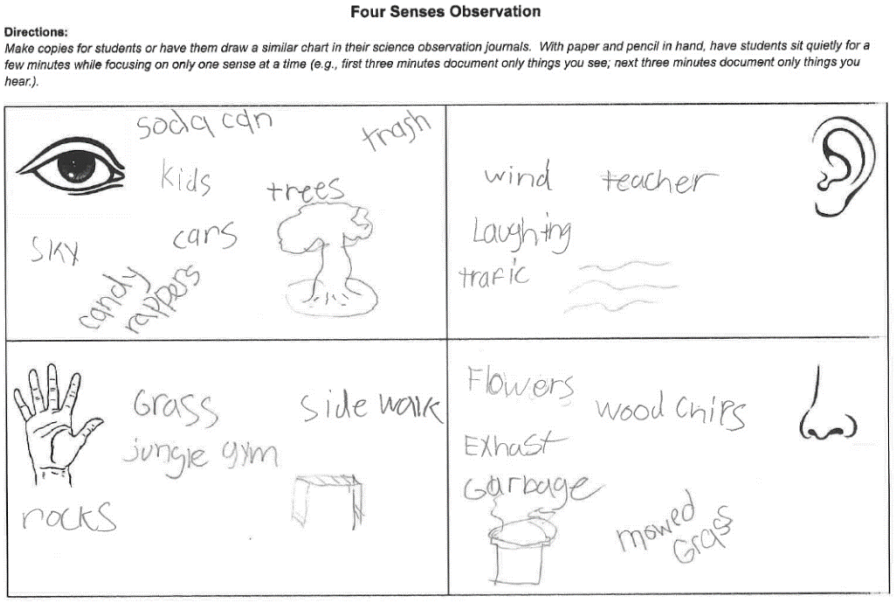
The Discovery stage is an opportunity for students to use their observation skills to identify situations or issues in which they may find solutions to and impact change. Choose an area in the schoolyard, neighborhood, or park to visit regularly for several days. There are a variety of science minded activities that can encourage students to engage with their surroundings and guide their observations. Two of our favorites include a Single Concept Field Trip and a Four Senses Observation.

The "Single Concept Field Trip" (Birchard & Crook, 2005) is an activity that you could use to get students thinking about changes in their environments. Brichard and Crook suggest repeated, "quick single-topic outings focusing on nature" (p. 34) to explore a variety of topics or events. These excursions can be completed in 10-20 minutes and may happen in your schoolyard or backyard setting. Some of these "single" concepts may include looking for relationships among living things (symbiotic, parasitic, collective), evidence of change (things that are growing, dying, changing colors), listening for sounds of nature (spring birds, summer insects, the crunch of autumn leaves), or even changing seasons (sprouting plants, changing leaves) (2005). These are just a few ideas that can be used to focus quick outings that may lead to the identification of possible changes or issues.

Another activity that you could use to get students thinking about changes in their environments is The Four Senses Observation. This activity requires students to spend several quiet minutes in an area to document what they can see, hear, touch, or smell (taste has been omitted for a variety of reasons). Students may take a sheet of paper that has been folded into quarters to document what they are noticing using each of the four senses listed above (Please see Figure 3 below.). It

can be helpful for the parent or teacher to provide focus by asking students to consider only one of the senses for a prescribed amount of time. During this time students may document what they hear (birds chirping, school bell, children's laughter), what they smell (wildflowers, wood smoke, dumpsters), what they feel (damp grass, smooth pebbles, rough bark of a tree), or what they see (autumn leaves, aluminum can, butterflies). These observations can be collected individually and kept in a science journal or shared as a class during a post observation debriefing.

Figure 3
Four Senses Data Collection



Note: The above image was created by a 4th grade student making observations on their playground. See Appendix A to find a copy of the Four Senses Data Collection sheet that you can use with your young learners.

Both activities are deceptively simple but pack a powerful punch. Oftentimes teachers and parents feel there is not enough time in the curriculum or day to spend time outside on field trips. Additionally, there is the concern of transportation, costs, and permissions. Students may also have some unease when being exposed to the outdoors. Many students do not have opportunities to explore outside so being outdoors in new places for extended amounts of time can be stressful. Wilson (2005) suggests exploring familiar outdoor landscapes with students and for shorter periods. These could include a child's backyard, the playground, a vacant lot across from the school, or a park down the street. Both the activities mentioned above will work across short periods of time and in nearby locations providing students with opportunities to become more at ease and more familiar with the natural areas they are close to.

Whether you engage in these activities once or twice or repeatedly over several weeks, the data collected will provide students with a starting point for their Discovery stage of Design Thinking. The collected observations will serve as a point for students to identify issues that may require intervention. It is possible that after several excursions outside that your students may identify such issues as trash on the playground or in the park, noise pollution from industry

or construction, or safety hazards with playground equipment. These are just suggestions and your students' ideas will drive this process.

Ideation

This stage provides students with an opportunity to brainstorm possible solutions to the issue identified during the Discovery stage. The first part of this stage is uninhibited, and ideas are generated regardless of constraints, real or perceived. Once an exhaustive list has been generated, encourage students to identify similarities (to sort and to classify) these solutions. They may sort solutions by ease of implementation, amount of work required, potential costs, etc. Once these ideas have been organized, students may move to the second part of the Ideation stage in which they must identify the most plausible, viable, solution to the problem.

Investigation

The investigation stage requires students to learn what others have done as well as what may be viable for their classroom or community. This stage involves both research and data collection. Data may be collected via surveys, observations, or interviews. The problem identified by the students would be the driving factor in whether they choose to interview classmates and teachers about litter on the playground or make observations why butterflies seem to be absent from the local park.

Interpretation

Once data are gathered and stories shared, students will need opportunity and guidance to make sense of it all. During this stage of design thinking teachers may want to create space and time for a debriefing session. Here teachers ask students to consider questions like: What did we learn? How did we learn it? Where did we learn it? Why did we learn it? As students wrestle with these questions patterns in the data and a larger picture will emerge. This is a prime moment in the learning process to encourage students to compare their learning to the research of experts.

Learning as a Conversation

Learning as a Conversation is possibly one of the most important and perhaps most overlooked of all the steps in PBL. This stage requires learners to once again come to a consensus on solutions to the problem they identified in the first stage. They have used their most viable or fruitful ideas from the Ideation stage to guide their Investigation stage. During the Interpretation stage, they shared their data, their findings, their understandings. But it is this final stage in which students must make others aware of the issues, provide solutions, and act on these solutions. In Figure 4 below, we have provided an example from a 4th grade classroom of students engaging in these processes that resulted from noting that there was trash on the playground and school.

Figure 4
4th grade example of Design Thinking

Discovery: A class of 4th graders took a daily walk around their playground area and individually discovered items on the playground that did not belong. Those items included jackets, candy wrappers, and various other trash.

Ideation: As a class, they collaborated and shared their discoveries realizing that they had all seen the same items on the playground. Next, the group brainstormed ways to get involved in cleaning up their playground. Their ideas included providing more accessible trash cans and forming a committee of weekly or monthly trash collectors.

Investigation: After their brainstorming session, the class got to work researching ways to improve the appearance of their playground. Additionally, several students collected data based on which days out of the month the playground had the most litter.

Interpretation: In this phase, the classroom teacher had a whole group debriefing session. The teacher engaged the class in fruitful conversations about their discoveries, did comparisons to the data, and had students consider how their findings compared to the research of experts.

Learning as a Conversation: A consensus was made, and the class decided that they did indeed need a weekly trash collector committee and more accessible trash cans on the playground. Next, the class presented their ideas to the school administration and parent teacher organization. The group had productive conversations about making their ideas systematic so that the cleanliness of the school playground was sustained. In the picture above, two of the weekly trash collectors are utilizing the accessible trash cans to collect trash from the playground area.

The teachers who engaged their students in this PBL activity reflected that they felt a little uncomfortable with not knowing what the final product or project would be. However, once students became involved and began driving the learning, teachers commented that they had wished to have provided more time in the early phases of design thinking (e.g., discovery and ideation) to allow for their students' ideas to deepen and develop. In contrast, student responses were positive. Students noted both satisfaction with being in charge of the project as well as learning through exploration. The authors noted a great deal of pride in the students' ownership of cleaning up the school playground and being a key part in solving an issue for the school.

Conclusion

Problem-Based Learning is a powerful tool that provides academic autonomy and places students at the center of learning ("Problems with Problems", n.d.), where they should be. While the PBL process is opened-ended and directed by student interest, a list of other possibilities that may arise in classroom discussions are listed in Figure 5 below. This is not an exhaustive list and several of the topics may lend themselves to a wider audience (e.g., zoo habitats, voter registration). However, we recommend these topics as a good place for teachers who have not yet engaged in the PBL process to start.

Figure 5
Possible PBL Projects

- Playground Safety
- Stray Pets/Animal Shelters
- Access to Clothing/School Clothes Closet
- Hunger/Schoolwide Food Pantry
- Endangered Animals
- Zoo Habitats
- Student Access to Electronic Devices (Digital Divide)
- Back to School Supplies
- Voter Registration or Voter Rights
- Bullying/Cyber Bullying
- Game Design (Video or Board)
- Welcoming New Students
- Promoting Mindfulness in the Classroom
- Stress Reduction
- Healthy Habits (Nutrition or Movement)
- Recess/Play Initiatives

The purpose of our paper was to share a children's book, *Spring after Spring* by Sisson, that offers teachers a literature-based parallel for Problem-Based Learning and students a starting point for engaging in their own learning. If you are unable to locate a copy of Sisson's book via your library or interlibrary loan, you may also consider other children's books about Rachel Carson listed in Figure 6 below. In conclusion, allowing a space for your students to observe the world around them via the PBL model, you can help them reach their potential both as a learner and as members of a larger community. Just as Rachel Carson's research revealed that pesticides were harming insects, birds, and other animals, your students can mirror Carson's data collection and problem-solving skills to become agents of change in their own communities. Problem based learning, both powerful and empowering, enhances 21st century skills of collaboration, communication, critical thinking, and problem solving. It is our goal that from this article you can see how children's literature can be used as the catalyst for learning and discovery.

Figure 6

Other children's story books about Rachel Carson

- *Women in Science and Technology: Rachel Carson—The Story of an Influential Marine Biologist and Conservationist* by M. M. Eboch and Illustrated by Elena Bia (2021).
- *Rachel Carson and Ecology for Kids: Her Life and Ideas* by Rowena Rae (2020).
- *Rachel Carson: Women in Science* by Anne Rooney and Illustrated by Isobel Lundie (2019).
- *Rachel: The Story of Rachel Carson* by Amy Ehrlich and Wendell Minor (2003, 2018).
- *Rachel Carson and Her Book that Changed the World* by Laurie Lawlor and Illustrated by Laura Beingessner (2014).
- *Who was Rachel Carson* by Sarah Fabiny (2014).
- *Rachel Carson: Pioneer of Ecology* by Kathleen V. Kudlinski (1989).

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Four Senses Observation

Directions:

Make copies for students or have them draw a similar chart in their science observation journals. With paper and pencil in hand, have students sit quietly for a few minutes while focusing on only one sense at a time (e.g., first three minutes document only things you see; next three minutes document only things you hear.).