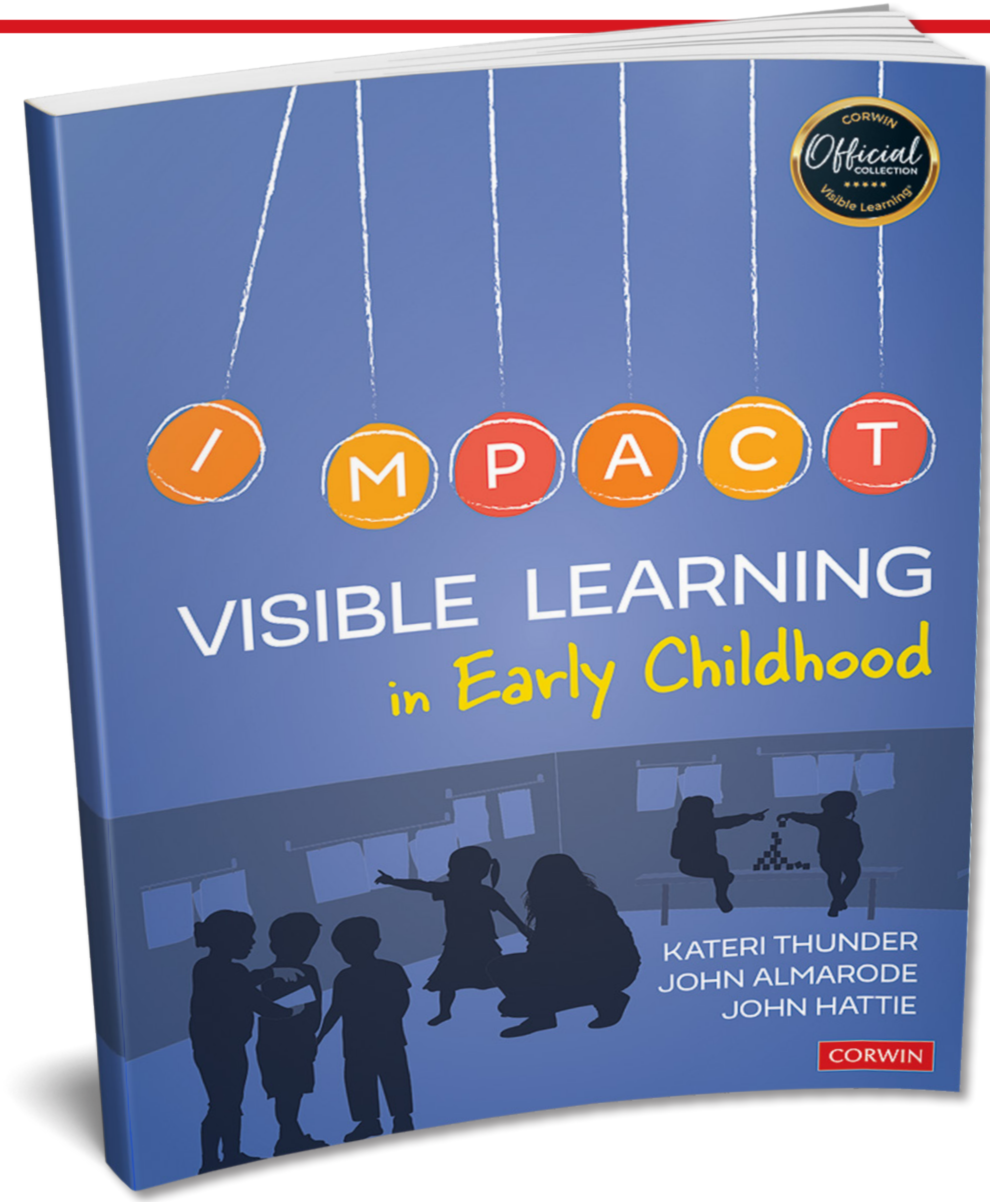

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Please enjoy this complimentary excerpt from Visible Learning in Early Childhood, by Kateri Thunder, John Almarode and John Hattie.

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CHAPTER 5

Visible Learning and Understanding the World in Early Childhood

From slime to gears, blocks to animals, family histories to classroom communities, and social justice to maps, the teaching and learning about children's physical and social environment allows young learners to acquire and consolidate knowledge about how the world works. As young children grow in their awareness and efficacy to explore, understand, and contribute to the world around them, early childhood educators intentionally create learning experiences about the natural and physical world, cultures and communities, and their histories. Understanding the world is the ideal area to balance learners' curiosity with educators' expertise and knowledge for activating intentional learning. The very nature of the content is engaging and offers a diverse pallet of topics, ideas, and concepts for a wide range of learners' interests.

This chapter focuses on the following questions: What works best in early childhood learning as children learn about their world? How do we activate learning in our young learners in ways that help them better understand the world, even if they do not ultimately become a scientist, historian, or geographer? Understanding the world around us and having tools for exploring and making sense of it is part of being an informed citizen of the world. This work starts in the early childhood classroom.

EFFECTIVE LEARNING TO UNDERSTAND THE WORLD IN EARLY CHILDHOOD

Science, humanities, and social sciences engage children in making sense of their physical and social environment, gradually learning about their expanding community, and cultivating a positive view of themselves as citizens. These content areas exist in meaningful integration within children's lives and are more than simply content.

BIG IDEAS, PROCESSES, AND WAYS OF KNOWING

Science is a body of knowledge about the physical and biological components of our environment, a set of processes for engaging with the environment, and a way of knowing about the environment (Bell, 2008). The body of knowledge includes the facts and figures of science—laws, principles, properties, and interactions. The body of science knowledge is built through a set of scientific practices or processes (see Table 5.1) that foster active, cognitive engagement with that body of knowledge. In other words, when children are doing science, they are building or even refining their knowledge of science.

TABLE 5.1 ● Processes of Science

Observing
Classifying and sequencing
Communicating
Measuring
Predicting
Hypothesizing
Inferring
Experimenting
Interpreting
Analyzing
Evaluating
Modeling

Adapted from Virginia Department of Education. (2012). *Practices for science investigation: Kindergarten-physics progression*. Author.

Scientists operate under the belief that we understand our world through hypothesis generation and testing. With that belief, scientists also come to understand that the current knowledge about how the world works is tentative and does not represent absolute truth. Progress in science is continuous. The way we know in science is not from seeking evidence that confirms our hypotheses, but attempting to verify them through replication.

EFFECT SIZE FOR SCIENCE LABORATORY PROGRAMS = **0.57**

In other words, we use the practices and processes of science to test and see if our hypothesis holds up to repeated experiments across multiple contexts and time. Thus, Visible Learning in the early childhood classroom seeks to build this distinct way of knowing in young learners.

EFFECT SIZE FOR SELF-JUDGMENT AND REFLECTION = **0.75**

Humanities and social sciences are composed of social systems, social concepts, and processes (National Council for the Social Studies, 2019). Social systems include relationships and interactions as well as the related societal norms and values, both explicit and implicit. Children gradually examine social systems beginning with their identity development, their family,

EFFECT SIZE FOR SELF-CONCEPT = **0.47**

their classroom and neighborhood communities, and eventually, their culture, country, and society (Bronfenbrenner, 2005).

Social concepts are big ideas that can both inspire and answer big questions about the world, such as continuity and change, perspectives and action, interconnections, cause and effect, power, authority, governance, resources, and diversity. Like science, humanities and social sciences also emphasize processes or action-oriented strategies for making sense of these social systems and concepts, including research, interviews, discussion, collaboration, data, evidence, and chronological awareness.

To effectively and truly learn science, humanities, and social sciences in early childhood, children must actively engage in processes to make sense of new knowledge and to access a new way of knowing. Therefore, effective early childhood teaching about the world must be more than relaying facts or replicating a process; it must engage children as scientists, historians, and geographers within their meaningful contexts so they can intentionally experience the depth and breadth of the content, processes, and ways of knowing.

COMPLEX QUESTIONS AND HIGHER-ORDER THINKING SKILLS

EFFECT SIZE FOR META-COGNITIVE STRATEGIES = **0.60**

EFFECT SIZE FOR SELF-REGULATION STRATEGIES = **0.54**

EFFECT SIZE FOR CREATIVITY = **0.58**

EFFECT SIZE FOR COLLABORATIVE LEARNING = **0.39**

Much attention has been given to the development of critical thinking skills or, in the United States, what is more commonly called the profile of a learner (Battelle for Kids, 2021). There are many variations of these skills based on how schools around the globe assimilate these skills and dispositions into their own vision for their learners (see Battelle for Kids, 2021). At the root of each profile variation are these four skills, often referred to as the four Cs: critical thinking, communication, creativity, and collaboration. Learning with our youngest students lays the foundation for subsequent growth and development in these four Cs (e.g., Samarapungavan, 1992; Schulz & Bonawitz, 2007; Sodian et al., 1991).

Science teaching and learning in the Visible Learning classroom contributes to the building of problem-solving skills (Rahayu & Tytler, 1999). When learners engage in the practices and processes of science within the context of authentic interactions with scientific phenomena, they begin to develop and apply problem-solving skills (e.g., Tytler & Peterson, 2003). In addition to critical thinking, young learners develop processes of higher-order thinking and reasoning (Gelman & Brenneman, 2004; Stein & McRobbie, 1997).

Similarly, the social systems and concepts of humanities and social sciences inspire complex questions and investigations that develop learners' critical thinking skills (Mindes, 2015). By emphasizing the processes of humanities and social sciences, early childhood educators can engage young children in purposeful debate, discussion, decision making, critical thinking, and problem solving (National Council for the Social Studies, 2019). Young children can also actively experience being a community member, collaboration, and diversity through their relationships and interactions with classmates (National Council for the Social Studies, 2019).

The progression of thinking in learners requires not only that they learn higher-order thinking skills (e.g., predicting, inferring, analyzing, etc.), but they also have multiple opportunities to practice these thinking skills within the context of authentic science, humanities, and social sciences content.

EFFECT SIZE FOR SPACED PRACTICE = **0.65**

Therefore, as early childhood educators, we must capitalize on children's curiosity as they encounter the world. When they wonder and experiment, we should intentionally select instructional strategies to emphasize higher-order thinking skills. And we should embrace rather than avoid complex questions about significant science ideas, social systems, and social concepts.

EFFECT SIZE FOR TEACHER EXPECTATIONS = **0.42**

For example, in Chapter 2, Ms. Demchak and Ms. Murrah's classes are engaged with the big idea of classification and sorting: *How are things (animals, vehicles, etc.) alike and different?* Meanwhile, Ms. Bullock and Mr. Heaton's classes are grappling with complex questions about interconnections and systems. Ms. Bullock's class is exploring, *How do businesses in a community rely on each other?* Mr. Heaton's class is examining, *How do animals in a habitat rely on each other?*

COMMUNICATION

Communication, both as one of the four Cs and as an essential part of learning, requires that learners effectively exchange ideas. For young children, oral language development lies at the foundation of the effective exchange of ideas. One piece of oral language development is vocabulary.

EFFECT SIZE FOR VOCABULARY INSTRUCTION = **0.63**

Science, humanities, and social science are rich in academic vocabulary. Making vocabulary visible enhances the vocabulary of learners by putting words into context and creating opportunities for learners to engage in academic discourse around science and social phenomena.

EFFECT SIZE FOR CLASSROOM DISCUSSION = **0.82**

This academic discourse relies on three tiers or types of academic vocabulary (Beck et al., 2013):

- **Tier 1 Vocabulary**—these are words or terms that are utilized in everyday life and are common in spoken language, and they typically do not have multiple meanings. Examples of Tier 1 words include *green*, *walk*, *tree*, and *window*. In many cases, this vocabulary is built through conversation. For our young English language learners and children with language needs, Tier 1 vocabulary may need to be deliberately taught and practiced.
- **Tier 2 Vocabulary**—this cluster comprises frequently used academic vocabulary terms that cross multiple subject areas and may have multiple meanings. For example, the processes of science, humanities, and social sciences (e.g., predict, infer, analyze, evaluate, etc.) are Tier 2 words because many of these processes are significant across the curriculum. Tier 2 words, such as *table*, *bark*, and *shade*, have different meanings depending on the context. Learners need to know and understand these terms, as they will be part of their learning experience across all content areas and outside of the classroom; therefore, this vocabulary should be the focus of much of our deliberate instruction for all children in early childhood.
- **Tier 3 Vocabulary**—this set of words includes terms that are domain-specific. This means that these terms have one meaning and are key to understanding specific concepts in a content area, such as science. Examples of Tier 3 words in science include magnets, motion, and liquid.

Through the planning, designing, and implementing of high-quality, high-impact teaching and learning in early childhood, we foster the effective exchange of ideas.

In Chapter 2, we examined research around teaching and learning language, including academic vocabulary. In Chapters 3 and 4, we extended this research and included research on another way to effectively exchange ideas: representations. The CRA (concrete-representational-abstract) method and writing progression are two important guides for growing children's use of representations to express scientific, historical, and geographical ideas. We will see that science, humanities, and social sciences provide yet another context for language development and growth in the use of multiple representations.

EFFECT SIZE FOR MANIPULATIVES = **0.39**

EFFECT SIZE FOR IMAGERY = **0.51**

The combination of developing both academic discourse and academic representation in young learners further enhances their academic vocabulary (Graham et al., 2020).

GROWING GLOBAL CITIZENS

Every early childhood classroom holds a vast number of discretionary spaces. Discretionary spaces are the moments that are not dictated by policies or curriculum, but are places where early childhood educators make countless decisions (Ball, 2020). One significant decision is whether to intentionally teach science, humanities, and social sciences and another is how to teach these big ideas and processes.

EFFECT SIZE FOR COLLECTIVE TEACHER EFFICACY = **1.36**

High-quality, high-impact teaching and learning in the early childhood science classroom is correlated with the development of interest in science-related areas. When we intentionally teach science, we capitalize on children's wonderings and expose them to the opportunities and ideas of science. In fact, when we develop children's interest in science early, their interest has long-range educational outcomes (Tai et al., 2006) and can open the doors to science-related occupations.

When we intentionally teach science, we capitalize on children's wonderings and expose them to the opportunities and ideas of science.

When we embrace diversity and social justice, when we intentionally counter bias and inequity in our early childhood classrooms, we set the tone for children's engagement as global citizens (National Council for the Social Studies, 2019). Early childhood educators can create "dialogical safe spaces" for children where dialogue around issues of bias and inequity can reflect children's real experiences, tentative thinking, and critical questions (Husband, 2010). In order to do this work well, early childhood educators need to develop their cultural competency (National Council for the Social Studies, 2019).

EFFECT SIZE FOR TEACHER CREDIBILITY = **1.09**

When early childhood educators plan and teach, it is important for us to keep an eye to the future: We are growing children who should have choice and voice in their futures as informed citizens of the world.

CHILDREN ALREADY KNOW

Children come to school each day with significant knowledge about themselves, their families, their communities, nature, race, oppression, and much more (Husband, 2010; Mindes, 2015; National Council for the Social Studies, 2019; National Science Teachers Association, 2014). Children experience their community and the world in ways that reflect the ways their families experience their community and the world. Therefore, early childhood teaching and learning to understand the world should begin with familiar experiences that bridge home and school and move to creating shared experiences for the class.

EFFECT SIZE FOR STRATEGIES TO INTEGRATE WITH PRIOR KNOWLEDGE = **0.93**

In humanities and social science, this means beginning with examinations of self, then family, community, and culture in

EFFECT SIZE FOR INQUIRY-BASED TEACHING = **0.46**

EFFECT SIZE FOR FAMILY INVOLVEMENT = **0.42**

EFFECT SIZE FOR INTEGRATED CURRICULA = **0.40**

ways that respect and appreciate diversity (National Council for the Social Studies, 2019). This also means examining complex questions—"How do people and places change over time?" and "How do we share power and resources?"—through the familiar experiences of daily life and community connections. In a farming community, farm life could be the context for examining these questions; in an immigrant community, the context might change, but the children and their families would remain rich resources for investigating these questions.

This work can also be integrated across the curriculum.

We see this in Ms. Demchak's classroom. In Chapter 4, her class shares their name stories to learn letters. In Chapter 6, her class learns about respecting and appreciating different perspectives. Finally, in Chapter 7, her class learns fine art and motor skills while developing self- and family identity and celebrating the class's diversity by creating family portraits.

EFFECT SIZE FOR FAMILY INVOLVEMENT = **0.42**

In science, this means incorporating home-familiar materials and experiences that illuminate scientific knowledge, processes, and ways of knowing. In this way, we can model replicating experiments from home to school in order to gather empirical evidence and to make explicit the science processes. As early childhood educators, we can also foster this home–school connection by having families share their experiences. Families' hobbies, chores, or regular activities indoors and in nature are often rich with scientific knowledge, such as cooking, construction, gardening, nature walks, hunting, and cleaning (Chawla, 2007).

From birth, children seek to understand the world around them, and our role as early childhood educators in this process is significant.

This is where science, humanities, and social sciences education research and Visible Learning research intersect: From birth, children seek to understand the world around them, and our role as early childhood educators in this process is significant. By choosing to intentionally teach science, humanities, and social sciences, we lay the foundation for their continued interest in and their embrace of diversity and social justice. By valuing children's home experiences, we allow all children access to big ideas, higher-order thinking skills, and the communication of their ideas. As we see and hear this intersection of science, humanities, and social sciences education research and Visible Learning research in action, note the ways our three early childhood educators intentionally make decisions to connect research and practice.

MS. DEMCHAK AND STEM CHALLENGES

Over the first semester, Ms. Demchak has observed her 4-year-old learners growing in their sense of agency and identity as members of the classroom community. The children often solve problems that arise during their interactions and make plans together for creations and pretend play. But Ms. Demchak wants them to grow more intentionally as a community of learners. She wants them to practice listening to each other's differing ideas and to collaborate on a science, technology, engineering, and mathematics (STEM) task.

In their vertical PLC, Ms. Demchak, Ms. Murrah, and the other teachers have been planning STEM challenges with the disciplines "turned up" or "turned down" depending on the learning intentions (Neill & Patrick, 2016). This turning up and down of the STEM disciplines allows the teachers to create tasks with meaningful integration.

EFFECT SIZE FOR INTEGRATED CURRICULA = **0.40**

Ms. Demchak and Ms. Murrah have decided to use a variety of familiar texts as springboards into their STEM challenges in order to contextualize or storify (Hammond, 2015) the tasks.

EFFECT SIZE FOR STRATEGIES TO INTEGRATE WITH PRIOR KNOWLEDGE = **0.93**

Ms. Demchak's class has read many versions of *The Three Little Pigs*, including *The Three Little Javelinas* (Lowell, 1992). Retelling and reenacting the story has quickly become a class favorite.

Ms. Demchak's class has also been exploring natural resources. They have sorted living and nonliving natural resources and concluded that some living things cannot move on their own (like plants) and some natural resources were alive but are not anymore (like sticks). They have categorized and classified natural resources based on their physical properties and realized surprising facts—for example, sand and soil can pour like liquids but they are solid.

Now, the majority of learners are in the transfer phase of learning. They are ready to analyze natural resources' properties to determine which will make a strong house.

EFFECT SIZE FOR ELABORATIVE INTERROGATION = **0.66**

LEARNING INTENTIONS AND SUCCESS CRITERIA

Ms. Demchak always has more than one goal in mind for her children's learning. She considers the content of their work as well as the processes for engaging in the work. She also values the dispositions or attitudes that the children can learn through these interactions. For this STEM challenge, Ms. Demchak identifies three targeted outcomes (Australian Government Department of Education and Training, 2019):

Outcome 4: Children Are Confident and Involved Learners

- Children develop dispositions for learning such as curiosity, cooperation, confidence, creativity, commitment, enthusiasm, persistence, imagination, and reflexivity.
- Children develop a range of skills and processes such as problem-solving, enquiry, experimentation, hypothesising, researching, and investigating.

Outcome 2: Children Are Connected With and Contribute to Their World

- Children develop a sense of belonging to groups and communities and an understanding of the reciprocal rights and responsibilities necessary for active community participation.

Ms. Demchak translates these outcomes into learning intentions and success criteria, which she calls the engineering design brief. She refers to each group as a "team of engineers." She turns up the science and engineering disciplines and turns down the technology and mathematics disciplines for her STEM challenge, "The Three Little Pigs' New House" (Thunder & Demchak, 2020).

Content Learning Intention: We are learning to analyze natural resources in order to identify the strongest material.

Language Learning Intention: We are learning to name plant, soil, rock, sand, and mineral resources.

Social Learning Intention: We are learning to actively listen to and include each person's contributions to meet a goal.

Success Criteria

- Your house must have walls, a floor, a roof, and a door. Two pigs must fit inside.
- Your house must be made of natural resources from plants, soil, rocks, sand, or minerals (like quartz).
- Your house must have a name based on its natural resources that you can explain and defend.
- Your house must withstand the howling wind of the Big Bad Wolf for 5 seconds (Figure 5.1).

FIGURE 5.1

Image source: Pixabay.com/ OpenClipart-Vectors

To complete the engineering design brief, Ms. Demchak adds the story or context (Thunder & Demchak, 2020):

The Three Little Pigs' New House

> The first and second Little Pigs are tired of living with their brother in the brick house. They are ready to build their own houses. And this time, they are working carefully to build strong houses that can't be blown down by the Big Bad Wolf. They have hired you to design and build one of their strong houses.

Now, Ms. Demchak is ready to plan how to communicate the learning intentions and success criteria through the lens of an engineering design brief.

By analyzing student work, Ms. Demchak's vertical PLC has noticed that the planning phase of the STEM challenges needs to be elongated and scaffolded.

Without this, learners tend to rely on trial and error and do not carefully consider and incorporate the contributions of each team member. In other words, without planning, the intentional transfer of learning does not take place. Ms. Demchak uses this feedback from the learners to refine her implementation of STEM challenges, and so, today is strictly about planning.

EFFECT SIZE FOR PLANNING AND PREDICTING = **0.76**

ACTIVATING PRIOR KNOWLEDGE

Ms. Demchak has just finished reading aloud the engineering design brief, including the success criteria, which are displayed as an enlarged visual checklist (Figure 5.2). The children are sitting with their assigned team of three engineers. "That was a lot of information! Who can tell us: What is our challenge?"

EFFECT SIZE FOR PROBLEM-SOLVING TEACHING = **0.67**

"We have to build a strong house," Noah summarizes.

"Strong like the brick house so the Big Bad Wolf can't blow it down!" Alinta adds.

"Yes, and each member of your team has to help plan and build the strong house," Ms. Demchak adds. "Let's look back at the success criteria. This is how we'll evaluate each house to see if it succeeds at meeting the challenge." This time, as Ms. Demchak rereads the success criteria of the engineering design brief, she engages the class in discussion to make sense of them using the familiar cognitive routine, Notice and Wonder. She asks, "What do you notice about the success criteria? What do you wonder?"

EFFECT SIZE FOR SELF-JUDGMENT AND REFLECTION = **0.75**

As the children notice, they use their own words to rephrase the success criteria.

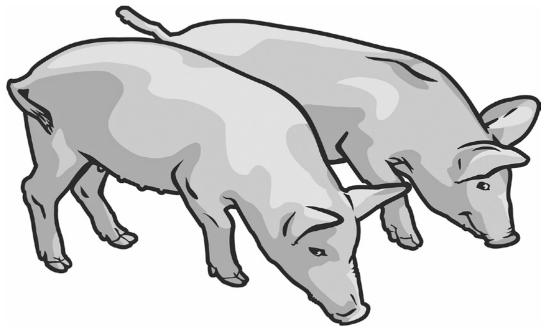
FIGURE 5.2 ● Engineering Design Brief: The Three Little Pigs' New House

The first and second Little Pig are tired of living with their brother in the brick house. They are ready to build their own houses. And this time, they are working carefully to build strong houses that can't be blown down by the Big Bad Wolf.

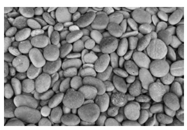
They have hired you to design and build one of their strong houses.

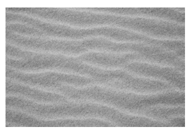
Success Criteria:

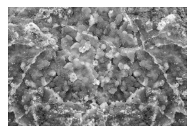
- Your house must have walls, a floor, a roof, and a door. Two pigs must fit inside.



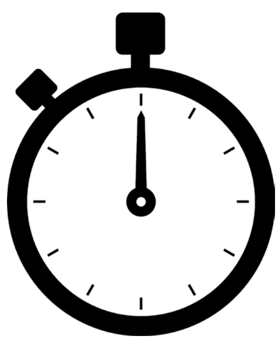
- Your house must be made of natural resources from plants, soil, rocks, sand, or minerals (like quartz).







- Your house must have a **NAME** based on its natural resources that you can explain and defend.
- Your house must withstand the howling wind of the Big Bad Wolf for 5 seconds.



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Source: Adapted from Thunder and Demchak (2020).

As the children wonder, they ask clarifying questions. “Do we only use one resource or can we combine?” “Can we use water to make the sand wet?” “Can we use glue?” “Does the house need rooms or windows?” “Does the roof have to be pointy?”

Some of their wonderings offer opportunities for Ms. Demchak to remind them about their prior learning for transfer to this new challenge.

EFFECT SIZE FOR TRANSFER STRATEGIES = **0.86**

For example, when Mirrin asks if sticks are natural resources, Ms. Demchak engages the class in a discussion to activate their prior learning about plants. She points out the class-created “Plants” anchor chart with drawings, photos, and magazine images of plants, including sticks. She also shows them the table covered in plant materials for the challenge. Teams of engineers turn and talk about what natural resources are plants. Ms. Demchak says,

> Today, we are only making a plan. We will construct houses tomorrow. As a team of engineers, you will record your plan by drawing a picture of your house. You will label its parts and the materials you will use. You can name your house. You might need to test something to help you make a decision about your plan. Testing something means you’re asking, “What would happen if . . . ?” If you want to see if something will work for your plan, you can test it today. Everyone in your team of engineers must contribute ideas to your final plan. At the end of work time, we’ll share the materials you will use to build your house.

SCAFFOLDING, EXTENDING, AND ASSESSING STEM THINKING

As teams move to their work areas, Ms. Demchak joins a team where one person seems to be dominating the planning. She wants to scaffold the social learning intention for this group. “I hear Zoe sharing a lot of her great ideas! One of our goals for today is to make sure we listen to and understand everyone’s ideas. What’s a strategy we use when we talk together as a whole class to make sure everyone’s voice is heard?” Ms. Demchak wants to make this whole group strategy explicit so they can transfer it to their small group work.

“We take turns around the circle,” responds Isla.

“Let’s see how we can take turns around this little circle of just three people. Zoe, you’ve started sharing your ideas. Who will share next?” Ms. Demchak points around the small circle.

"Liam is next," Zoe says and turns to face him.

Liam shares his ideas, followed by Isla. Zoe wants to build a stick and mud house, Liam wants to build a rock and mud house, and Isla wants to make a sandcastle-like house.

EFFECT SIZE FOR COGNITIVE TASK ANALYSIS = **1.29**

"You've listened to each person's ideas by taking turns around the circle. Now, how will you make a plan for your strong house that includes everyone's ideas?" Ms. Demchak breaks down the social learning intention to help the group identify their next step.

"We all want to use something sticky to make the house strong," Zoe points out.

"My sand could be a sticky floor for the walls," Isla offers.

"Rocks and mud make strong walls," says Liam, who has been building many rock and mud walls outside.

Isla walks to the visual checklist of the success criteria and points as she says, "Sand floor. Rock and mud walls. Zoe, can your sticks make a roof?"

"Sure! They can make anything!" Zoe responds.

EFFECT SIZE FOR STRATEGY MONITORING = **0.58**

"Wow! Each of you is contributing your idea to make one part of your strong house. Let's look at the visual checklist again like Isla did," Ms. Demchak points to each part of the house image as she says, "Isla's sand floor, Liam's rock and mud walls, Zoe's stick and mud roof . . . What else do you need?"

"We need a door!" Liam reads the image.

"Sand does not make strong doors," Isla admits.

"I could find one flat rock for a door," Liam suggests.

"Or I could make a mud and stick door," Zoe adds.

"Let's go look at the materials for a flat rock. If we can't find one, Zoe, you can make the door and roof!" Liam proposes.

EFFECT SIZE FOR FEEDBACK = **0.62**

"It sounds like you're listening to each other and making sure everyone's ideas are included. You're even making a backup plan! You have almost all of your house parts. You're using a combination of natural resources. You still need to draw your plan, label it, and name your house. I'll be back to see how your work is going." Ms. Demchak summarizes their progress toward the learning intention and leaves the group as they look for a door. She makes notes about their progress and then moves to meet with two other teams of engineers.

Jedda's group is testing whether clumps of moss will balance on sticks. Ruby's group is testing what happens when they mix soil, sand, *and* water. After meeting with those groups and noting their questions and discoveries, Ms. Demchak returns to Zoe, Isla, and Liam, who are debating who will draw the plan.

"What are you trying to decide?" Ms. Demchak inquires.

"Isla wants to draw the house, but that's not fair," Liam says.

"Why isn't that fair?" Ms. Demchak probes.

"Because we want to draw too," Liam explains.

"I see. Everyone contributed ideas to create your strong house plan. And now, you want everyone to contribute to the recorded plan also," as Ms. Demchak says this, Liam and Zoe nod in agreement. "Let's think about what you still need to do and figure out a way for everyone to contribute. You need three things for your plan: you need to draw the house. And what else?"

"Label it," says Zoe.

"Name it," says Isla.

"Three things for your plan and three people on your team of engineers. That's interesting. Your house needs four parts." Ms. Demchak points to the parts on the visual checklist as the children name them: floor, walls, door, roof. "Four parts of the house and three people on your team. Also interesting." Ms. Demchak waits quietly. She wants to point out options but allow the children to make the decision for how to contribute.

"If Isla draws, I can label. I'm good at letters. And Liam can name the house," Zoe suggests.

"Or Isla can draw the floor and label it, and I can draw the walls and door and label it, and Zoe, you can draw the roof and label it," Liam provides an alternative.

"But who would name the house?" Isla wonders.

"We all could!" Zoe exclaims.

Again, the team has identified a strategy for including everyone's contributions while also transferring their understanding of natural resources to this new context. Ms. Demchak adds to her notes. All of the teams are drawing their plans.

EFFECT SIZE FOR SMALL GROUP LEARNING = **0.47**

TEACHING FOR CLARITY AT THE CLOSE

During their share, each team of engineers shows their house plan and explains the materials they will use. Because

EFFECT SIZE FOR CLASSROOM DISCUSSION = **0.82**

Ms. Demchak has conferred with the teams as they planned, she is able to facilitate the class discussion. She asks questions that engage the class in noticing similarities and differences in plans as well as in tests the groups conducted during planning time.

"Jedda's team of engineers wondered if moss could balance on sticks. Sophia, what did you discover?"

"If it's just one stick up like this, then it'll fall over when moss is on top. Or it'll break," Sophia explains while holding a stick vertically.

"I thought it would work because I've seen moss on tree branches," Jedda explains his connection.

"But if the sticks are like this, then you can put moss on top and it'll stay! And it's stronger than just sticks," Noah adds holding a bunch of sticks horizontally.

"You observed moss in nature and that inspired your question. Then you collected important empirical evidence about how to use sticks and moss together. What did you decide based on your experiments?" Ms. Demchak asks.

"We're making a whole roof of sticks and then moss on top," Jedda responds, pointing to their picture representation of their house.

Now, Ms. Demchak turns to the whole class, "How is this experiment similar to Ruby's team of engineers' experiment?" The teams turn and talk to each other. Many children point out that the groups were testing what happens when you combine natural resources. As a class, they conclude that often combining natural resources makes a stronger structure. Tomorrow, they will refer back to their picture plans, actually build their strong houses, and then test every structure against the blowing wind of the Big Bad Wolf!

MS. BULLOCK AND BEING A SCIENTIST

EFFECT SIZE FOR TIME ON TASK = **0.42**

Ms. Bullock knows that when children are familiar with materials, their depth of inquiry and investigation increases. She begins her school year with home-familiar materials throughout her classroom. Gradually, she introduces new materials in the now-familiar context of school.

Today, Ms. Bullock is ready to deepen her 3-year-olds' examination of new materials. Most of the children are at the surface phase of learning as they begin a study of physical properties. Ms. Bullock wants her learners to recognize themselves and their families as already engaging in scientific practices. She also wants to connect their rich experiential knowledge with new scientific language, concepts, processes, and a distinct way of knowing.

EFFECT SIZE FOR STRATEGIES TO INTEGRATE PRIOR KNOWLEDGE = **0.93**

Ms. Bullock has assembled exploration trays. Each tray contains materials for scientific exploration:

- Prisms, mirrors, glass pebbles, and flashlights
- Kinetic sand and sand tools
- Slinkys
- Seashells and magnifying glasses
- Magnet wands, magnet balls, paperclips, toothpicks, buttons, and washers
- Block ramps, cardboard tubes, and marbles

She will interact with the children as they engage with the exploration tray materials. Through this formative assessment, Ms. Bullock will learn what types of questions the children are already asking, what connections they are making, what language they are using, and what investigations would be appropriate next steps.

LEARNING INTENTIONS AND SUCCESS CRITERIA

When Ms. Bullock selected the Illinois Early Learning and Development Standards for her first exploration tray lesson, she was surprised to see the focus on communication embedded with the science learning goals (Illinois State Board of Education, 2013). Yet this makes sense to Ms. Bullock because, regardless of the content, she knows that language is the linchpin of early childhood teaching and learning.

- **Science 11.A.ECa:** Express wonder and curiosity about their world by asking questions, solving problems, and designing things.
- **Science 11.A.ECf:** Make meaning from experience and information by describing, talking, and thinking about what happened during an investigation.
- **Science 11.A.ECg:** Generate explanations and communicate ideas and/or conclusions about their investigations.

Ms. Bullock's big idea for learning is "Scientists ask questions and investigate answers." She anticipates learners will ask six types of questions that she calls BIG questions because there are many possible answers:

- How does this work?
- How is this made?
- How is this the same or different?
- Why?
- What would happen if . . . ?
- Will it always work?

These questions reflect significant scientific processes. Each exploration tray holds materials to unpack a different scientific concept. Her learning intentions and success criteria unite these different materials by focusing on process and communication. A big part of communication is exchanging ideas, which requires talking as well as actively listening and responding to another person's ideas.

Content Learning Intention: We are learning that scientists ask questions and investigate answers.

Language Learning Intention: We are learning to communicate our questions and answers using words and actions.

Social Learning Intention: We are learning to think about what friends are saying.

Success Criteria

- I can ask BIG questions.
- I can try different ways to answer my questions.
- I can show and tell my questions and answers.
- I can think about friends' words when they share.

Ms. Bullock knows her learners bring a wealth of knowledge related to these learning intentions. They are inquisitive and attentive children. She also knows she will need to differentiate to meet each learner where they are and move them forward. As Ms. Bullock observes and interacts with her learners, she will use her formative assessment data to inform her next instructional steps and to determine which instructional strategies are most effective for which learners (Figure 5.3).

FIGURE 5.3 • Observation/Conference Chart

Date ____________________

NAME	EXPLORATION TRAY	CONNECTIONS	LANGUAGE	QUESTIONS	NOTES

Content Learning Intention:

We are learning scientists ask questions and investigate answers.

Language Learning Intention:

We are learning to communicate our questions and answers using words and actions.

Social Learning Intention: We are learning to think about what friends are saying.

Success Criteria:

- I can ask BIG questions.
- I can try different ways to answer my questions.
- I can show and tell my questions and answers.
- I can think about friends' words when they share.

Anticipated BIG Questions:

- How does this work?
- How is this made?
- How is this the same or different?
- Why?
- What would happen if . . . ?
- Will it always work?

online resources Available for download at **resources.corwin.com/VLforEarlyChildhood**

ACTIVATING PRIOR KNOWLEDGE

Ms. Bullock finishes reading *Ada Twist, Scientist* (Beaty, 2016), saying, "Ada has the heart of a young scientist and so do you. Today, we're going to show each other our scientist's hearts by doing the work of scientists, speaking and thinking the words of scientists, and listening to each other as scientists." Ms. Bullock pulls out one exploration tray. "Scientists ask questions and investigate answers. Today, everyone will get an exploration tray to explore. You can ask questions about the materials in the trays and you can investigate answers. Let's try one together."

Ms. Bullock shows the contents to the class: prisms, mirrors, glass pebbles, and flashlights. She picks up each item and thinks aloud. As she holds the prism, Ms. Bullock wonders, "I've never seen this before. It looks like it's made of glass. I can kind of see through it. I wonder what it is. Does anyone know what this is?" There is silence. "Ms. Thompson, do you know what this is?" Ms. Bullock asks the paraprofessional who is sitting in the circle with the children.

EFFECT SIZE FOR HELP SEEKING = **0.72**

"Yes, that's a prism," Ms. Thompson responds.

"It's a prism," Ms. Bullock holds it up to the light and looks through it. Next, she picks up the flashlight, "I have one of these at home. I use it to see in the dark, like when the electricity goes out. I forget what it's called. Do you remember?" Ms. Bullock turns the flashlight on and off as she asks the class.

Several call out, "Flashlight!"

"Right! It's a flashlight!" Ms. Bullock continues pulling out the mirror and the glass pebbles, making connections to the mirrors in the classroom and the glass pebbles at the light table. "I wonder why these are together. What can I try with them?" Ms. Bullock pauses to allow the children to think with her. "I'm wondering . . . What would happen if I shine the flashlight at each one? What questions are you wondering?" Ms. Bullock has several children share their questions: "What can you build with them? Will they break like glass? What can you see in the mirror?"

Ms. Bullock continues,

EFFECT SIZE FOR META-COGNITIVE STRATEGIES = **0.60**

> Scientists ask questions and investigate answers. We asked some small questions like, *What is this called?* And we asked some BIG questions like, *What would happen if I shine the flashlight on each item?* Now I'm going to investigate answers by trying different strategies. I'm going to show and tell you about my answers. And you can be thinking in your head about my words.

Ms. Bullock proceeds to shine the flashlight at the prism, the mirror, and the glass pebbles. She summarizes her answers as she shines the flashlight on each item again: "I can see the light go through the prism and the glass pebbles. I can see the light shine on the mirror and it shines back into my eyes. That's called a reflection. The light reflects on the mirror. Are you thinking about my words?" Many children shake their heads yes. "We are being scientists!"

"Today as you investigate your exploration tray, ask questions and try different ways to answer your questions. Then, we'll show and tell what we discover," Ms. Bullock says. Each child picks an exploration tray and goes to a work area to begin their investigation. When they are done with their tray, they can trade it in for another tray. Ms. Bullock and the paraprofessionals confer with the children as they explore.

SCAFFOLDING, EXTENDING, AND ASSESSING SCIENTIFIC THINKING

Through her interactions as children work, Ms. Bullock notices that the magnet trays are the most popular. As she confers with Kayvion, she notes that he uses the magnet wand to push the magnet balls across the table.

Kayvion shouts proudly, "Look! It's moving! I'm not touching!"

"Wow, you're using the magnet wand to push the magnet balls across the table. But the wand and balls aren't touching! Scientists ask questions. What are you wondering, Kayvion?" Ms. Bullock prompts Kayvion to consider the learning intentions and success criteria.

"Why is it doing that?!" Kayvion wonders excitedly.

"*Why?* is a BIG question!" Ms. Bullock records Kayvion's observation and question. She also notes that he is invested in experimenting with the magnet materials but without using their names. Kayvion says this is his first time using the magnets.

Ms. Bullock also confers with Sabina as she works with magnets. Sabina uses the word "magnet" and shares that she has letter magnets on her fridge at home. Her mom uses the magnets to make her pictures "stick" to the fridge. "What are you wondering about magnets, Sabina?" Ms. Bullock asks.

"How work? What inside?" Sabina shakes the magnet balls and wands. They can hear something shifting.

EFFECT SIZE FOR QUESTIONING = 0.48

"*How do magnets work?* is a BIG question! *What are magnets made of?* is another BIG question! Scientists ask questions *and* investigate answers. What could you try to answer your questions?"

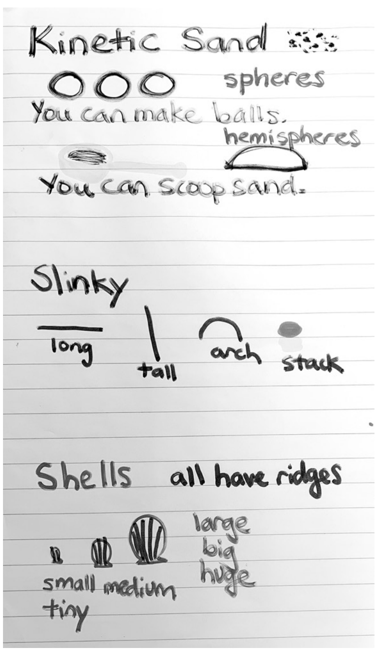
Ms. Bullock records Sabina's connections to home and her BIG questions. Sabina begins to touch the magnet wand to each item in the tray until all of the magnet balls, washers, and paperclips are attached.

"They stick!" Sabina points to the magnet wand and then points to the toothpicks and buttons in the bottom of the tray and says, "They don't. Why no stick?"

"You touched each item with your magnet and some stuck to it and some did not. Now you have another BIG question: *Why do some things stick to a magnet and some do not?*" Ms. Bullock notes Sabina's investigation and question.

Ms. Bullock also notices that some children try the same strategy—stacking—regardless of the materials and others either only ask questions about objects' names or do not ask any questions and rather tell about the materials.

FIGURE 5.4



Record of children's discoveries

TEACHING FOR CLARITY AT THE CLOSE

To bring closure to the lesson, Ms. Bullock facilitates the children's sharing about their exploration trays. This provides the children with another opportunity to practice as well as model for each other the learning intentions and success criteria.

Ms. Bullock records the children's discoveries and introduces new language for talking about the materials (Figure 5.4). At the same time, Ms. Thompson records the children's questions so that Ms. Bullock can analyze the types of questions they are asking and use this to guide her instruction.

As the children worked today, Ms. Bullock gathered feedback from the learners about her instructional decisions. Magnets are a high-interest topic to dive deeply into next, and there are children at the surface and deep phases of magnet learning. The exploration trays were effective for her initial assessment of children's language, questions, and connections, but they were ineffective for some of her learners to meet the learning intentions and success criteria today. Ms. Bullock knows she needs to use a variety

EFFECT SIZE FOR TEACHER CLARITY = 0.84

of instructional strategies and, especially for her learners at the surface phase of questioning and problem solving, she needs to use deliberate instruction and practice, modeling, guiding questions, and direct vocabulary instruction as they continue learning to ask BIG questions and problem solve.

EFFECT SIZE FOR EXPLICIT TEACHING STRATEGIES = 0.57

Tomorrow, the learning intentions and success criteria will emphasize scientific communication and problem solving with magnets:

Content Learning Intention: Today, we are learning that magnets make things move.

Language Learning Intention: We are learning ways to describe movement with words and actions.

Social Learning Intention: We are learning to work together to try many strategies to solve a problem.

Success Criteria

We'll know we have it when . . .

- We can answer the question "How do magnets make things move?" with words and actions.
- We can show different ways magnets make things move.

Ms. Bullock plans to read aloud *Magnets Push, Magnets Pull* (Adler, 2017). She will give the children a variety of supplies, including magnetic tape, cardboard, cardboard tubes, scissors, paper, fabric, tape, paperclips, washers, magnet balls, and magnet wands. As teams of scientists, they will create objects that can be pushed or pulled along a pathway using magnets. Based on her feedback from learners today, Ms. Bullock is able to select the right instructional strategies at the right time for her children and to refine and differentiate her instruction to move their learning forward tomorrow.

EFFECT SIZE FOR PROVIDING FORMATIVE EVALUATION = 0.40

MR. HEATON AND MAPS

Treasure maps, story maps, maps for field trips, underground transportation maps, map puzzles—the children in Mr. Heaton's class are really excited by maps. They have even found "maps" in the end pages of books. Most of the children have surface knowledge about maps. They know maps show where things are, maps have small pictures of places and sometimes symbols like "X marks the spot," maps often have roads or paths, and maps are useful if you are lost (Figure 5.5).

Mr. Heaton wants to deepen their understanding of how maps represent a place; he wants to engage the children in creating

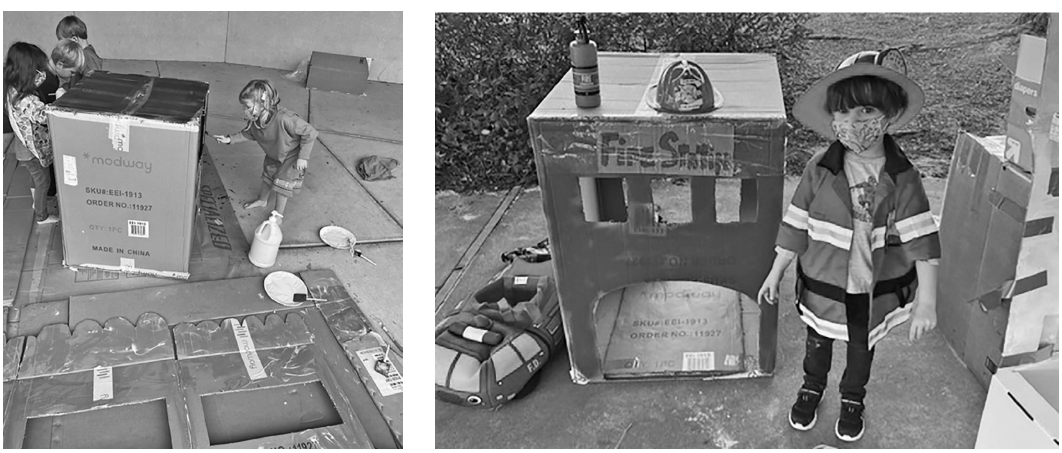
FIGURE 5.5

Children drawing “maps” with chalk, showing what they already know

a three-dimensional space and then translating this place into a two-dimensional representation—a map. He believes that through the creation process, his learners will better understand how a map is made and, therefore, grow their spatial reasoning to read, use, and create other maps.

The class has created a three-dimensional box town by cutting doors and windows into large cardboard boxes, painting the boxes, and creating signs to name each “building.” Outside, they ride tricycles and walk between the buildings as peers pretend to live or work inside them (Figures 5.6 and 5.7).

FIGURES 5.6 AND 5.7



Constructing and playful learning in the three-dimensional box town

To deliberately practice constructing miniature towns with familiar materials, Mr. Heaton has blocks, Legos, and train kits available inside as well as floor mat maps for miniature vehicles (Figures 5.8–5.11).

EFFECT SIZE FOR DELIBERATE PRACTICE = **0.79**

FIGURES 5.8, 5.9, 5.10, AND 5.11

Constructing and playful learning with miniature towns using familiar materials

Next, the class worked together to build a miniature version of the box town using small cardboard box buildings placed along a grid of roads (Figure 5.12). Again, they cut doors and windows, painted the small boxes, and created signs to name the "buildings."

FIGURE 5.12 ● The Three-Dimensional Miniature Box Town

Image source: Photo by Katherine Murrah. Used with permission.

EFFECT SIZE FOR MANIPULATIVES = **0.39**

EFFECT SIZE FOR IMAGERY = **0.51**

Today, the class is translating this three-dimensional representation of their box town into a two-dimensional map.

They will choose images to represent each building and then place those images on a replica of the town's road grid.

LEARNING INTENTIONS AND SUCCESS CRITERIA

Mr. Heaton knows that maps capture significant concepts and processes, including representation, spatial reasoning, and the relationship between geography and the social system of a neighborhood (U.K. Department of Education, 2021). Reading and using maps can lead to discussions about interconnections, changes over time, distribution of resources, and comparisons between places. Mr. Heaton identifies three goals for their map learning:

- **ELG People, Culture and Communities:** Describe their immediate environment using knowledge from observation, discussion, stories, non-fiction texts and maps.
- **ELG Creating With Materials:** Safely use and explore a variety of materials, tools and techniques, experimenting with color, design, texture, form, and function; Share their creations, explaining the process they have used.
- **ELG Listening, Attention and Understanding:** Listen attentively and respond to what they hear with relevant questions, comments and actions during whole class discussions and small group interactions.

With these big ideas and processes in mind, Mr. Heaton creates learning intentions and success criteria that will guide his instructional decision-making process. He anticipates that both he and his learners will make mistakes as they use position words to describe where to place images on the map, so he uses the learning intentions and success criteria as another opportunity to make learning about mistakes both positive and intentional.

EFFECT SIZE FOR STRATEGY MONITORING = 0.58

Content Learning Intention: We are learning that maps have images that represent specific places.

Language Learning Intention: We are learning position words to describe things on a map.

Social Learning Intention: We are learning that mistakes are a chance to be kind and to learn.

Success Criteria

- I can use images to represent buildings.
- I can use words to describe where images go on a map to match the buildings in our town.
- I can use kind words when someone makes a mistake.
- I can learn something new from a mistake.

These learning intentions and success criteria serve as guideposts as Mr. Heaton plans each part of his lesson. The tasks, materials, his questions, and his feedback are all aligned to the learning intentions and success criteria.

ACTIVATING PRIOR KNOWLEDGE

Mr. Heaton begins, "Today, we are cartographers. Cartographers make maps. We are making a map of our tiny town. We will use the map to hide treasure for each other to find using our code-apillars tomorrow." By previewing future work, Mr. Heaton gives purpose to today's work.

> I started our map by making the roads. The roads are exactly the same as the roads of our tiny town. Now, we need our buildings. But this is a map. We can't put buildings on here! I want to be able to fold this map up and put it in my backpack. What could we do instead of actually placing the tiny buildings on the map?

The children suggest drawing pictures and using stickers or stamps. They also add that matching the color of the building with its sticker or using the name of the building on the picture would help.

"Those are great suggestions. Maps have images that represent specific places, like our tiny buildings. And, we can use images or pictures that match what the building really looks like—maybe they're the same color or maybe its name is on the image." Mr. Heaton pulls out a variety of images he has gathered to glue onto the map. Some are just colors. Others are symbols or pictures. He places the images on the floor in the middle of the circle.

"You will work on using images to represent the buildings you constructed. I'll show you how. I'm going to work on using an image to represent the building I constructed," Mr. Heaton cues the children to pay attention because he is going to model what they will do later.

"Do you remember what I built? It's my favorite place to eat."

The children shout, "Pizza!"

"Yes, I made the pizza restaurant because I love pizza. I love to walk my dog from my house, down the street, to the pizza restaurant and eat dinner," As he talks, Mr. Heaton walks his fingers along the road of the tiny town to the pizza restaurant. Then he carefully picks it up and places it on the ground in front of him. "Look at the images. Which one could represent the pizza restaurant? Which one reminds you of this building?"

EFFECT SIZE FOR DELIBERATE PRACTICE = **0.79**

In pairs, the children turn and talk about which image they think Mr. Heaton should use to represent the pizza restaurant. Mr. Heaton purposefully included multiple options that would work so the children can practice making a decision and justifying it.

After rehearsing their thinking with their partner, the children take turns sharing their ideas with the whole group.

"It should be the pizza slice. That's what you eat there," Harper says.

"Use green. It's green," suggests Bahar, who is matching the color of the sticker with the color of the building.

"See the circle with the little circles inside. It looks like pepperoni pizza," Aurora explains.

"Pizza starts with /p/ for P. Put the P for pizza," connects Hamza.

Mr. Heaton says, "Each of you has good justification for your choice of image to represent the pizza restaurant. I'm going to combine some ideas. I'm going to use the green sticker because it matches the color of the building. And I'm going to draw a pizza slice and a P on the sticker. I'm also going to make a matching green image with a pizza slice and the letter P for our key." Mr. Heaton adds the picture and letter to two green stickers. He models placing one in the key and writing "Pizza Restaurant" next to it.

> Now, where should I put my pizza restaurant sticker so that it matches the tiny town? I'm going to need a partner to help me. Mabel, will you help me please? I'm going to look at the tiny town and use my words to describe where you should place my pizza sticker. We will probably make mistakes as we do this work but mistakes are important. We can help each other when we make a mistake. We can use kind words and we can learn something new.

Mabel holds the sticker as Mr. Heaton stands over the tiny town and describes where to place the sticker. Together, they model talking through positional words, like *down*, *top*, and *next to*. Mr. Heaton is careful to model making a mistake and using kind words when Mabel makes a mistake. Eventually, the class agrees that they have found the right location for the pizza sticker and Mabel places it.

SCAFFOLDING, EXTENDING, AND ASSESSING GEOGRAPHICAL THINKING

The map making is one choice during work time. Mr. Heaton facilitates this work while the paraprofessional circulates and interacts with children working in other centers (Figure 5.13).

FIGURE 5.13

Translating the three-dimensional miniature box town into a two-dimensional representation (map) with a key

EFFECT SIZE FOR CONCENTRATION/ PERSISTENCE/ ENGAGEMENT = 0.54

Amelia and Hunter are excited to select their images for the map. One of Hunter's buildings is the library because he loves to read books. Amelia constructed a zoo, her favorite place to go with her family. Amelia and Hunter first point out their buildings to each other in the tiny town—looking and talking about it has retained a high level of interest.

Then they begin to look through the images while talking:

"I need a lot of animals, not just one," Amelia thinks aloud, "Or a rainbow. My zoo is rainbow colors."

"Yeah I need a lot of books too," Hunter agrees. "Or B for books or L for library or R for read."

"That's a lot of letters. I need /z/. What letter goes /z/?" Amelia asks Hunter.

"Z. Look, you wrote zoo on your sign. You need Z-O-O," Hunter points to her tiny building.

EFFECT SIZE FOR SELF-EFFICACY = 0.66

Mr. Heaton notes that Amelia and Hunter are engaged in powerful conversation filled with opportunities for growing self-efficacy and language through peer modeling and feedback. Mr. Heaton is listening carefully so that he can extend their language and thinking. He is also hopeful that this interaction will be an effective place for the children to practice learning from and being kind about mistakes.

Hunter and Amelia are now ready to place their images on the map. Hunter walks back and forth between the three-dimensional tiny town and the map while Amelia walks. Mr. Heaton asks, "Hunter, what are you thinking about?"

"I'm trying to remember where my library is so I can put it on the map. But it looks different," Hunter looks perplexed.

"How does it look different?" Mr. Heaton probes.

"These are tall and this is flat," Hunter visually compares the completed tiny town with the incomplete map.

EFFECT SIZE FOR TRANSFER STRATEGIES = 0.86

"The map is flat with images representing the buildings," Mr. Heaton affirms Hunter's observation and uses the learning intention language. "Do you remember how I placed my image on the map? Mabel helped me. Maybe Amelia can help you."

Amelia walks to the tiny town and starts describing the location of the library, "Do you see Yasmin's grocery store? Your library is next."

"I don't know where Yasmin's grocery store is," Hunter responds, getting frustrated.

"Let's look at the key," Mr. Heaton scaffolds. "This says grocery store and here is Yasmin's image representing her grocery store."

EFFECT SIZE FOR EXPLICIT TEACHING STRATEGIES = **0.57**

"It's grapes! Yasmin loves grapes!" Hunter finds the image of grapes and puts his image (the letter L next to a stack of books) to the right. "We did it!"

"You used an image to represent your building and Amelia used the words *next to* to describe where your library is located. Remember when I made a mistake describing where my building was and Mabel helped me fix it? How can we check to make sure your library is in the right place?" Mr. Heaton refers back to his mini-lesson to prompt their self-evaluation.

EFFECT SIZE FOR STRATEGY MONITORING = **0.58**

Hunter walks to the tiny town and says, "It goes school, library, grocery store." He walks back to the map, "I see school, grocery store, library. Wait. That's not the same."

"Library is *next* to grocery store," Amelia emphasizes as she repeats.

"And it's *next* to school," Hunter adds.

"That's tricky! In the tiny town, your library is next to two buildings but on the map it is only next to one building. What are different words we could use to describe where the library is?" Mr. Heaton targets positional language.

"They *beside* each other," Amelia suggests.

"The library is *beside* the grocery store and school. That's true!" Mr. Heaton rephrases.

"It's in the *middle*," Hunter adds.

"Yes, the library is in the *middle* of the grocery store and school buildings. There's even another word we could use: *between*. The library is *between* the grocery store and school," Mr. Heaton directly teaches this new positional word.

EFFECT SIZE FOR VOCABULARY INSTRUCTION = **0.63**

Hunter moves his image. Mr. Heaton connects their interaction to the success criteria again. "We made a mistake when we first placed Hunter's image on the map. But we used kind words to find the mistake and fix it. And we learned new words to describe where buildings are; we learned *next to*, *beside*, *in the middle of*, and *between*!" Mr. Heaton makes notes about this interaction as Hunter and Amelia work together to place Amelia's image on the map.

TEACHING FOR CLARITY AT THE CLOSE

"Look at our amazing map of our tiny town! I heard many people make mistakes, use kind words to talk about their mistakes, and then learn something from their mistakes. Turn and tell your partner about a mistake you made and what you learned." Mr. Heaton gives everyone a chance to talk and then focuses the whole class discussion on one pair, "Bahar and Evelyn, will you share about your mistake?" Mr. Heaton has already met with Bahar and Evelyn to ask them to share with the group and to practice what they will say. He wants the children to feel confident and safe as they share with the whole class.

EFFECT SIZE FOR TEACHER–STUDENT RELATIONSHIPS = **0.47**

"I told Bahar start at the top and go down two streets. Bahar thought this was the top," Evelyn explains pointing to one end of the map. "And I thought this was the top," pointing to a different end.

"How did you talk about your mistake with kind words?" Mr. Heaton facilitates.

EFFECT SIZE FOR PEER- AND SELF-GRADING = **0.42**

"I say, 'My pet shop no fit.' And Evelyn come look and see. And we know is mistake. She say, 'Oops!' And I say, 'Oops!' And it's no big deal," Bahar recalls.

Mr. Heaton retells the story while Bahar shows with his fingers. Bahar started at his "top" and walked down two streets to discover the whole block is full of buildings. Then Evelyn uses her fingers to start at her "top" and walks down two streets to where Bahar's pet shop image is now located.

"'Oops!' And 'It's no big deal.' Those are kind words to talk about a mistake. Then you figured out why you were thinking differently about the word *top*." Mr. Heaton focuses the conversation on the success criteria and asks, "What did you learn from your mistake?"

EFFECT SIZE FOR SELF-JUDGMENT AND REFLECTION = **0.75**

"Top isn't good for maps," Evelyn states.

"What words did you use instead?" Mr. Heaton probes.

"Evelyn say, 'Start fire station,' and then I know," Bahar explains.

"Lots of places could be the top of a map but we just have one fire station. That was a great way to describe where Bahar's image should go!" Next, Mr. Heaton brings closure to the lesson by previewing why this emphasis on language is so important. "Tomorrow, we are going to hide treasure in our tiny town. And we will have to tell the code-pillar where to go to find the treasure. We have to use precise words to describe location. We can use what we learned from our mistakes today to help us be precise tomorrow."

Ms. Davis and Distance Learning to Understand the World

When Ms. Davis plans, she tries to maximize the unique opportunities that distance learning presents. Her families now regularly exchange video documentation of their children learning with her. Most families include siblings, who often want to teach their younger prekindergarten siblings or learn with their older prekindergarten siblings. Some families include grandparents or aunts and uncles who are helping with childcare during school hours. Distance learning means Ms. Davis can create learning opportunities at home and in the neighborhood that include multigenerational family members. She can also capitalize on family interactions to facilitate intentional learning with families.

EFFECT SIZE FOR FAMILY INVOLVEMENT = **0.42**

As the children study the past and develop chronological awareness, Ms. Davis asks community members, including some who attended the same school, to video record themselves telling about how the community has changed over time. She asks indigenous community members to share the story of their families reaching back to the first people living in Virginia. These videos form an oral history library for the class. Ms. Davis then encourages the children to interview their family and friends to learn about their life experiences within the community and to document their own life timelines. She sends home materials so families can create a physical timeline of their child's life. In these ways, her children intentionally learn their histories from and with their families.

EFFECT SIZE FOR SELF-CONCEPT = **0.47**

An important part of their community is the intersection of neighborhoods and businesses with nature. In previous years, Ms. Davis's class went on seasonal walks along the same nature trail to note the ways it changed with the seasons. Often family members would join these hikes. In distance learning, Ms. Davis videotapes herself on the seasonal hike and asks the children to notice and wonder with her as they watch. She asks families to share their own videos, drawings, and stories of their family walks across the seasons. Some

(Continued)

(Continued)

families hike trails with historic home sites. Some families walk the city routes with historic markers or simply walk to the grocery store. Others document noticings in their backyard or at their favorite park. Ms. Davis also collects nature items from her walks and sends them home for the children to physically explore. As a class, they play *I Spy*, *Pictionary*, and *Charades* using the nature items.

EFFECT SIZE FOR DELIBERATE PRACTICE = **0.79**

Even from a distance, Ms. Davis values the experiences children share with their families and facilitates children intentionally learning about the world around them.

UNDERSTANDING THE WORLD AND PLAYFUL LEARNING

As you intentionally select the materials and create the contexts for learning with science, humanities, and social sciences content, skills, and understandings, consider these guidelines and tips:

- Rather than a science center, provide science content and the opportunity to apply science practices and processes throughout the classroom (e.g., informational or nonfiction text). Science is more than just one area of the classroom.
- When selecting science informational or nonfiction texts, make sure the content does not ignite or perpetuate scientific misconceptions. As an example, the four seasons (summer, fall, winter, and spring) are not caused by the distance of the Earth from the sun! Common misconceptions can be found in Table 5.2.

TABLE 5.2 ● Common Misconceptions in Science

- Animals are living because they move, but plants are nonliving.
- Anything that pours is a liquid.
- When liquids evaporate, they just disappear.
- Electric current is used up in bulbs, and there is less current going back to a battery than coming out of it.
- Light rays move out from the eye in order to illuminate objects.
- Loudness and pitch are the same thing.

- Suction causes liquids to be pulled upward in a soda straw.
- Earth is flat.
- The phases of the moon are caused by shadows from Earth falling on the moon.
- Seasons are caused by the changing distance of Earth from the sun (see Driver et al., 1994).

- Like mathematics learning, capitalize on familiar home contexts where practices and processes are used, often without even realizing it, and create those contexts in school so that children can show what they know. Listen for informal language and watch for nonverbal understandings of significant science, humanities, and social sciences concepts, skills, and understandings.
- When learners utilize informal language or demonstrate nonverbal understandings, be ready to explicitly teach science, humanities, or social sciences vocabulary. When we engage in this content and these skills and understandings, we must ensure that we use precise academic vocabulary.
- Build children's familiarity with science tools, models, and materials by making them available for exploration while pairing this exploration with language. Use guided questioning, think-aloud protocols, and teacher modeling to make science knowledge, practices, processes, and this distinct way of knowing visible to all learners.
- Keep an eye out for models that make science concepts, ideas, and phenomena concrete. These models come from many sources (e.g., home, playground, grocery store, etc.). Do not limit your source of models to science catalogs or textbooks.
- Integration is critical. In science, humanities, and social sciences, you may have already noticed many connections to social learning, self-concept development, classroom community development, and much more. You can read and reread the chapters in this book through different lenses. For example, you might notice in Chapter 4 that children are learning their name story, which is an oral story history that supports identity development and values the diversity of their classmates. In Chapter 7, while the children are developing fine motor skills, they are also examining the similarities and differences between the

physical properties of slime and playdough and analyzing and celebrating the diversity of their families through family portrait creation. Chapter 2 is full of playful learning in science, humanities, and social sciences, including constructing animal habitats, acting out occupations in the community, and sorting forms of transportation, animals, and so much more.

- Background knowledge is vital to reading and language comprehension. Intentionally teach science, humanities, and social sciences to build this background knowledge. Be sure to intentionally move learners through the phases of learning, from surface to deep to transfer learning, so that this learning is memorable and accessible in the future.