

# Tomorrow's architects and engineers: They're hammering and sawing in today's classrooms

by Dianne Pape and Barbara Hatcher

It's the end of another busy week, and parents are picking up their preschool children. The child care director, Ms. Rodriguez, has finished helping 4-year-old Daniel collect his belongings and notices a father standing at the bulletin board with a quizzical look on his face.

"Hello, Mr. Collins," says Ms. Rodriguez. "Do you have a question?"

"Yes," he says. "According to this activity list, our children will be doing some woodworking next week. Does that mean they'll be making bookshelves and birdhouses?"

"Oh, no," says Ms. Rodriguez. "They'll do some sanding and gluing, maybe some sawing and hammering. It's more about the process than the product, you see. We'll also read some books about tools and building houses...."

"...so they can grow up to be architects and engineers?" he asks.

She smiled: "It's possible we

have future architects and engineers, but we believe children learn many things in woodworking—muscular control, language and thinking skills, social skills, and creativity—you name it."

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**W**oodworking is valuable for preschool and school-age children for many reasons. Certainly it promotes mastery of basic woodworking skills such as measuring, hammering, sawing, and finishing. It can also be therapeutic for young children (Sosna 2000). But more important, it promotes skills in all five domains of child development.

**Physical.** It promotes the development and coordination of large and small muscles and competence in motor control and skill achievement.

**Cognitive.** It develops relational thinking—cause and effect; relatedness of things, activities, and feelings; single attribute and cross-set classification.

It leads to the understanding of number concepts through concrete use of counting, one-to-one correspondence, awareness of simple shapes, comparison of size, and experience with measure in three dimensions.

It leads to problem-solving through divergent thinking and planning to create three-dimensional structures.

**Social.** It promotes cooperation with others and sharing. It develops awareness of others as children learn to handle tools in ways that will not harm others.

**Emotional.** It develops a sense of power and self-esteem as children use adult tools and complete adult-type projects. It builds strong, positive feelings of competence and the ability to meet new situations well.

It encourages sustained interest in a given task and the ability to overcome frustration successfully. It allows for a healthy release of emotional tensions.

**Creative.** It offers children opportunities to invent, imagine,



and creatively express their own ideas through a different medium. Using their own visual/spatial perceptions of the world, they can begin to perform transformations upon those perceptions.

## Developmentally appropriate practice

Building upon sensorimotor skills acquired during the toddler years, woodworking is a developmentally appropriate approach to curriculum. It is a fascinating way for young children to discover their world by experimenting with natural materials (Patnaude and Costantino 1995). It provides an excellent strategy for creating an inclusive, non-sexist, and self-fulfilling environment that invites each and every child to be successful at the woodworking area (Huber 1999).

## Developmental stages

Children progress through stages of interest and skill in woodworking, just as they do in art, blocks, and writing.

**Age 2-4:** Younger children are more interested in the process than the product. They need to explore equipment and supplies. They want to feel, smell, touch, and handle woodworking tools and materials.

Two- and 3-year-olds find satisfaction in such simple activities as sorting wood pieces, pounding pegs into a toy cobbler's bench, tapping golf tees into Styrofoam® blocks, and hammering nails into a wood block or tree stump—and pulling them out.

**Age 4-5:** At this age, children are interested in combining woodworking materials. They may want to glue and nail things together, but only after satisfying

their initial curiosity about materials and refining their skills.

The form of their products may remind them of something, and they will name it, but combining materials is the focus.

**Age 5 and older:** By school-age, many children begin to show greater interest in the product. Although they are still interested in the pleasure of the process, they have an idea of a product in mind before they begin. It is usually something simple like a boat or a car.

As children become more experienced, skilled, and mature, they make increasingly realistic and complex products.

It's important to remember, however, that children of the same age may have vastly different skills and needs in woodworking (Brandhofer 1971; Moffitt 1973). For safety, teachers need to assess each child individually and tailor woodworking activities to the child's developmental level.

## Where to start

Children of all ages will be interested in the broad areas of construction, building and carpentry trades, architecture, and engineering. To stimulate or gauge their interest, consider the following activities:

- Take a field trip to a construction site. Plan the visit in advance with the contractor so that work crews can plan safety precautions.
- Visit a hardware or building supply store to see the types of materials sold and the jobs of people working there.
- Visit a carpenter's shop or high school shop class to see tools and people using woodworking skills.

- Invite a carpenter, cabinet maker, wood carver, house painter, roofer, rock mason, or other skilled-trades person to demonstrate two or three simple skills.
- Invite an architect, designer, or engineer to demonstrate the difference between using paper blueprints and computer-assisted design.

When inviting speakers to class, keep in mind gender diversity. Today many women work as architects and engineers on their own and in large companies.

## Planning the woodworking center

Before introducing children to woodworking, carefully plan the environment and think through tool use and safety rules. Some tips:

- Locate the woodworking center out of traffic flow and some distance away from quiet centers. Placing the center in a corner helps reduce distractions. Woodworking can also be set up in a hallway, as long as it is well supervised, or taken outdoors.
- Match tools and materials to the children's interests and development levels. See the selection criteria at right.
- Start with a few basic tools and materials and gradually add more as children gain experience and skill.
- Understand how to use each tool and practice using it before introducing it to children. Ask for help, if you need it, from a carpenter or hardware specialist.
- Introduce a tool before the child uses it for the first time. Place your hands over the child's hands to guide the sawing or hammering.

- Start simple and easy. Begin with a 1 1/2-inch roofing nail, which has a large head, for example. For sawing, start with a narrow wood piece less than an inch thick.
- Instruct children to tap, not pound, the nail into wood.
- Check tools and materials for safety each day before children arrive. Repair or replace broken tools before children use them. Order and neatness help promote safety. Tools can be hung on a pegboard, with outlines marked to help children remember where each tool goes. Nails can be stored in coffee cans with plastic lids. The bottoms of the cans can be nailed to a board to prevent them from getting tipped over. A nail taped to each can help children remember which size nail goes in which can. Wood scraps can be stored in a cardboard box or plastic bin.

### Criteria for tool selection

- Are the tools suitable for the age and interest of the child using them?
- Do they serve the number of children involved?
- Are the tools of good quality, adequate for long and hard use?
- Can the tools be re-sharpened or reconditioned and have broken parts replaced?
- Will the tools build a child's respect for tools as a functional means to an end, stimulate interest, and encourage a wide variety of experiences?
- Do they afford the means for developing in children appreciation for fine furniture and construction, in wood, in many forms?

Most teachers limit the number of children in the center to two at a time. Stocking the center with two safety goggles not only protects their eyes but also reinforces the two-children-at-a-time rule.

Remember, part of the joy of woodworking for the children is the addition of useful work-related items such as a carpenter's apron and pencil, roll-up measuring tape, a tool belt, or special gloves or shoes.

### Teach safety rules

In addition to demonstrating how to use tools properly and providing appropriate activities, teachers must teach and model safety rules, such as the following:

- Use tools only when an adult is there to supervise.
- Use tools only in the wood-working area.
- No more than two children can use the center at a time.
- Wear safety goggles while working in the center.
- Keep the work area free from clutter. Take out only the tools and materials you will be using.
- Use hammers for pounding nails only, not people or toys.
- Hammer nails into your project only, not the workbench or table.
- Use saws for sawing only. Other uses can break the saw's teeth.
- If another child is sawing, keep your hands safely away from the saw in case it slips.
- Use a clamp or vise to hold materials firmly in place. Have the teacher check to be sure items in the vise are secure.
- Never hold nails, tacks, or other items in your mouth.
- If you have a disagreement with another child, put down the tools immediately.

### Basic equipment and materials

- workbench, waist high for children
- storage shelves
- safety goggles (use the term "goggles" for consistency), wrap-around type with air vents
- claw hammers, 7 to 10 ounces, with wooden handles
- nailing block such as cork-board, old tree stump, or Styrofoam® blocks
- crosscut hand saw, 16 or 11 points
- coping saw for cutting curves
- vise for workbench
- nails and tacks, variety of sizes and types
- large wood pieces, finished or unfinished, such as soft pine or spruce, poplar, white cedar, molding and dowels 1/2 to 1 inches in diameter, plywood (for older children)
- small wood items such as toothpicks, craft sticks, tongue depressors, paint stirrers, small branches, sticks
- Styrofoam® pieces
- ruler, yardstick, measuring tape
- pencils
- Elmer's® white wood glue
- scissors
- small wheels, thread spools
- bottle caps, pop-tops from cans
- sandpaper in various grits
- paintbrushes
- paint, nontoxic
- string, yarn, tapes
- rags for cleaning
- broom, dustpan, hand brush
- trash can
- first-aid kit



- If you cannot observe the safety rules, expect to leave the center and find another activity.
- Return tools to their proper storage place. Replace leftover nails in their storage containers. Return unused wood pieces to the storage box.

### Optional equipment and materials

- sawhorse
- hand drill with several bits (non-electric)
- brace and bit
- combination or lineman's pliers, 6 inches
- wire, wire mesh
- wire cutters
- T square
- miter box
- Surform®, made by Stanley tools, for smoothing surfaces but easier to use than planes, rasps, and files
- plane for shaving wood surface
- rasp for smoothing edges
- half-round file, 8 inches
- file card (brush with metal bristles for cleaning file)
- C clamps, 4 to 6 inches
- keyhole or compass saw
- backsaw
- monkey wrench
- machine nuts and bolts, various sizes and lengths
- hooks, knobs, hinges
- cardboard, Tri-Wall, and posterboard boxes
- Formica®, tile, linoleum pieces
- wallpaper scraps, leather
- paint scraper
- magnets
- hole punch, center
- work gloves
- paint shirts
- sink, mild bath soap

Adapted from B. Day, *Woodworking*, in *Early Childhood Education: Creative Learning Activities*, 1988.

- Never store wood that has nails sticking out of it.

Adapted from P. Skeen, A. Garner, and S. Cartwright, *Woodworking for Young Children*, 1984.

## Literacy connections

Offering books about construction and tools in the literacy center will extend children's learning. Whether teaching children about various tools or giving them ideas for their own construction projects, books provide that important literacy connection that adds to children's exploration. Likewise, providing paper and writing utensils will encourage children to create their own plans prior to construction and to label their woodworking creations upon completion (Huber 1999).

To capitalize on opportunities to add literacy to woodworking, locate the literacy area near, but separate from, the actual construction area for safety and easy retrieval of resources. Provide markers, pens, and paper for list making, note taking, and sketches. Include advertisements from hardware and lumber stores. Post illustrations of simple wood projects youngsters can study.

Have books about working with wood and posters of individuals of all ages engaged in wood crafting. Create a word wall with pictures of tools and their appropriate names, and make a list of action words used daily in the center such as *saw*, *sand*, *scrape*, *hammer*, *drill*, and *press*.

Finally, create a 3-D gallery for children to showcase their work. Label each creation with the child's name and the title of the piece, if appropriate. If space is limited, photograph their work for display and documentation. Provide opportunities for children to share their woodworking experiences with others.

## Activities

The activities below are arranged by age to match children's developmental abilities. Remember that younger children are more interested in exploring materials and tools than making anything.

Take steps to provide safety and instruction in using tools, and then adopt a playful attitude. Observe children as they work, ask questions, offer encouragement, and build confidence.

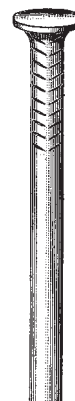
## Wood play

(Age 2 and older)

### Here's what you need:

- assorted lumber scraps with smooth edges

1. Introduce the lumber scraps to children. Ask children to compare color and size. Invite them to smell and feel the pieces.
2. Ask children to identify things made of wood in the classroom.
3. Set out wood pieces on the floor for play. Children can stack and unstack them or place them in containers.



## Sawing sounds

(Age 2 and older)

**Here's what you need:**

- Styrofoam® pieces
- plastic knives, one for each child
- newspaper

1. Spread newspaper on the table or floor. Offer each child a plastic knife and piece of Styrofoam.
2. Invite children to saw the Styrofoam with the knife. Encourage them to listen to the sounds it makes.

## Sawdust play

(Age 3 and older)

**Here's what you need:**

- crosscut hand saw (for adult use only)
- scrap of soft pine
- workbench or sawhorse
- newspaper
- sawdust from a carpenter, someone who cuts firewood, or building supply store
- metal baking pan
- cups, wooden spoons, and other household utensils

1. Spread newspaper under the workbench. Start sawing a piece of pine, just enough to demonstrate how sawdust is made.
2. Invite children to feel and smell the sawdust.
3. Spread sawdust in a metal baking pan for play. Children can tamp and squeeze the sawdust, move it around with their fingers, or pour it into containers.  
**Variation:** Mix sawdust with water. Add it to dirt for making mud pies. Mix sawdust with white glue to make modeling clay.

## Sanding and oiling

(Age 3 and older)

**Here's what you need:**

- sandpaper, various grits
- wood pieces
- mineral oil
- newspaper
- rags

1. Invite children to gently feel the surface and edges of wood pieces, being careful to avoid splinters. Use words such as *smooth*, *rough*, *edge*, and *corner*.
2. Spread newspaper on the table. Offer sandpaper for practice in sanding. Compare how wood surfaces feel after children have sanded them with coarse, medium, and fine sandpaper.
3. Invite children to apply oil to their sanded pieces of wood using a rag. Discuss what happens to the wood color and grain.  
**Variation:** Instead of oil, children can use nontoxic paint.

## Wood art

(Age 3 and older)

**Here's what you need:**

- newspaper
- wood piece, approximately 10 inches square, one for each child
- small wood scraps in odd and various shapes from a high school shop class or construction site
- collage materials such as thread spools, bottle caps, paper clips, string, and pieces of old wooden toys or puzzles
- white glue
- hammer
- nails or tacks
- paint (optional)

1. Spread newspaper on the table. Invite children to create a collage by gluing wood scraps and collage materials onto the wood piece. Some children may want to attach pieces with nails or tacks.
2. Let the collages dry overnight.
3. Invite children to paint or decorate their collages, if they wish.  
**Variation:** Instead making a collage, invite children to glue wood pieces into a free-standing wood sculpture.

## Wood scrap critters

(Age 3 and older)

**Here's what you need:**

- various sizes and shapes of wood
- white glue
- paint or markers
- newspaper

1. Explain that children will select several pieces of wood and glue them together to make an animal, bird, or fish, for example. One piece of wood might form the body, another the head, and another a wing or leg.
2. Spread newspaper on the table and provide wood pieces and glue. Let children use their imagination in making a critter. Avoid providing a sample or model to follow.
3. Let the critters dry overnight.
4. Encourage children to mark eyes on the critter's face or paint other features, if they wish.  
**Variation:** Paint the entire critter. Use other materials for features—tacks for eyes or yarn for tails, for example.

## Tree walk

(Age 3 and older)

### Here's what you need:

- a field guide to trees
- plastic bag for collecting leaves, bark, nuts, and twigs

1. Prepare for this activity by getting acquainted with common trees in your area. To identify trees, you will need to distinguish between leaf shapes and seeds. Borrow a field guide from your local library or go online at [www.arborday.org](http://www.arborday.org).
2. Invite children to point out items made of wood in the classroom. Ask: "Where does wood come from?"
3. Take children on a nature walk along a tree-lined street or to a park with a wooded area. Point out a half dozen common types of trees. Encourage children to feel the bark, crush and smell the leaves, and gather items to take back to the classroom.
4. Encourage children to make a collage with the items or paint a picture of a tree.

**Variation:** Set up an assortment of small wooden items—cutting board, spoon, salad bowl, jewelry chest, picture frame, pencil—in the science center for children to explore.

## Measure it!

(Age 3 and older)

### Here's what you need:

- yarn
- wood scraps
- scissors
- rulers or yardsticks
- marker

1. Give each child some yarn and a scrap of wood. Explain that they will measure the wood by extending the yarn along an edge and then cutting the yarn at that length.
2. Ask the children to find something else in the classroom that matches their length of yarn—a book, card, pencil, or paintbrush, for example.
3. Invite children to lay their yarn length along a ruler and read the number. Explain that each number represents an inch. Use the ruler to measure an inch on the child's pointer finger and mark it.
4. Have children use the ruler to measure the wood. Explain that *length* refers to the longer side, *width* refers to the shorter side, and *thickness* refers to how thick the wood is.
5. Encourage children to measure other objects in the room using yarn or a ruler. Challenge children to find objects of specific lengths—"something 11 inches long and 8 1/2 inches wide," for example.

**Variations:** Instead of yarn, use other objects such as unsharpened pencils, blocks, or postcards for measuring. Have children make a simple rain gauge by marking inches on a can.

## Draw with a straight edge

(Age 4 and older)

### Here's what you need:

- yardstick or meter stick
- chalk

1. Take children to a sidewalk outdoors. Using chalk, show children how to mark straight lines with a yardstick. Point out the line length in inches and feet.
2. Divide children into pairs, one to hold the yardstick while the other draws a straight line. Have them take turns drawing straight lines of various lengths.
3. Show children how to use the yardstick to draw geometric shapes such as a square, rectangle, and triangle. Point out the number of sides each shape has, and measure the length of each side.
4. Invite children to pair up and draw geometric shapes of specific sizes—a 4-inch square, a triangle with 6 inches on each side, or a rectangle 3 inches by 6 inches, for example.

**Variations:** Draw geometric shapes on cards using a ruler and pencil.

## Nail designs

(Age 4 and older)

**Here's what you need:**

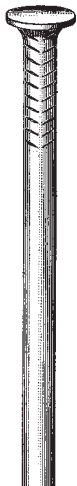
- hammers
- nails
- short boards, 6 to 8 inches long
- string or yarn of different colors

1. After children have practiced hammering nails into a tree stump or wood block, invite them to hammer nails into a geometric shape or design on a board. They can draw the design on the wood first, if they wish, and then hammer nails along the lines.
2. Encourage children to wind string or yarn in and around the nails.

**Variation:** Paint the nails different colors to harmonize with the design.

### To hold a nail

Push a nail through a piece of cardboard or Styrofoam on the wood where the nail is to go. The cardboard will help keep the nail upright while the child hammers it.



## Name plaques

(Age 4 and older)

**Here's what you need:**

- short lengths of one-by-fours or other boards
- pencil
- ruler or measuring tape
- large nails
- hammers
- sandpaper
- short lengths of rope
- tacks

1. Invite children to write their names in pencil on individual boards. Encourage them to make their letters about 3 inches tall.
2. Show children how to hammer a nail into wood just enough to puncture the surface. Invite children to make puncture dots in their boards to form the letters of their names.
3. Encourage children to sand the boards, especially edges and corners.
4. Have children use tacks to attach a length of rope as a hanger at the top edge of the plaque.

**Variation:** Use wood screws instead of tacks to attach the rope hanger.

## Boats, trains, and planes

(Age 5 and older)

**Here's what you need:**

- small blocks of wood, various sizes and shapes
- wooden dowels
- crosscut saw
- vise
- ruler
- wooden wheels, buttons, thread spools
- cardboard, fabric scraps
- toothpicks, craft sticks
- white glue
- nails
- hammers
- paint, markers

1. Encourage children to glue or nail pieces of wood together to make a boat, train car, or airplane.
2. Provide tools that allow children to add details—a saw for cutting a piece of dowel rod for a smokestack or making the pointed prow of a boat, for example.
3. Encourage children to use their imagination on finishing details. They can mark windows and other features on their vehicles, paint the entire vehicle, make flags from toothpicks and fabric scraps, and make propellers from craft sticks, for example.
4. Let boat makers try out their craft in the water play table. Make sure the glue has dried sufficiently first. Invite train makers to hook all of their train cars together with cup hooks.



## Build a house

(Age 5 and older)

### Here's what you need:

- *How a House Is Built* or another children's book on construction
- cardboard pieces from large boxes
- scrap lumber, logs
- bricks
- sheets, blankets, or tarp
- heavy-duty tape, rope
- hammer and nails
- camera

1. Engage children in a discussion about houses. Encourage them to talk about the design of their own houses or apartments. Point out similarities between houses and your building—*floor, wall, roof*.
2. Read a book about constructing a house or other building. Discuss the sequence of building such as selecting or preparing the site, laying a foundation, erecting the walls, putting on the roof, and finishing the interior.
3. Take children outdoors and show them the building materials you have collected. Invite them to make a house over the next few days. Discuss the design, including which materials will be used for each part of the structure. Divide children into groups of three or four to build a different part. Review safety rules before beginning.
4. Take photos to record the construction progress.  
**Variation:** Invite a parent with construction skills to visit while the children are building and offer help.

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