

DISTANCE LEARNING

for Elementary STEM

Creative Projects for
Teachers and Families

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Introduction

Elementary children experience the world through play, and they learn best when actively engaged in hands-on content learning, often with peers. But in the spring of 2020, teachers and families throughout the world grappled with how to keep young children engaged in learning while isolated at home during a pandemic. Educators were suddenly faced with designing emergency distance instruction for children of all ages, with unequal access to technology and high-speed internet, usually with minimal experience with online learning.

At the same time, parents were thrust into new roles as homeschool teachers, often while adapting to job loss or working from home themselves. Teachers, administrators, academics, professional organizations, and edtech companies sprang into action, offering a variety of supports and resources for teachers and students to teach and learn online. Meanwhile, families supported young children's distance learning at home as best they could under extraordinary circumstances. Yet, few easily accessible, high-quality resources provided support for both teachers and parents to support engaging, distance STEM learning for elementary children.

The flexibility of online schooling offers an unprecedented chance to engage children in active learning through project-based STEM experiences. As the saying goes, with great challenges come great opportunities. Widespread distance learning at the elementary level is challenging for many educators and families, but it also permits innovation and individualization that can be difficult in traditional school settings. Research and practice have long indicated the positive potential of contextualized, integrated teaching approaches; yet standards, class time, lessons, textbooks, and assessments remain overwhelmingly siloed into individual subject areas.

About the Book

K–5 teachers can use this book to inform their design of distance STEM education. Families can use the STEM projects in this book to supplement and enrich their child's school-based distance learning at home.

This book offers a collection of elementary STEM projects that educators and families can adapt to individual children's needs and interests as part of distance learning.

Introduction

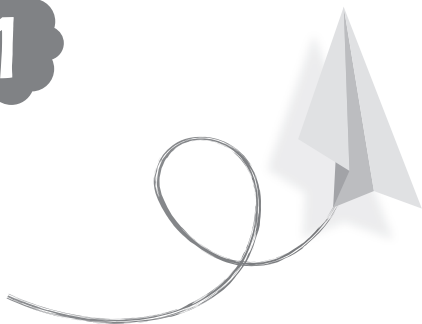
The first chapter addresses supports for educators designing distance STEM learning for elementary children, and speaks to parents', families', and caregivers' perspectives about STEM learning for young children.

The next eight chapters feature STEM projects designed around themes, aligned to STEM content standards for grades K through 5, and adaptable for flexible online and offline use. Technology resources—which might include videos, applets, or online games—are used to launch each project. The chapters include activities related to science and math as well as engineering challenges. The engineering component introduces children to a type of engineering that corresponds with the theme of the chapter. Engineering design challenges them to extend learning about the project theme so that STEM learning is applied and connected in engaging, hands-on experiences.

This book concludes with suggestions and guidelines for teachers and families to design their own creative STEM projects that can keep children engaged in rich, fun learning experiences.

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Supporting Distance STEM Learning for Elementary Children

The elementary STEM projects in this book are designed for distance, online, blended, and remote learning. These projects are not curriculum materials akin to textbooks or lesson plans. Instead, each project is an adaptable set of ideas, designed around a central theme. Teachers and families can choose the components that best align with their students' grade levels and draw from other options for enrichment or remediation activities.



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STEM Projects Overview

This section provides a breakdown of the components of each project-based chapter, which includes connections to relevant standards and grade-level guidelines, with suggestions for students in grades K–2 and 3–5. Each project provides information on necessary materials; suggested online resources; and extensions and connections beyond STEM, such as film, literature, and fine arts.

Connection to Standards

All projects in this book are aligned to standards that connect with the four STEM content areas: science, technology, engineering, and mathematics. Standards help articulate expectations for student learning, and alignment with standards helps ensure that students learn content they're "supposed to know" in an order and depth that is developmentally appropriate.

The standards to which activities in this book are aligned are all widely adopted in the US and informed by decades of research and practice in STEM education content areas. However, some states have adopted their own standards, often heavily influenced by the ISTE Standards, Next Generation Science Standards (NGSS), and Common Core State Standards for Mathematics (CCSSM) (Pruitt, 2014; Reys, et al., 2013). While exact alignment to state-level standards may differ, big ideas tend to be somewhat consistent (Thomas & Edson, 2014) and children who engage in these activities will learn STEM content that is useful no matter where they are. Families may have a variety of perspectives and questions about standards, but it is important to keep in mind that they are all goals for learning designed to prepare children for eventual success in college and careers. Emphasis on standards throughout this book is intended to reassure educators and families that the STEM projects align with what children are expected to learn in school.

Table 1.1 provides access to key sources for standards that are addressed in the book.

How Educators Can Support Distance STEM Learning

Most elementary teachers are accustomed to planning for physical classroom environments, routines, interactions, and teaching. And while teaching and managing a room full of young children requires a great deal of skill and compassion, teaching practices for online learning may seem even more daunting. How can virtual environments possibly support the learning needs of children who developmentally rely on concrete experiences and emotionally need affirming teacher–student relationships? The truth is that online learning will not replicate in-person experiences, especially for elementary-age children. Online teaching isn't better or worse; it's just different—and it can be difficult, especially when it is new or rushed. This section describes considerations for elementary teachers to design and support online STEM learning, as well as information for teachers to implement the projects in Chapters 2–9.

Ensuring Equitable Learning

Unlike middle school, high school, or college students, elementary children are rarely alone when they engage in online learning. In most cases, younger children participate in online schooling while under the supervision of a parent, older sibling, or caregiver. On the one hand, this is a great opportunity to partner with families and caregivers in a very direct way. On the other hand, families and caregivers must take on heavier responsibilities for supporting young children's online schooling. Some families may be better positioned to embrace those responsibilities, while others may face greater challenges. Just as in the classroom, it is of the utmost importance for distance elementary teachers to know the children and their families when planning for instruction. The better relationships teachers can develop with children and their parents, the better they can understand the opportunities and constraints students and families face with online learning.

One of the biggest challenges for distance learning is planning for equitable learning in situations that may be quite inequitable for children (Rose, 2014). Often online learning is designed for children who speak the predominant language and reside in middle-class households with access to high-speed internet, a computer, safe and quiet spaces to work, and a stay-at-home parent. This approach does not acknowledge the diverse cultures, experiences, needs, and circumstances of all children. These issues transcend individual teachers and are often made at the

completed and submitted like any other work in an online course. Some activities include experiences that are not as easy to “turn in” or assess. Teachers are encouraged to take advantage of technology for these types of activities. For instance, have students take and share photos of drawings or engineering design projects, or have classes incorporate a tool such as Flipgrid to easily create and share short videos of students’ experiences or their reflections about what they learned in a project. Alternatively, have students create videos or screencasts to share in approved educational spaces such as Google Classroom or Edmodo; demonstrate their learning through creating and sharing presentations, slide decks, or written work; or communicate with other students in a discussion board. These are general suggestions that span across activities. Some specific suggestions are included within activities, but educators can apply a variety of technologies to assess student learning in ways that connect with their teaching practices.

Possibilities abound, but educators must be mindful of the diverse circumstances for distance learning, as well as what is developmentally appropriate for young learners. Activities include ideas and resources to support teachers in this work, but choose flexibility over a prescriptive approach. Teachers can and should also draw upon their own creativity and the technologies they are comfortable using in their distance schooling contexts to provide options for assessing students’ work in a variety of ways.

How Families Can Support Distance STEM learning

Throughout April 2020, the United Nations Educational, Scientific and Cultural Organization (UNESCO) reported that more than 90% of the world’s children had been impacted by school closures due to COVID-19. Never in modern history had distance and remote learning been implemented at this scale. Unsurprisingly, adapting to schooling at home was a challenge for many families. As parents began abruptly shifting to homeschooling their children, social media was quickly flooded with posts and memes, humorously but sincerely affirming how invaluable teachers truly are. As teachers and schools rallied to rapidly shift to new modes of learning, families were the ones responsible for motivating, supervising, and holding children accountable for learning—from home—during a traumatic time in world history.

In many households with elementary children (including my own), emergency online schooling resulted in frequent struggles to get kids to do their schoolwork,

stay on task, and learn enough to minimize disruptions to their education. Most families know it's not as easy as asking a young child to log on to their online class at 8:00 a.m. and work independently until they've completed their lessons and schoolwork.

There are plenty of reasons why online schooling for elementary children during a global pandemic is challenging for kids and families, many of which relate to the equity considerations identified earlier in this chapter. And while many of those reasons are beyond our control, we can address what we know about children's learning. By and large, children learn best when they are actively engaged in interesting content that provides opportunities for three Cs: communication, collaboration, and connections (O'Connell & Groom, 2010). In the best of circumstances, these opportunities can be difficult to create in distance classes (or physical classrooms, for that matter).

Teachers spend years acquiring the professional education and expertise needed to design engaging lessons and facilitate active learning that meets the diverse needs of every student in their classrooms, so it's no wonder that keeping children actively and independently engaged in distance learning for hours each day is challenging for many families. But, for many kids, staying engaged in a video game for hours on end seems easy and is often the reason that families impose limits on screen time. This book offers some possibilities for how we can harness that type of online engagement, combined with hands-on activities at home, to motivate STEM learning for elementary children.

An Integrated Approach

The STEM projects in this book provide children with opportunities to learn grade-appropriate math and science through a variety of activities centered around a particular theme. By using an integrated, project-based STEM learning approach, children can delve more deeply into a topic over the course of a week or two, exploring and applying what they learn about science, technology, engineering, and math in active, engaging ways. And while many of the activities should be fun and may feel like play to children, parents and families can feel confident that they are still learning what they "need to know," because each project is aligned to grade-level math and science standards (Common Core State Standards for Mathematics and Next Generation Science Standards, respectively). Projects include ideas for connecting to other content areas outside of STEM, as well.