STEM PLAY

Integrating Inquiry into Learning Centers

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Introduction

Play has been established as a major avenue of learning for young children. Learning centers have provided opportunities for play and learning at the preschool level for years. Integrated learning centers make sense for young children because the concept aligns with the way children learn. Young children don't separate content into different areas; they naturally see and integrate learning in a holistic way as they play.

> Play is often talked about as if it were a relief from serious learning. But for children play is serious learning. Play is really the work of childhood.
>
> —Fred Rogers

The idea of integrating science, technology, engineering, and math (STEM) into learning centers is relatively new. Although literacy integration has become more common by providing books and writing materials within learning centers, focusing on STEM in different centers is a fresh approach. Because science is an avenue for children to learn about their world, it fits naturally with learning centers. Young children's learning reflects a cycle that begins with an awareness of ideas and materials, moves to exploration with materials, then progresses as children develop concepts. This cycle of learning that occurs through explorations, inquiry, and building of knowledge uses similar processes as the engineering method and scientific inquiry. The initial explorations provide children with the experiences to build new ideas through these methods. Children need time and interactions to facilitate their learning and play. Learning centers provide a perfect platform for these experiences.

Integration of STEM in the early years exposes young children to a problem-solving approach to learning that aligns with their own curiosity. The integration of STEM in the preschool setting may spark an interest in and increase preparation in these fields in for future, which could lead to interest in STEM careers.

How to Use This Book

Learning centers are the cornerstone of the early childhood classroom. Children love choices with the opportunity to pursue their own interests and ideas while playing in centers. Learning for young children is integrated and includes different skills and content areas. This book is designed to bring learning centers to the next level through integration of content, and to be a guide for teachers to think more broadly about children's learning options.

Each chapter focuses on a specific learning center and includes general ideas to implement various content areas within the center. These ideas can help children to extend and expand learning that naturally develops while playing with materials commonly found in the center. The second portion of each chapter focuses on a theme. This section provides ideas and activities to integrate in the learning center that are aligned with commonly used themes, such as the zoo or a restaurant.

When using this book, begin with one center, one activity, or a theme. Some lessons build on each other, but most can be used at any time to foster an integrated approach to learning. It is helpful to take time to introduce topics before children begin the center period, to interact with them during play to promote further thinking and involvement during centers, and to encourage children to share experiences at the end of centers.

Ways to Use Learning Centers

Because the goal of many of these activities is to support children's autonomy in learning centers, you may find it helpful to introduce the activities during group time, prior to releasing children to play. This format allows the teacher to reinforce specific activities that can be accomplished during centers time. Some activities will require that the teacher be more focused or involved with children at one learning center, but the overall point is to encourage children to pursue various opportunities for integrated learning during play. The following strategies can help achieve this goal.

- Whole group introduction: Select one learning center and introduce activities that are available. Teachers may find it works well to introduce one related activity for one learning center per day using the directions provided. This will help create excitement about specific learning centers and will allow the teacher to maintain a focus on that learning center for the day. The activities at specific learning centers will be available for more than one day for students who are unable to participate on the first day. The teacher also can remind students of other special activities that were previously introduced and may be ongoing in the learning centers.
- Learning center time: Release children to the learning centers. The teacher's role may be to assist, question, interact, or observe children during play. Although specific lessons are the focus, the teacher may want to dedicate more time to that learning center while still being aware of all students in the room.
- Learning review: At the close of learning centers, invite the children to come together again to discuss their learning and activities. Encourage children working on the special center lessons to share ideas related to their learning that day. Some activities in this book specifically suggest that children share their work at the end of play time.

Enjoy the activities in this book with children. Watch them during play time as they begin to think like scientists and engineers while using the tools of mathematics and technology to support their learning!

1

Enhancing the Focus on STEM

Current research encourages the use of play in learning for young children, and children's social development is enhanced during play interactions. Literacy research also suggests that the integration of reading and writing materials helps to support children's emergent literacy skills in an authentic way. Although our educational system recognizes the value of play in the preschool years, social development and literacy development are considered the main benefits of play for young children. Beyond these benefits, play can support children's learning in other areas, including STEM. Children's natural inquisitiveness offers early childhood teachers avenues for introducing STEM activities.

An enhanced emphasis on STEM at all levels of education is a trend gaining support. Based on the results of several national testing efforts, it is apparent that students in the United States need a stronger focus on the mathematics and science areas to be competitive globally. In early

childhood classrooms, STEM and the beginnings of STEM investigations are already happening in learning centers. Teachers can help to strengthen this type of inquiry by understanding how to integrate STEM into certain learning areas and enhance understanding through materials and interactions during play.

When you enhance the focus on STEM learning, you will allow young children to exercise their curiosity by investigating different ideas and activities during play. The learning environment should center around encouraging children to consider their questions, what they want to know, and how they can find out. You can encourage inquiry and engineering processes by talking with children about their questions and by interacting with them when they are participating in different learning centers. You can also ask questions to get children thinking. When teachers have conversations and feedback loops with young children, it can help to promote their thinking and learning processes.

When young children begin to play, they don't say, "I'm going to do science today, or maybe math. I think I'll do math today!" Instead, children think about finding out about the world around them, and the learning is all intertwined. Unconsciously, they ask questions such as, "What will happen if I move this block?" or "How far will the car go if I let it roll down this ramp?" The questions that guide children as they begin to play may not be visible unless teachers observe carefully. As teachers, our objective is to consider what children's goals are during the play and to try to support those goals.

Supporting STEM in Centers

The components of a STEM curriculum in learning centers include the following:

- Science builds on the natural curiosity of young children. In the play environment, investigations with materials lead children to discover more about their world through their everyday experiences. Encouraging children to ask questions, observe, and explain their ideas can support the development of science inquiry. Open-ended questions provide a rich context for engaging young children in meaningful conversations that can enhance their learning.
- Technology for young children includes the integration of tools that are used to support children's work. These tools can range from simple crayons, markers, and a clipboard to more sophisticated items, such as digital cameras and tablets. Many applications are available that allow young children to communicate their ideas from their learning and also support learning in content areas.

For example, the Busy Shapes app by Edoki lets children work with matching shapes on a tablet screen and the StoryKit app lets children record themselves telling stories. Because preschoolers cannot, express themselves well through writing, these applications provide a valuable means of showing learning progress.

- The engineering process begins with a problem. Students work to consider various solutions then test out their solutions to see what works and how they can refine them. In play and learning centers, blocks and other open-ended play materials offer various opportunities for engineering activities. Children enjoy building and are often intrigued with how things work. These foundations of engineering support children's creativity as they build structures with materials during play. Providing challenges to children allows them to use their creativity and thinking skills to solve problems.
- Mathematics occurs quite naturally in play and learning centers. It can include number sense, spatial relationships, geometry, patterns, and comparisons. Math often goes hand in hand with science and engineering, as it gives children the language to share findings of investigations and problems. For example, children at the science center may investigate bones and use the mathematical concepts of measurement and comparison to explore them.

Providing Time and Materials

Providing materials along with teacher introductions and interactions during learning centers will set the stage for STEM learning. Young children need time to observe and interact with materials during play. By continually exploring with adult guidance and scaffolding, children can become better observers. You can provide a variety of materials to stimulate children's curiosity.

The learning centers should be stocked with different props and materials that will support children's learning in certain areas. The integration of STEM in various centers will allow young children to discover, explore, and work to solve problems related to each center's focus area. The teacher can further support ongoing investigations by selecting additional materials and placing them in the centers to extend children's learning.

You can use the activities in this book as a starting point to encourage children's STEM interactions with materials in play centers. As you observe children's play and developing interests, you can design other activities that guide and scaffold

children's experimentation. Young children need to be able to manipulate the materials to develop their own understanding of the scientific process.

Planning for Classroom Management

Before introducing center activities, review the expectations for learning center behavior with children. The goal is to continually encourage positive patterns of behavior as children work in learning centers. Teachers can reinforce this process by reviewing instructions periodically and by having equipment organized in a manner that will promote children's ability to take things out and put them away easily and quickly. These strategies can help the learning centers run more smoothly.

Behavior Management

Teachers also can take steps to support children in their interactions with others during learning centers. If you discuss various strategies for how to take turns and collaborate during centers, children's play will go more smoothly. Occasional conflicts during play will naturally occur, as young children are still learning appropriate behaviors. By observing children's interactions in centers, you will have opportunities to step in and model strategies to use when conflict arises.

Classroom and behavior management are important elements of creating a comfortable environment for integrated learning in centers.

2

Art Center

The art center provides young children a place to experiment with art materials; investigate ideas; and work with various tools, processes, and media. Children's natural inquisitiveness should be encouraged as children encounter sensory experiences, learn to make choices, and communicate their ideas. Art offers enjoyment and stimulation for the imagination. Children create relationships between ideas and objects, and then link them to thoughts and actions. Opportunities to develop self-discipline, reinforce self-esteem, foster thinking skills and creativity, and practice teamwork or cooperation take place in the art center.

The art center is a place where children can develop skills across the prekindergarten curriculum. These include social-emotional skills, such as sharing materials and cooperating on projects; language and pre-literacy skills, such as describing their work and writing captions; and gross- and fine-motor skills, such as large arm movements for easel painting or cutting with child-safe scissors. Art

provides opportunities for learning in mathematics through hands-on experiences with shape, size, and measurements; in engineering through investigations of structure and function, design or composition, and three-dimensional (3-D) projects; and in science through explorations of color, shape, structure, balance, space, texture, mass, and volume.

Examples of STEM Learning

Science

- Experimenting—Asking what happens if you mix red and blue paint.
- Investigating—Looking at the different textures you can make with crayons.
- Physical science—Wondering if a clay animal will stand up on four feet.
- Problem solving—Deciding whether to use a staple or glue or tape to connect an object you're creating.

Technology

- Creativity programs—Recording your ideas using apps such as Starry Night for art and Story Kit for literature.
- Brainteaser programs—Developing your logical thinking and spatial perception by using apps such as OverColor, which challenges you to copy colorful patterns using geometric shapes.

Engineering

- Constructing—Exploring how to construct a 3-D structure of a butterfly using recycled materials.
- Designing and building—Figuring out how to make a boat out of water bottles.

Math

- Counting—Finding out how many items it will take to fill in a space.
- Geometry—Exploring what shapes you can use to make a cat.
- Measurement—Figuring out how long the line should go in a picture.
- Patterns—Creating a design with a pattern of red, blue, and green beads.

Examples in Other Areas

Literacy

- Narrative language—Describing how you used red paint and mixed it with blue to get purple.

- Oral language—Explaining how you made your colors so bright. Asking a classmate to pass the crayons.
- Written language—Labeling and writing while using invented spelling.

Social Interactions

- Cooperative play—Engaging in cooperative play with others while making items.
- Sharing—Cooperating to use materials while working together.

Physical Development

- Fine motor—Gaining practice using child-safe scissors to cut.
- Gross motor—Trying to paint with water outside along the wall using your whole arm.

Art Center Activities: No Theme

The art center is a fun area of the classroom where children can use their creativity, but the center also enhances learning in other content areas. It should be orderly and organized, and the teacher can rotate materials—such as collage items—in and out and replenish them frequently.

Using materials such as paint and glue, children can experiment with mixing colors and explore a variety of science concepts, such as different properties of liquids. The following ideas can help children extend and expand learning that naturally develops while working with materials commonly found in the center.

SHAPE PICTURES

Children will use different shapes to create their own picture.

Skills supported:

- Creating and designing
- Exploring and experimenting
- Developing fine motor skills
- Using geometry
- Developing eye-hand coordination

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Start with STEM
and branch out in learning centers!

Young minds constantly want to know why and how! When you help them investigate questions, solve problems, and think about potential improvements, you're putting the power of science, technology, engineering, and math (STEM) in their hands. Starting with STEM as a focus, you can strengthen and expand a network of connections among learning centers and content areas.

With chapters focused on different learning centers, ***STEM Play*** offers valuable ideas for materials and lessons to use during center time. By exploring the activities in this book, you may be surprised how seamlessly you can integrate STEM into art and creative expression, block play, literacy learning, dramatic play, and music and movement in centers.

The authors share an innovative approach that joins STEM-related activities with popular preschool themes such as the zoo, restaurants, colors, sounds, and the body.

By giving children fun challenges that involve inquiry, imagination, planning, creating, and reflection, you just might find that their learning expands to exponential proportions. Give them the tools and let them play!

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