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INTRODUCTION

Encouraging Big Ideas From Little Learners

OVERVIEW

Young children are natural scientists. Little learners play, explore, and test with wonder as a guide to learning. In order to encourage innovative thinking, we must offer our youngest learners opportunities to nurture these skills while solving problems. This book, *Hands-On STEAM Explorations for Young Learners*, shares 10 STEAM (science, technology, engineering, arts, and mathematics) investigations based on popular nursery rhymes that little learners (and adults) know and love. Several critical factors, such as learning environment, growth mindset, innovation strategies, personalized learning, and early childhood standards, should be considered to effectively reach the unique needs of each young learner.

ENVIRONMENTS FOR EXPLORING

Physical Environment

The physical environment of an early childhood classroom should be one that allows the child to be as independent as possible. We want to be sure that materials, tools, tables, and chairs are at the appropriate level. First and foremost, ensure that all materials, including those used in STEAM investigations, are appropriate for students ages 3 and up. The nursery rhyme-themed challenges in the 10 lessons in this book all provide the opportunity for students to make age-appropriate choices as they plan, design, and create.

One way to help students is by organizing materials so that they can easily see in a very concrete way what they are selecting. For example, rather than circling on a piece of paper the materials they will use, let them first actually see (and touch, if necessary) the materials they have access to. (See the Teacher's Lesson Guide for more information on how to organize materials within each lesson.) Labeling with pictures and words is also an important component for the early childhood classroom. This not only promotes literacy,

but also helps the little learner be more independent as he or she selects materials and cleans up—which brings us to the last, but most important, point of this section. We want students to be responsible for as much of the cleanup as safely possible; therefore, they will need access to brooms, dustpans, water, sponges, and other cleaning materials. The students need to "own" their classroom. Learning to take care of their environment is a part of building responsibility and creating a sense of community.

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STEAM Investigation Guidelines

STEAM investigation guidelines and lab safety are critical components of the classroom environment. When working with young learners, make safety as clear and easy to understand as possible. Posting the following guidelines in the classroom and reviewing them prior to each lesson will help students remember how to play and explore safely:

L: Learn by exploring!
(Trying and failing is learning; failing to try is not.)

A: Always keep materials *away* from your eyes, nose, mouth, and hands.
(As needed, wear safety goggles and gloves to keep your body safe.)

B: Be aware.
(Notice what's happening around you.)

Emotional Environment

The emotional environment of a classroom is very important to learning, and this is especially true in STEAM challenges like those in this book. Students will be required to share, collaborate, and communicate in every investigation in this book. This is an important lifelong skill for our young

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learners to begin practicing. In order to make this happen, students need to be working in an environment that supports their needs. If we think of Maslow's Hierarchy of Needs (1943), we know that students need to first feel safe and secure before they can advance to the higher levels of thinking. Our little learners need a sense of belonging in the classroom. *Life in a Crowded Place* by Ralph Peterson (1992) shared many ways that we, as educators, can make a learning community. Peterson suggested that teachers should facilitate their classroom to be more like a family. Two ideas in particular he discussed involve creating routines and celebrations to help build a community of learners. Each of the nursery rhyme challenge investigations offers an opportunity for learners to follow a specific routine and communication pattern, like the curiosity catchphrases and partner talks. There are also celebrations of learning that occur during each lesson as the students share their creations or thinking. For example, each time a lesson calls for a Scientist Stroll (see the Teacher's Lesson Guide), this is a celebration of new learning. It is important to communicate these celebrations of learning with students.

Be an engineer (or scientist, artist, mathematician, etc.). Several lessons instruct the teacher to encourage children to do things like "put on engineer eyes" or "listen with engineer ears." These phrases help the students understand that engineers (and scientists, mathematicians, and artists) use their senses to make observations, solve problems, and create. We also want to encourage students to see themselves in these roles; therefore, telling them to become a STEAM professional in this simple way helps to create a community of scientific thinkers, makers, and problem solvers.

Mistake Makers and Innovative Thinkers

Mistakes mean you are learning, but it doesn't always feel this way. Even to young students, mistakes feel negative. You can help change this thinking in two simple ways:

1. **Celebrating mistakes as learning and sharing your own mistakes.** Young students learn so much from what we model, both intentionally and unintentionally.
2. **Giving feedback to students by placing the value on thinking rather than knowing.** You can do this by having students share examples of mistakes they made and what they learned, rather than only sharing what they learned. This simple change can completely change the class mindset on mistakes. *Mindsets in the Classroom* by

Mary Cay Ricci (2017) shares many more ideas on creating a classroom with a growth mindset.

The five curiosity catchphrases used in this book are specific strategies designed to model and encourage innovative thinking for young students. The catchphrases were influenced by the ideas and beliefs found in *Mindsets in the Classroom* (Ricci, 2017), *Strategies That Work* (Harvey & Goudvis, 2007), and *Creating Innovators* (Wagner, 2012). The following models of higher order thinking and innovation in education also impacted this book: Bloom's taxonomy (1956), the Innovation Model (Project GEMS, 2011), Design Thinking (Stanford d.school, n.d.), and Sheffield's (2003) heuristic for creative and innovative mathematicians.

Personalizing Learning

Our education world is filled with many acronyms—GT, PTP, IEP, 2e, ELL, RtI—that sum up to one basic idea: personalized learning. Dr. Julia Roberts and Dr. Tracy Inman (2015) discussed the notion of there being no such thing as a "one-size-fits-all" lesson or classroom for students in their book *Strategies for Differentiating Instruction*. Roberts and Inman went on to note that the ultimate goal of differentiation is to create lifelong learners. The minds-on, hands-on investigations in this book offer natural opportunities for lifelong learning by differentiating through task. Although at first glance it may appear that everyone is doing the same work, that is not the case. When we think of differentiation or personalization, that means the teacher is intentionally matching the readiness level of the child to the content he or she is exploring. The explorations in this book are personalized for each learner because the challenges are set up as opened-ended tasks, with multiple approaches and many possible answers. This format offers a natural opportunity for students to take their language, content, and thinking to their own levels of readiness, wherever they may be.

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STANDARDS ADDRESSED IN THIS BOOK

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Next Generation Science Standards: K–2 Engineering Design

Students who demonstrate understanding can do the following:

- K-2 ETS 1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through a new or improved object or tool.
- K-2 ETS 1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to help solve a given problem.

Common Core State Standards for English Language Arts: Speaking and Listening

Comprehension and Collaboration:

- CCSS.ELA-LITERACY.SL. (K.1, 1.1, and 2.1) Participate in collaborative conversations with diverse partners about (grade level) topics and texts with peers and adults in small and larger groups.