# Chapter 8
# Fostering Science Learning for Deaf Children in Early Childhood

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## ABSTRACT

*Deaf children are natural born scientists. They explore their natural surroundings, build things, make sense of the world through their senses. Many Deaf children do not have such opportunities to build such background knowledge through social interaction and language before they arrive in early childhood programs due to lack of or limited language access. It is critical to provide unstructured and structured science learning activities where learners can develop critical thinking, problem-solving skills, and foster inquiry-based learning. This chapter will explore the elements of science pedagogy for Deaf children who use sign language in early childhood classrooms with an emphasis on four key areas: play and inquiry-based and hands-on learning approaches; using SL as a primary language of instruction; incorporating written language for literacy development in science; and visual/tactile aids and multimedia integration. In addition, a sample lesson plan for early childhood is included that is not an inherently "science" lesson but integrates scientific learning into the plan.*

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## INTRODUCTION

Deaf children are natural born scientists. They explore their natural surroundings, build things, make sense of the world through their senses. In doing so, they build background knowledge through sensorial experience, including physical experience. When they have social interactions with caregivers or community members who help guide their exploration and understanding using a language. Unfortunately, many Deaf children, especially those born to hearing families, do not have such opportunities to build such background knowledge through social interaction and language before they arrive in early childhood programs due to lack of or limited language access. In early childhood education, the foundations of scientific inquiry are exploration, observation, reflection, and discovery. It is critical to provide unstructured and structured science learning activities to Deaf children where they can develop critical thinking, problem-solving skills, and foster inquiry-based learning. This chapter will explore the elements of science pedagogy for Deaf children who use sign language in early childhood classrooms.

Research suggests that early exposure to science not only enhances children's curiosity and problem-solving skills but also contributes to their overall cognitive development (Gerde, Schachter, & Wasik, 2013). Deaf children need to have access to science content in a natural and accessible language, that is sign language (SL). This, in turn, supports their written literacy development. In doing so, they need to be taught through the integration of these two languages to develop a deeper understanding of scientific concepts and allow for effective communication of science ideas. A multilingual, multimodal approach has the potential to offer deaf learners access to science education in ways that align with their linguistic and communication strengths.

The chapter will discuss four areas of science education: play/inquiry-based learning approach which is learning through senses and scientific thinking, using SL as a primary language of instruction, incorporating written language for literacy development in science, visual/tactile aids and multimedia integration, and multiple cultural knowledge in science.

Early childhood education is a pivotal stage for fostering curiosity and foundational knowledge, and play is a powerful tool for engaging deaf learners. Deaf children need a dynamic environment that emphasizes play-based and inquiry-based learning approaches, combined with hands-on and mind-on activities, to learn scientific concepts and develop language skills. Before we discuss the four areas of science education, we want to discuss science content. What science content is usually covered in early childhood education? First of all, there are many phenomena that can be explored directly in the child's environment. We recognize that the environment varies school by school and home by home. As a teacher, you want to select phenomena that are available for direct exploration and drawn from the environment in which they live. For example, your school environment has a wooded area. The study of plants is a good example. Your students can collect the leaves, nuts, sticks, etc. and make a natural artwork out of them. Secondly, concepts that are important to science should be explored. For example, children learn about the plants in the wooded area and their roles in the ecosystem, such as providing shelters to animals. Thirdly, concepts that are developmentally appropriate and can be explored from multiple perspectives. For children, the wooded area provides a platform for multiple perspectives depending on their interests and experiences. In all, as the teacher, you want the phenomena and concepts to be engaging and interesting to your students and yourself.

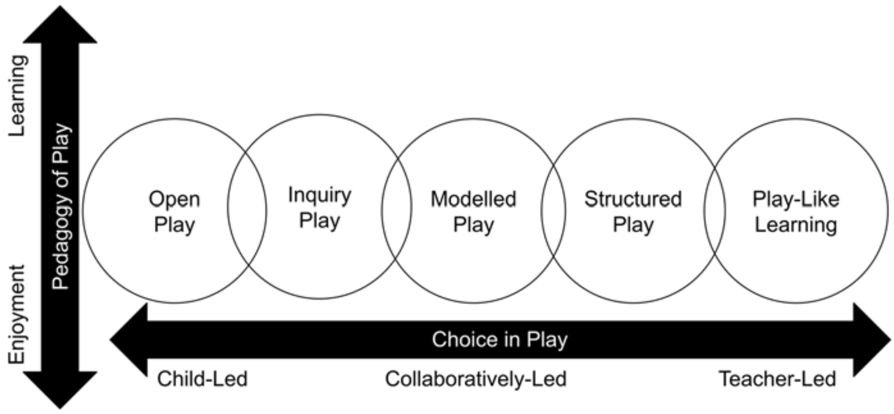
## Play and Inquiry-Based and Hands-On Learning Approaches

Play is an innate way for children to explore their world. In early childhood education (ECE), play is a central component of learning, and it serves as a natural foundation for introducing scientific concepts. Play can be unstructured (with no planning or intention) and structured (with planning and intention). Unstructured play provides young children with opportunities to explore concepts naturally. Through curiosity, they manipulate materials, ask questions, and observe outcomes. Unstructured play is open-ended exploration to foster a sense of wonder and build the curious and open mind. Structured play involves guided activities designed to introduce specific concepts. Young children receive intentional prompts and materials with scaffolding instructions from their adults to develop thinking, observation, prediction and experimentation skills. Play-based learning allows children to engage in exploratory activities where they can observe, question, and experiment with phenomena. Such learning helps introduce scientific inquiry in an accessible and engaging manner. For deaf children, this approach can be impactful because it aligns with their need for visually and tactilely rich experiences, and at the same time, they receive sign linguistic input from peers, older students and/or educational professionals.

One effective strategy for teachers is to set up science centers in classrooms or natural environments where deaf children engage in exploratory play that encourages observation, experimentation, and questioning. For example, a classroom science center might include a water table with different materials (e.g., sponges, cups, floating objects, common objects that they see in their houses). The center allows deaf children to explore concepts such as buoyancy, absorption, and water displacement through minds-on and hands-on play. To express their scientific thinking, teachers can facilitate by using SL to guide observations and ask open-ended questions, such as "What happens when you squeeze the sponge?", "Why do you think this object floats?", or "How does the water level move higher when you put this object in the water?", and deaf children can talk while they are doing the activity as well. These prompts encourage scientific reasoning. This allows for language development with science exploration as teachers use science-related vocabulary during the activities. The minds-on hands-on nature of science supports visual / tactile learning, as it allows deaf students to observe, manipulate, and experience scientific phenomena directly.

Play-based learning promotes collaboration and communication among deaf students and their peers. Group activities like building structures with blocks or creating simple machines with LEGO sets or equivalent materials allow children to work together, exchange ideas and problem solve in a visually and tactilely accessible way. These interactive activities support the development of social and linguistic skills alongside scientific inquiry. Teachers can support the activities by modeling along with other adults or with students. Some teachers feel that play and academic instruction are separate (Pyle & Danniels, 2017), especially for a more rigorous subject like science, however, play as a method of teaching and learning has academic, social, and psychological benefits to young learners and should be thoughtfully incorporated into the classroom in multiple ways and activities (Ali, et al., 2018; Bulunuz, 2013). For deaf children, play serves the dual purpose of learning the content of the play (whether academic or social) and the language that organically arises in the context. When a teacher ensures that some of the day's play includes scientific concepts, then scientific language and ability to think and reason through scientific concepts comes to a student as easily as any other part of play and has long-term positive learning impacts (Fleer, 2019). Play is not one type of thing, though. Play is a continuum that ranges from fully student led to fully teacher directed and can serve purposes more aligned with enjoyment or more aligned with instruction/learning, as shown in Figure 1 below. Teachers should consider the types of play they use in their classroom and make sure that students have the opportunity to run the full spectrum of play in their learning environment.

*Figure 1. Continuum of Play in the ECE Classroom*




*Note. Synthesized from Pyle & Danniels (2017), Wickstrong & Pyle (2024), Edwards & Cutter-Mackenzie (2013), & Veraska, et al. (2022).*

Inquiry-based learning includes the process of asking questions, seeking answers, and constructing knowledge through active exploration during learning activities. The natural curiosity of young children can be tapped in this approach as they develop a deeper understanding of how the world works in the context of scientific concepts. Through this approach, deaf children take ownership of their learning through active participation and engagement. For teachers, the key element of inquiry-based learning is to use open-ended questions to spark curiosity and guide exploration and investigation. For example, a teacher might ask "Why do flowers need sunlight?", "What do you notice about the shadows on the ground?", or "How do the birds stay in the air?" These open-ended questions allow children to observe, hypothesize, and experiment to find answers. The questions can be supplemented with visual and tactile aids such as diagrams, videos, materials, and real-world demonstrations that support their understanding of abstract concepts.

The term "inquiry" is, unfortunately, one of those words that many people use but don't always share a common definition. Inquiry has different approaches and levels of learner-centric design that serve different purposes and will get different results from learners. Inquiry-based learning, then, needs to be thoughtfully planned; that may seem a little contradictory, as inquiry is about the learner posing questions and following their curiosity, so how is a teacher supposed to plan for that? We are not suggesting that a teacher needs to have a plan for every possible question a student may ask, rather, careful planning will prepare for the most common questions that are posed by learners that age and plan for the possibility of other questions. When a teacher uses inquiry in the classroom, that does not mean that learners have to be given free rein to explore any and every question, but, instead, that the teacher is able to capitalize on questions and guide students to ask deeper questions about the topic being explored while being willing to take reasonable, related detours from how the teacher had envisioned the day's sequence. A full approach to inquiry that is fully guided by student motivations and questioning, such as Montessori or Reggio Emilia approaches to early childhood learning, may take time and training for teachers and learners to be able to fully implement. However, there is great value in implementing inquiry even before a teacher has received the formal training. Opening up instruction through inquiry follows students' lead and learning becomes more minds-on, maximizes the value of play, and leads to richer language opportunities. In the table below, Wang (2011), used research about levels of inquiry as a frame to explore inquiry in Deaf education. That frame can be used by teachers as a guidepost as they create more opportunities for open-ended inquiry and exploration. The goal for many early childhood education programs is to implement the more open inquiry models, such as the Montessori or Reggio Emilia approaches mentioned, which align to the higher inquiry levels in this chart.

*Table 1. Levels of Classroom Inquiry*

| Inquiry Level | Role of the Teacher | Role of the Learner |
|---|---|---|
| 0 | Teacher knows the question, process, and the answers.<br>Teacher controls the exploration. | Learner is told the question and the answer format by the teacher.<br>Learner experiences the exploration. |
| 1 | Teacher chooses the question and process.<br>Teacher guides the exploration. | Learner is given the question and process but expected to articulate the answers on their own.<br>Learner engages in the exploration. |
| 2 | Teacher chooses the question.<br>Teacher and learner co-lead the exploration. | Learner creates the process and decides the answers.<br>Teacher and learner co-lead the exploration. |
| 3 | Teacher provides resources and structure based on learner's problem and process.<br>Teacher supports the learner's exploration. | Learner decides on the problem to be explored and the questions and process.<br>Learner leads the exploration. |

*Note*: Adapted from Wang (2011).

Inquiry and play go hand-in-hand and inquiry can be a type of play, as shown on the Play Continuum in Figure 1, but they are not necessarily the same. Inquiry is a mindset rather than a single activity. Teachers can use a great deal of inquiry in their instruction and not have any planned inquiry during play times or centers. Conversely, teachers could have a great deal of inquiry during play while not using inquiry-based learning during academic lessons. When a teacher incorporates inquiry, though, especially from the higher levels of inquiry, students will naturally use their questioning and exploration skills in other avenues. When teachers encourage curiosity about the world and experimenting on it, learners will happily engage in inquiry in all areas of their early childhood experience. When scientific ways of thinking are used during play, then learners will be able to be scientific during read alouds or circle time or academic lessons. When teachers purposefully plan scientific activities and have play opportunities, then little scientists will naturally emerge as they play.

The combination of inquiry and play can also lead to natural experimentation by learners. The term "experiment" conjures up images of test tubes, a lab, and meticulous scientific writing. Yet, in early childhood, students do not need the formality of being taught the scientific method or expected to run a lab and write a report. The organic process of observing, questioning, exploring, and reviewing will take place as part of inquiry activities and just letting students question and explore their world. When play is included with inquiry, then *any* environment becomes experimental and explorable. The best experimentation that is fully minds-on does not always occur naturally in people; teachers need to thoughtfully consider how they support students to become good experimenters. Although we aren't expecting students to write lab reports, they can still use science journals or other science writing (see later this chapter) to document data and questions they have. They can communicate their thinking and questions with adults and peers. Teachers can foster these natural experimental experiences with their own questioning (both to the student and showing their own internal thinking aloud), modeling experimental processes, and providing scaffolding for student learning.

Scaffolding strategies are important to support deaf children's investigative process. Scaffolding allows for students to have the resources to truly explore and experiment, especially when they are trained in inquiry and given the play time to engage with their world. Examples of inquiry could include teachers using visual schedules, step-by-step guides, or SL modeling to guide activities such as planting seeds, observing the growth process, or conducting simple experiments. During a lesson on magnetism, for example, children might be given a variety of objects to test whether they are magnetic or not. The teacher can show how to record observations using charts or drawings. There is a fine balance between providing scaffolding and doing things for students. As teachers incorporate more inquiry in the classroom, they should be conscious of providing scaffolding to allow for student growth and exploration rather than simplifying the experience for students (or the teacher).

Hands-on learning is essential for younger deaf children who need to build experiential learning and foundational skills through sensory experiences. During hands-on activities, deaf children directly manipulate materials and engage with phenomena to bridge concrete learning to abstract concepts. For example, children investigate the textures of rocks, compare the weights of different objects, or observe the melting process of ice cubes to explore the properties of materials through sensory experiences. These activities support scientific concepts such as texture, weight, and states of matter through the sensory strengths of deaf children. In addition, teamwork and communication can be incorporated into hands-on learning experiences. For example, children design and construct a bridge using various materials like popsicle sticks, marshmallows, straws, and tape. During this build a bridge activity, deaf children can work collaboratively to test the strength of their bridges by placing objects of different weights on them.

In a similar vein, minds-on learning emphasizes the importance of cognitive engagement and critical thinking during the learning process. Deaf children learn to actively process and connect information rather than passively receiving it. One strategy for the teacher is to encourage children to predict outcomes before engaging in a hands-on-activity. For example, before conducting an experiment on plant growth, the teacher might ask. "What do you think will happen if we put one plant in sunlight and another in the dark?" By making predictions, children activate prior knowledge and set a purpose for the activity. This enhances their cognitive involvement. Another strategy is to integrate visual thinking routines, such as "See-Think-Wonder", to guide observations and reflections. During a lesson on weather patterns, children might observe a time-lapsed video of clouds and use this routine to share what they see, what they think is happening, and what questions they have. These structured prompts, which support both scientific reasoning and language development, can support their cognitive engagement. During a different lesson on tardigrades, children might observe a close-up picture of a tardigrade and share their observations, thoughts and questions.

Another strategy is concept mapping. Deaf children organize and synthesize information with teacher guidance. After exploring the volcanic eruption, for example, children can create visual diagrams showing the cause and effect relationships. Another example, children can create visual diagrams showing the relationships between evaporation, condensation, and precipitation after exploring the water cycle. Teachers can scaffold this process by providing partially completed maps or guiding children through the steps in sign language. These concept maps can be done as a whole class or can be incorporated into writing activities (discussed later this chapter), such as science journals.

Minds-on strategies are valuable because they encourage deeper understanding and foster meaningful connections between scientific concepts and everyday experiences. Furthermore, minds-on strategies foster metacognitive skills by encouraging children to reflect on their thinking processes. Teachers can ask questions like, "How do you figure this out?", "What would you do differently next time?" These reflections help deaf children develop self-awareness and problem-solving skills, both of which are essential for scientific inquiry. Beyond the scientific applications, this style of learning and dialogue leads to stronger language outcomes and cross-content applications of minds-on learning.

Minds-on, physical, and play-based learning experiences are especially important for students who come to the classroom with delays in language or development. These are natural, linguistically rich access points to the learning journey that are open at any student, especially those who may have multiple disabilities. Science learning, as we have discussed, is a natural motivator and draws on curiosity that all students, regardless of delays or disability, have; teachers should be aware, though, that these students may need additional scaffolding and language support as they explore, play, and learn.

As a teacher develops these play-based learning experiences in the classroom, they should also consider how these experiences, activities, and resources can be extended into the home environment. Part of learning is the way that the learning environment shapes the learning experience (Yemini, et al., 2025); by collaborating with families, science learning can be extended, reinforced, and reframed in the home environment which will bring richer language and understanding to young learners. Connections with family are essential to build the cooperative bridge between classroom and home. Teachers can share classroom newsletters with activity ideas for home, send home play kits focused on science learning activities, and communicate with families about the activities in the classroom that have sparked learning in their young scientist.

## Using Sign Language as a Primary Language of Instruction

Sign language is often the most natural and accessible language for deaf children when they arrive in early childhood programs. SL can support deaf children when they are naturally curious and learn through minds-on/hands-on experiences and sensory exploration. Using SL as the primary language of instruction is crucial for fostering equitable access to learning and ensuring the holistic development of deaf children while they learn scientific concepts in early childhood science lessons. In science education, the effective transmission of complex ideas is crucial for children to build foundational knowledge. For deaf children, sign language provides an accessible way to bridge the gap between abstract scientific concepts and concrete understanding. By prioritizing sign language, teachers can create accessible and engaging environments that empower deaf children to explore, question and understand the world around them.

Sign language has rich linguistic features that can be tapped to illustrate complex abstract concepts or properties. As such, SL leverages visual-spatial skills, allowing children to grasp abstract ideas through facial expressions, hand shapes, modifications, and spatial relationships. Scientific concepts, especially, benefit from expression in SL using the linguistic features and the three-dimensional nature of SL in being able to show both static and dynamic information of these concepts. For example, a teacher uses sign language to illustrate the motion of a pendulum or the growth of a plant can help children visualize and internalize these phenomena more effectively.

Some signed words/phrases/concepts offer visual representations of abstract concepts. For example, when teaching young deaf children about the concept of living and non-living things, teachers can use classifiers and depicting verbs in SL to show movement, growth, and change over time, supporting deaf children's understanding through direct analogies. In an inquiry-based preschool classroom, teachers can incorporate SL to tell storytelling and visual/tactile narratives that relate to scientific phenomena. For example, in exploring the life cycle of a butterfly, teachers can use SL to show the transformation from caterpillar to butterfly, engaging children in both the process and the language used to describe it. This storytelling in SL helps to connect abstract scientific ideas to concrete experiences which can be meaningful for deaf children.

Teachers can use and explicitly teach science-related vocabulary in sign language. Deaf children, in turn, have the linguistic tools to understand and discuss scientific concepts. Some teachers may be wary of using full science vocabulary with young learners, but the natural curiosity of young learners is motivating for using complex vocabulary and retaining the vocabulary they interact with (Guo, et al., 2015) For example, during a lesson on the water cycle, teachers can introduce signed words for evaporation, condensation, and precipitation, using visual aids and demonstrations to reinforce understanding. Another strategy is to create a science word wall following signed word families (shared topic or handshape or location) can also help children review and retain vocabulary. To encourage bilingual development among multilingual Deaf students, teachers can pair signed science vocabulary with written science vocabulary (labels or captions). Children can then make connections between sign language and written language.

Teachers can use visual demonstrations, diagrams, and real-world objects alongside sign language to provide multiple representations of the same concept. For example, teachers can demonstrate how magnets attract and repel objects while using sign language to describe the process. Chaining reinforces the brain's way to associate multiple representations of the same concept. This multimodal approach allows children to connect signed words to tangible experiences. During hands-on and interactive activities, deaf children have opportunities to explore and manipulate materials while communicating in sign language. For example, children can conduct experiments such as building simple circuits to understand electricity or planting seeds to observe growth. Teachers can guide these activities by using signed vocabulary to describe each step, pose questions, and encourage discussions among children.

Teachers can create a language- and culture-rich environment that prioritizes SL. Teachers can label classroom objects with their corresponding signed vocabulary and encourage children to sign their observations during science activities. In addition, teachers can incorporate sign language storytelling and visual narratives into science lessons, which can help children connect new concepts to familiar experiences. Another strategy to maintain the language- and culture-rich environment is to invite deaf scientists or deaf community members to participate in classroom activities. Having deaf adults from the outside, such as deaf farmers, deaf construction workers, who can explain scientific concepts in sign language can inspire children and provide them with authentic examples of how sign language is used in their work contexts. These role models can share their experiences and demonstrate how science works in their fields in sign language.

Teachers can integrate technology to support science learning with SL. For example, teachers can use videos with SL explanations, virtual labels, and apps designed for deaf young children to explore scientific concepts. Augmented reality (AR) tools that visualize processes like the solar system's motion or the anatomy of plants can be paired with sign language to create immersive learning experiences. SL storytelling or narratives can be created in a video or a multimedia format. For example, each child signs a sentence in a story about a volcanic eruption. The video includes a series of signed sentences which relates to the eruption of a volcano. Parents can then learn from watching the video. These technology resources can sometimes also be shared with home, allowing parents and children to practice signing science together.

Furthermore, encouraging active participation in discussions, observations and experiments through sign language can foster linguistic and cognitive development. Deaf children who learn science through sign language are more likely to develop critical thinking skills while they engage with the material and express their observations, hypotheses, and conclusions. Science also provides the opportunity to engage in social dialogue about concepts and to expand, debate, and describe propositions and reasoning. Lang and Albertini (2001) discussed the social constructivist nature of science learning, which places the teacher in role of organizer and facilitator of social interactions as part of the scientific learning process to grow understanding, build language, and deepen understanding of science concepts as students are able to use social patterns and scientific patterns to make connections beyond what just demonstration or, especially, lecture by the teacher can create. When students communicate with each other and the teacher, they will more deeply understand science. When students communicate about science with each other and adults, they will more deeply understand their world.

It is crucial that young Deaf learners have opportunities to express their thoughts on science concepts using sign language. This fosters an inclusive environment where their unique perspectives are valued. Their signed production does not need to be linguistically perfect, as the primary goal is to encourage the articulation of their thinking processes about scientific ideas. Teachers can create a safe space where Deaf students of various language skills and feel confident exploring science concepts without fear of judgement. This approach empowers them to engage deeply with science and build thinking and problem-solving skills. Allowing Deaf children to learn and create ideas freely in sign language promotes their curiosity and strengthens their connection to scientific inquiry. Teachers should incorporate video-signing (v-signing) in their lesson plans where their students' signing are recorded for viewing, shared, etc.

Teachers can work closely with families to extend the sign language learning space into the home, tapping into the hours and days not spent in the classroom. Teachers can utilize technology, newsletters, apps, parent classes, parent coaching, home visits, or other visually connective approaches to support families in not only using sign language to the home but adding scientific terminology, phrases, and thinking into their lexicon. As mentioned in the previous paragraph, videos of their children's science signing can be shared for families to learn vocabulary and concepts in sign language.

## Incorporating Written Language for Literacy Development in Science

While SL is the primary language in the early childhood science education for deaf children, teachers should also provide opportunities for written literacy development. In early science learning, teachers can introduce age-appropriate written vocabulary alongside its signed vocabulary, using picture books, labels, and fingerspelling. Literature shows deaf teachers use chaining and sandwiching strategies, both of which includes fingerspelling, more than hearing teachers. Such strategies support bridging two or more languages for Deaf students who are multilingual. This chapter espouses an ASL/English bilingual teaching approach, where SL is the primary language used in the classroom and English is the second language used in the classroom. While a full, balanced bilingualism is the eventual goal of an ASL/English language philosophy, teachers need to understand and balance age appropriate development of written language skills. However, teachers should not shy away from a rich exposure to written language, even for younger learners or those who come linguistically delayed. Science topics provide naturally motivating opportunities to both read and write for young learners. Yore (2000) stated the charge to teachers for scientific literacy, "If we wish to promote science literacy among deaf students, we must address how we can help our students become members of a language community and better communicators, especially science readers and science writers" (p. 105). As with all subject and print literacy, early childhood is a critical, foundational time to develop written language literacy. Yore's charge is speaking broadly across all grades, but the urgency in developing literacy skills can and should begin with our natural scientists in early childhood education.

## Incorporating Scientific Reading

Reading instruction in ECE is truly a foundation for good learning for the rest of a student's life (Brown, 2014; Hjetland et al., 2017). As teachers also incorporate scientific reading into their instruction, this will build an even stronger literacy foundation for students, which is especially important for students who come to deaf programs with delays. Books and texts with a science focus can also be shared with families, extending reading and science literacy to the home. Teachers should always be conscious about the language(s) used in homes and the linguistic background and context a student comes with to the classroom. Some students may come with no or little language while other students may arrive already multilingual. Strong, continuous connections with families can support the teacher in multilingual-multicultural learning while still accomplishing the focused learning in both the written and signed languages used in the classroom.

One of the most common activities for reading development in early childhood is to explore and practice the letters of the alphabet. This activity already has a great deal of scientific-leaning thinking involved and with some increased emphasis by educators, can become a rich scientific activity. At the base of talking about letters are the shapes involved in creating letters - curves, lines, and angles. Talking about these shapes and comparing/contrasting with other shapes develops natural observational skills and communication about observations using evidence and vocabulary. Another common letter learning activity is to discuss what each letter can represent in English and showing pictures of the represented concept/object; including scientific and non-fictional concepts/objects in letter representations builds a wealth of vocabulary and scientific schema in students. Another common letter learning activity to mention is taking a letter and coloring and/or gluing objects onto the letter. This activity can be simply modified to become more scientific by discussing the colors or objects being placed on the letter, utilizing some objects that are considered "scientific" in the process, and discussing attributes of the colors and/or objects being placed on the letters. These simple adjustments allow for rich discussions that build the ability to reason, compare, and describe things as part of rigorous scientific language. These examples are only a few ideas for how a small emphasis shift can take a commonplace early childhood activity and adapt it to become scientifically rich without sacrificing the purpose of the activity.

Another common activity is having a curated classroom library for the theme being used in the classroom during that time frame (usually a two-week period). As the teacher curates the books for the theme, an easy and beneficial approach is to include nonfiction texts for students to self select for their independent reading time. A large benefit, of course, is the opportunity for students to explore scientifically themed reading materials, but also, students then have the opportunity to see and explore more genres of literature. Not all nonfiction books are scientific in style, though. Nonfiction covers everything from very scientifically written texts, to more informationally written texts, to more socially written texts. All of these are worthwhile to students but care must be taken to not assume "nonfiction" means "science supportive". To take independent reading a step further in language development, teachers can practice "book talk" with students by asking them about what they're reading, summarizing the story/content, asking questions it prompts for the learner, and how the child could explore more on the topic, as well as suggesting other books to read (especially those from another genre); this book talk can be applied to both fiction and nonfiction and develops the scientific thinking approach of drawing ideas and questions from the text and supporting them.

On the subject of book choice, read alouds are an essential component of the early childhood curriculum and should be part of the daily schedule for students. There are two approaches to read alouds in the early childhood classroom and both should be considered when approaching literacy development for these deaf students. First, many teachers choose a text that will act as an anchor text for the two-week theme and will be read daily with activities and student involvement building each day of the theme. Second, additional texts, often related directly to the theme, are included as an additional read aloud during the day. For the first approach, many teachers will choose a text that is often part of the cultural consciousness (e.g. the story of Goldilocks and the three bears, *The Very Hungry Caterpillar*, or other stories that are considered essential reading for children). The value of these keystone texts should not be dismissed, but if a theme does not have one of these essential texts, consider using a scientific nonfiction text as the primary read aloud. However, if a text chosen is one of great value, that does not dismiss the ability of teachers to leverage scientific learning within these texts, even if they are fiction. In considering Goldilocks and the three bears, for instance, a teacher could ask students to consider if bears really do live in houses and eat porridge which will naturally lead to discussions about animal habitats. In reading a seminal text like *The Very Hungry Caterpillar* by Eric Carle, the general information of this fictional story follows the real life cycle of a caterpillar/butterfly and could easily lead to students learning more and using a butterfly hatching kit. For the second approach to choosing read aloud texts, it's beneficial to expose students to a variety of text types (Harrison,

2023) and so nonfiction texts can easily be incorporated into the rotation of read alouds and can still be supportive of the biweekly theme.

Another reading consideration is the use of labeling with English words. Even very young children can begin to recognize the linguistic reality of words and their role in conveying information. This leads, naturally, to beginning understanding of key principles of written language, such as the alphabetic principle. The simplest form of labeling is to have prepared labels affixed to classroom objects such as doors, windows, chairs, tables, etc., so that students can see the words. Care must be taken, though, that these labels are referred to and not just environmental "art" to be ignored. Another form of labeling is for the teacher to label pictures and objects as teachers introduce them during instruction. This is an easy way to introduce scientific vocabulary to students, especially when coupled with a chaining approach (sign - fingerspelling - printed word). Another beneficial form of labeling is to label students' produced artwork, journaling, or attempts at writing. As students produce their work, educators can support students in labeling the items on the page and have enriching dialogue about both the words and concepts. This labeling provides both a sense of ownership and achievement to students as well as supporting caregivers in knowing what their child has been expressing. As scientific writing approaches (see next section) are used, this activity takes on extra scientific vocabulary support. Some educators may question adding in complex or lengthy vocabulary, especially when students have language delays. However, when labeling items of interest to a child, the child will give extra attention and effort to the words - think about the ability of children to discuss complex dinosaur names or describe their favorite cartoon characters. Children are capable of recognizing the patterns of favorite words and attempting approximations, especially when given patience and support, of those words in both written language and SL.

## Incorporating Scientific Writing

In the vital mission to develop reading skills, educators can sometimes overlook the vital literacy component of writing skills. Often, early educators only focus on handwriting skills relating to the letters and, although that is important, there is so much more that can be done for writing skills and science instruction provides a rich backdrop for writing to take flight (Tortorelli et al., 2022). Scientific knowledge is often considered to be socially constructed, especially with deaf students (Lang & Albertini, 2001), and so expressive activities using SL, written language, and drawing allow for both the construction and the social expression of scientific ideas. When students are given the time, environment, and engaging prompts (Lang & Albertini, 2001; Rinke, Gimbel, & Haskell, 2013), they naturally use their curiosity as deaf children to explore what has presented to them. Educators have the job, then, of creating the environment and not standing in the way of students' learning and the natural scientific method that comes with early childhood. Writing in early childhood education is not expected to be actual sentences or long writing, but individual words (independently or spelling given by an adult), world-like scribbles, drawings, representations of signs in a written form, or other attempted-symbolic writings will come with support, modeling, and (most importantly) the opportunity to explore and communicate.

Writing development, especially in ECE, has stages that are developmentally appropriate and should be thoughtfully integrated into the early childhood curriculum (Byington & Kim, 2017). The first two stages in writing are drawing and scribbling, which are great places to incorporate scientific activities given the visual nature of science, especially in the bilingual environment. A natural way to incorporate these types of drawing/writing is to incorporate science notebooks into the early childhood curriculum (Brenneman & Louro, 2008). The notebooks or journals don't need to be fancy or specialized but, rather, use the common style of a box for drawing and a place to write (or attempt to write) a few words. The power of the notebooks comes in their use - consistent usage with clear prompts from the teacher and then referring to them during discussions. Students can draw, attempt writing, practice labels and letters, and have a place for teachers to assist in labeling and modeling individual writing. There are many ways to use notebooks in the classroom, such as:

- Use a daily weather journal to draw and describe the weather.
- As seasons change, observe trees, playground equipment, and/or outdoor objects to draw and describe what is happening to the plant or object.
- Explore different fruits and vegetables and create a notebook describing each produce item, including descriptive terms like "sweet" or "sour".
- When teaching a Goldilocks and the Three Bears theme unit, learn about different types of bears and record what is learned in a notebook.
- When teaching a community helpers unit, use a notebook to record each helper and focus on describing what they do and the equipment they use for their job.

In addition to notebooks, there are many other activities and media that can be utilized for developmentally appropriate writing activities, which can easily include scientific thinking, drawing, and writing. For example, when practicing writing letters, students can add in colors, shapes, materials, or representations of what the letter represents such as animals, weather, foods, or other item groups. Educators who engage in dialogue with students will be able to use the artistic nature of the letter activity to bring out the science of the representations and descriptions. Another useful medium is the whiteboard of the classroom. Students are naturally drawn to and motivated by using the whiteboard and educators can use the whiteboard to practice expression with both free play and specific prompting. Another resource is purposefully chosen worksheets that can occasionally be used to provide structure for writing practice and scientific concepts or practice can be used as the content for these papers. There are many more possibilities for writing practice, all of which can include scientific concepts and applications. Teachers should be aware and collaborate with service providers when there are disability considerations in how a young learner produces their writing. Additionally, as has been discussed, the use of dialogue with students while writing provides meaningful opportunities to incorporate scientific language and discussions while guiding the writing activity to become *scientific* science writing.

### A Note on Spoken Language

Students in early childhood education receive speech and language services at the highest ratios compared with older grades (National Center for Education Statistics, 2024). Additionally, many learners in these settings also receive additional spoken language instruction, usually through a Listening & Spoken Language (LSL) approach. This spoken language time can feel at odds with the work a teacher using ASL/English is trying to do in their classroom. However, with a collaborative mindset, ASL/English teachers can work with these providers to integrate the classroom learning, including scientific learning, into the spoken language activities and therapies that are going to occur (Tanner & Harrison, 2023). The team can support families in how to integrate science dialogue into daily activities. This collaborative approach requires communication and co-planning with these providers and there may be friction that comes up when differing philosophies interact, but the benefits to students with cross-setting learning will be bilingually beneficial. Through this collaboration, science topics and activities can be used across settings in addition to the language focus that is usually done.

## Visual/Tactile Aids and Multimedia Integration

ECE is a time of exploration and play (Almon, 2004). There is a natural need, as part of developmentally appropriate learning, to have resources that engage all the senses of students and allow for an organic use of visual and tactile resources to enhance learning. Science has a natural tendency towards visual and hands-on, experiential learning. This naturalness of both the learning style of young learners and the nature of science inquiry combine well in the early childhood classroom to allow teachers to build learning experiences that are both deep and fun. In this section, we'll discuss more about enhancing these learning styles by incorporating visual media, tactile resources, and multimedia into teaching and learning and how both directly teaching science and incorporating science into other areas can utilize these resources to their best benefit.

## Visual Materials

There is a natural tendency towards visual information for children who are deaf or hard of hearing. Most teachers use this tendency to provide sufficient visual information in their classroom. However, we need to be strategic in the choices we make for visual resources and information to make sure we're not just creating noise for the eyes. For example, teachers use labeling to expose young learners to English words, but often these labels are put up in August and remain up until the end of the school year. In relatively short time these become passive objects in the environment and lose efficacy. Consistently referencing key labels and switching the labels makes them more noticeable to the young learners as well as providing more rich instructional content (Kuby et al., 1999). For scientific learning, this also provides an opportunity to expose students to vocabulary that may not normally be labeled; when teaching about weather, for example, labels could be added for the classroom thermostat and air vents as part of learning activities. Of course, we wouldn't expect mastery of these words in early childhood but the exposure to vocabulary will have long-term benefits. Another type of vocabulary labeling that some teachers employ is to also have representations of the ASL sign in addition to the English print. This bilingual approach is meaningful, as long as pictorial representations are meaningful to the student and the signs chosen, especially for science concepts, are part of the actual lexicon used in the school.

Another consideration with visual materials is the look and representations of the materials. Academic, social, and play materials created for early childhood education are often "cute" in design and usage. This is understandable given the cognitive lean toward perceiving the "cuteness" of the infant and early childhood ages (Doebel, Stuck, & Pang, 2022). However, seeking educational materials based on cuteness alone can leave our young learners with less valuable academic materials. Teachers need to be aware of why they are choosing a particular resource and how they are sourcing and applying that resource. This is not to say that cute, fun, or engaging materials don't have a place - they do! The message is that the *strategic* choosing of resources will value academics over aesthetics in these resources. Another consideration is the use of real pictures over just cartoon or drawn images. Drawings, no matter how well done, are still abstractions of the real object. Pictures, although having their own limitations, show the actual object with all the important and unimportant details; using pictures in the classroom allows for students to directly apply learning to the real world without having to negotiate the meaning of the abstractions in a drawing (Ganea, Pickard, & DeLoache, 2008). For students with language delays, using the real picture allows for connections to be made more quickly and their existing schema to be activated by something that does not require the language skills they do not yet possess. For scientific concepts, using real pictures allows for more depth and nuance to discussions and overall learning. Simply put, when you can use a real life picture, it will be more beneficial than a drawing. This doesn't mean that all cartoon drawings need to be removed - it's also important for students to learn how concepts are represented beyond the real picture and, to a lesser extent, students should have a comfortable environment that would include drawings and cuteness.

Technology has made the use of multimedia technology easier to use in the classroom than ever before. This rise of technology has also made it easier to *create* multimedia and there is an increasing number of signed or deaf-friendly videos and media styles available today. Teachers must be cautious and strategic, however, in how they use multimedia in the classroom. Watching a show can be a highly passive act in young children that leads to a neutral result in learning - no gains and no losses (Alloway et al., 2014). This suggests that using multimedia as a method of instruction on its own is not going to support the type of learning we want in classrooms. This is especially true when children cannot access the content due to it being auditory in nature, even when captions are used; after all, young children cannot be expected to read and keep up with captions. At the same time, multimedia provides an amazing opportunity to truly *see* what is being discussed, bring in role models and "field trips" that couldn't be accessed normally, and provide an opportunity for visual information in another format that is common to our modern world. The difference in passive and active multimedia usage comes down to the role of the teacher. In passive usage, the teacher puts on the video and then removes themselves from the viewing. In active usage, a selection of multimedia is portrayed with the teacher using similar strategies as they would to reading a book or viewing a sign story: pausing to reflect, modeling thinking and reading, and asking questions. The use of dialogue is also language rich and helps students access multimedia content, even if the content is already presented in sign language. For scientific learning, there are tremendous amounts of short and long videos available, especially related to the natural world and areas of extra interest to young learners (such as farms, weather, rocket ships and planets, or building construction). With strategic application, multimedia can enhance, rather than replace, good scientific instruction in the early childhood classroom.

## Tactile Materials

In addition to visual materials, an important avenue of experiential learning for young learners are tactile resources. There is more to learning than just being told about something; the ability to interact, manipulate, and experience through hands-on materials allows for deeper learning and opportunities for natural, language-rich dialogue with and between students. Teachers can incorporate activities like building structures out of blocks where deaf children explore balance and stability or sorting natural objects (e.g., rocks, leaves, shells) while discussing the properties of the object. These tactile activities allow young learners to activate their scientific thinking and have increased academic dialogues in sign language while having natural opportunities to be exposed to English print.

Centers are a useful activity for learning in ECE. They provide an opportunity to have small groups more deeply explore the topic of the day. For example, when learning about the weather, deaf children can explore tactile materials like a "rain box" filled with water droplets and cloud-like cotton balls, while watching animations of weather patterns and SL narratives. Centers are also an excellent way to include scientific thinking into the day's activities, even if the main activities for the day are not explicitly scientifically focused. For example, when learning about farms, a center could include opening fruits to explore the internal structures of the fruits, allowing for scientific drawings and dialogue about comparing and contrasting. Centers can follow both structured and unstructured formats, both of which have a place in the classroom. Structured centers allow for the teacher to lead the young learners through activities that will directly build their scientific knowledge and language skills. These centers would have procedures to follow and will, most likely, have a guiding adult. Unstructured centers allow for young learners to explore and apply what they have been learning about, which can both directly and indirectly involve scientific concepts. For example, a dramatic play center can include scientific materials to role play as a chemist, biologist, or paleontologist. Another idea would be to have cars and different "road" materials to explore concepts of friction, movement, and engineering. With centers, teachers should always consider the background knowledge and context of their students, especially their home context, to connect what they already know with broader themes being introduced in the center.

There are many words that could be used to describe tactile materials, such as physical, hands-on, or manipulatives, but the word *tactile* also reminds us that our materials need to be accessible to students who have visual access considerations or are DeafBlind. There is great value to these tactical avenues for learning and it provides opportunities for deaf and DeafBlind children to engage with scientific content in a minds-on and hands-on way. Tactile access and activities for students with visual considerations do not need to be an entirely separate station or lesson plan, using concepts of Universal Design for Learning (UDL) (CAST, 2024) can have adaptations built in to your lesson plan or, for more impact, allow other young learners to engage in activities that have more depth to them due to the adaptations. Science is inherently "hands on" for early childhood and this allows for meaningful integration of low vision strategies and supports for learning. If you need ideas or support on how to support more tactile access to learning for your young learners, consult with a DeafBlind specialist.

## Learning Through Action

Part of visual and tactile learning is the application and active interaction with learning. For ECE, it is not enough to just talk about scientific concepts, young learners need opportunities to develop understanding through *doing* science (Larimore, 2020). The opportunity to engage with visual materials, to dialogue, manipulate, and create them, is of more value than a description by the teacher. Tactile materials are of best value when young learners do not just feel them once but get the opportunity to truly explore and use them. When a new object is brought in to learn about, often it is passed around and each student gets a single chance that day to interact with the object; it would be more beneficial to also allow the object to be part of a center (structured or unstructured depending on the object) to allow time for depth not just exposure. With other tactile materials, multiple opportunities for interaction and creative usage are better than a single center exposure to them.

Getting outside the classroom allows for enriching and incidental scientific learning (Gomes & Fleer, 2020). Getting out to the greenspace of the school allows for direct application of scientific learning about weather, plants, animals, and more, as well as being fun and engaging for young learners. When learning about food, the cafeteria and kitchen are amazing places to explore heat, food safety, types of food, cleanliness, and other science concepts. With walking around the school, though, there is the opportunity for incidental science learning that can occur in posing questions to students, stopping to watch something being fixed or installed, taking a minute to look outside a window, feeling the wall and describing it, and many more dialogues and experiences that are only limited by the teacher wanting to capture them. The classroom is a valuable and important space that should be the priority, but the world is full of learning spaces that can be capitalized upon and, especially, for scientific learning. Even regular walking paths can have new ideas and emphases incorporated into them.

In discussing science learning, we need to consider a broader way of viewing scientific learning: STEAM learning. STEAM is an acronym for science, technology, engineering, art, and mathematics. As teachers, it is too easy to divide up our days into separate categories: reading time, play time, science time, art time, math time, lunch time, etc. What STEAM reminds us is the reality that learning is overlapping and school subjects are meant to support each other. Ideas for this cross-subject STEAM learning could include art centers can include drawing the scientific concept of the day, read alouds can include using legos to build the house or setting of the story, math time can include counting toys in the play center, or learners use technology to film themselves signing a story. STEAM in the classroom depends on intentionality - not just having the components of STEAM but considering how these pieces can integrate to allow students more opportunities to explore, create, and integrate as they learn.

These types of physically-involved activities should be purposefully used and thoughtfully integrated to amplify minds-on learning, which we discussed earlier in this chapter as being utilized best through play and inquiry based learning. Learning through action is the way that inquiry and play connect with the materials, locations, and activities that a teacher has chosen for the learning journey that day. As students engage with purposefully-designed learning experiences that use both the classroom and the entire campus, students will be able to apply inquiry to the fun of the experiences they engage in. With all activities, teachers need to consider the access and support needs of all students and especially those who come with disabilities. As teachers consciously plan for scientific topics and activities, students will be able to use the natural curiosity and scientific orientation of early childhood to engage more deeply in the classroom and develop even deeper language as they explore and experiment.

## Multiple Cultural Knowledge

Science knowledge has been built on and shared from diverse cultures and civilizations over millennia. For example, African Kingdoms, such as Mali and Great Zimbabwe, contributed advanced metallurgy, architecture (e.g., Great Zimbabwe's stone structure), and astronomical knowledge for navigation and agriculture). Timbuktu was a center for Islamic scholarship. Indian Civilization introduced the concept of zero, the decimal system, and astronomy thoughts (e.g., Aryabhata's heliocentric ideas). Mesoamerican Civilizations, particularly Maya, developed a sophisticated calendar system, precise astronomical observations, and mathematics, including the concept of zero. Ancient Chinese Civilization contributed technologies like the compass, gunpowder, and printing. While historical records from the above civilizations did not explicitly document contributions from Deaf people, there are works of deaf scientists who have contributed to the fields of science (see Lang's *Silence of the Spheres: The Deaf Experience in the History of Science* (1994)) and current resources highlight Deaf scientists' impact on fields like astronomy, physics and chemistry. Integrating Deaf cultural perspectives into science education is important, especially their visual-spatial strengths and storytelling. Similarly, incorporating knowledge systems from diverse cultural groups in the world ensures science is comprehensive.

Incorporating multiple cultural perspectives in science education enhances inclusivity and engagement for Deaf learners. Indigenous knowledge systems, such as Native American ecological perspectives, can contextualize concepts like biodiversity through storytelling, hands-on activities, and visual representations. Visual tools, like 3D models or simulations, support Deaf learners by leveraging their visual-spatial processing. Teachers can scaffold visual aids by using sequential (step-by-step) pictorial guides to break down complex processes. This ensures clarity for young Deaf learners. In addition, culturally responsive pedagogy, including Deaf role models (e.g., farmers, electricians, scientists, mechanics) and cross-cultural frameworks, fosters equitable science education for diverse Deaf learners. Deaf cultural narratives, such as signed stories about scientific concepts, can make the concepts accessible and engaging.

## Assessing Science Learning in Early Childhood Education

Science learning is typically less assessed in early childhood education (Greenfield, 2015). This may be due to the nature of traditional assessment practices in science education that use tests or formal labs to measure understanding and these types of assessments are much less appropriate for early childhood. Although formal measures do exist (Greenfield, 2015; Brenneman, 2011), the best methods for assessing science learning for early childhood learners is to focus on the organic science that occurs during everyday interactions as part of playful learning (Brenneman, 2011; Guarrella, et al., 2023). This, of course, doesn't mean assessment of science should be accidental, rather that it should be intentional while also being a natural part of the learning routine. Teachers can use classroom lessons, purposeful centers, or activities to leverage towards science learning assessment. Also, teachers can utilize assessments they are doing for other purposes, such as language samples or observation tools, to also identify science learning. In assessing science learning in age appropriate ways for early childhood, teachers can focus on measuring the *integration* and *application* of science concepts and approaches in the everyday interactions of students.

Integration of science learning will generally be in how scientific terminology and ideas are used within both science contexts and general contexts. Looking for integration best measures spontaneous usage and, thus, language samples or other observations would best serve this measurement. Language samples can be collected in several different ways and so teachers can use general windows of observation time or after giving a prompt (of a scientific nature) for students to respond to within a given time frame. Beyond observations that only record word production, teachers can use video or pictures and record how students integrate science learning into both science and non-science settings.

Application of science learning will generally be in activities when students can engage in science either by the design of the activity is scientifically oriented or that the open design of the activity can allow students to reorient it toward scientific themes. Application is best assessed by performance-based measures (Brenneman, 2011; Guarrella, et al., 2023). As this kind of science learning requires context within which application of learning can be measured, which means that teachers need to create the context and decide what specific applications they want to measure for that context. Greenfield (2015), recommends a performance-based measure where a teacher poses a problem and observes how learner(s) go about solving the problem. Another approach would be to use a familiar center with a science focus and observe how students interact with the center without adult direction, observing if they can replicate the purposes of the center and if they extend their thinking within the parameters of the center. Again, teachers need to decide what "performance" they plan to measure before beginning the assessment. Within these applied contexts, teachers can use checklists, observation rubrics, or multimedia recording to record and share the data of the assessment with other educators, parents, and the learners themselves.

## Tying it All Together

Deaf children are natural born scientists. Teachers in early childhood classrooms have the amazing opportunity to draw in the natural curiosity and inquiry of their learners. In this chapter, we discussed the approaches teachers can use to achieve these goals by leveraging play and inquiry based learning, using SL as the primary language of instruction and using the features of ASL in scientific dialogue, incorporating written language instruction through science, and enhancing learning through the use of visual, tactile, and multimedia materials. These strategies, in addition to being good for science, are also beneficial strategies for all subjects in the early childhood classroom. Science learning, too, can and should incorporate strategies from other subjects - good teaching applies across subjects. Science learning, as well, needs to be purposefully planned and regularly implemented. Rather than solely a separate time, this chapter has recommended that science learning also be incorporated into the regular curriculum, activities, and structures of the early childhood day. Beyond the classroom, connecting with families to encourage reinforcement of science learning in the home provides additional ways families can feel involved in their deaf/hard of hearing child's education and development.

## Sample Lesson Plan

This lesson plan is based on the theme "The Farm" as part of a two-week unit in an early childhood classroom for 3 and 4 year old learners (often called Preschool). This lesson is not a "science" lesson, but scientific learning is embedded throughout the day's learning activities.

*Table 2. Sample "The Farm" Lesson Plan with Science Learning Embedded*

| Activity and Time | Activity Description | Corresponding Skills |
|---|---|---|
| Circle time (10-15 min) | Sign ASL rhyme and rhythm song Who's Here? Connect sign, fingerspelling, print with attendance poster and name tags.<br>Identify the weather of the day.<br>Review schedule for the day. | Letter recognition<br>Handshape recognition<br>Relationships/Sense of community<br>Vocabulary<br>Temperature and weather |
| Storysigning (15 min) | Sign *The Little Red Hen* (Foresman, 1989) big book; support with picture/print card of target words: words *farm, barn, hen, cow, rooster*. Ask open- ended questions.<br>Discuss the process of growing feed from a seed while making connections to the text. | Concepts of print<br>Story comprehension<br>Vocabulary<br>Plant life |
| Storytelling (10 min) | Sign farm-related ABC or number stories and encourage engagement. | Letter recognition,<br>Handshape recognition<br>Story comprehension |
| Center time (45 min) | Have at least three centers for students to choose where to go. You can include barn, grocery store, cow milking station, pumpkin patch (extension unit).<br>Include multiple books, writing materials, and print (fiction and nonfiction) related to the farm!<br>One center should be science-related such as playing with seeds, planting and watering, or comparing/contrasting farm animals. | Vocabulary<br>ASL skills<br>Social-emotional learning<br>Plant life cycle, animal identification and description |
| ASL rhyme and rhythm (10 min) | Sign together the ASL rhyme and rhythm song about cows playing. Ask children to come up with additional words using the Y handshape. | ASL phonological awareness<br>Animal behavior |

continued on following page

*Table 2. Continued*

| Activity and Time | Activity Description | Corresponding Skills |
|---|---|---|
| Snack time (15 min) | Give students animal crackers and ask them to identify the print/ picture of the animal to match the animal cracker. Count the number of each animal before they nibble on it. Have farm- related books in the snack area that children can read when they are done (e.g., informational text, *From Cow to Carton* or *Farm Animals*). | Following directions<br>Numeracy<br>Vocabulary in ASL/print<br>Reading informational text<br>Animal identification |
| Outside time (15 min) | Create a scavenger hunt. Hide pictures/print of target vocabulary. When children find a card, ask them to sign or fingerspell what their picture is to check for Comprehension.<br>Ask if the person/animal/object in the picture is small or large in real life. | Vocabulary<br>Expressive/Receptive ASL<br>Comparing sizes |
| Guest farmer (15 min) | Invite a Deaf farmer(s) to your class or show a video of a Deaf farmer on their farm.<br>Ask questions about reading, numbers, and scientific concepts already explored. | Identity development<br>Positive sense of self<br>Academic applications to real world careers |
| Goodbye time (5 min) | Sign an ASL rhythm and rhyme goodbye farm song and encourage engagement. | ASL phonological awareness<br>Vocabulary |
| Home Connections | Share video with parents of storysigning for the week's story, <u>The Little Red Hen</u>. Encourage parents to watch with child.<br>Encourage parents to go to local library to borrow copy of book.<br>Send home paper where parents and child look for animals/bugs in their neighborhood and document them on the paper. | Story comprehension<br>Vocabulary<br>Plant life<br>Animal life<br>Observation skills<br>Vocabulary<br>Communicating observations (print, picture, sign) |

*Note*. This lesson plan is an adaptation of the early childhood lesson plan given in Holcomb, Golos, Hipskind, & Rivera. (2024). Early childhood instruction (Ages 3-5). In D. Golos, M. Kuntze, K. Wolbers, & C. Kurz (Eds.), *58-IN-MIND: Multilingual strategies for diverse deaf students* (pp. 14-40). Gallaudet University Press.

## Discussion Questions

1. What is the value of integrating scientific content into the early childhood curriculum?
2. How can science be incorporated into the play activities of early childhood classrooms?
3. In what ways can a teacher grow scientific language in both sign language and written English for young learners? How can you consider the scientific language needs of students who come with language delays? How can you consider the scientific language needs of students who come with home languages other than SL or the dominant local language?
4. How can existing lessons, activities, and practices in the early childhood classroom be modified to include scientific learning?
5. How can science learning be used to enhance the educational experience of deaf/hard of hearing learners with disabilities and/or deafblindness?
6. How can you connect with families to become partners in extending science learning to both home and school?

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