

Ramps & Pathways

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IOWA
REGENTS' CENTER FOR
EARLY DEVELOPMENTAL
EDUCATION



Developed and tested for over 20 years by children, their teachers, and early childhood researchers and funded by the National Science Foundation



PURPOSE OF THE STUDY OF RAMPS & PATHWAYS

Ramps & Pathways is an integrative STEM experience for children PreK-2nd grade, though people of all ages benefit from working with them. It has tremendous educational value as children actually engage in science and engineering practices when they design and build their own technology of a system to move objects. In this act they are challenged to ponder concepts within force and motion - something that many educators believe students only learn in high school. We start early, because we know the importance of children understanding how the world works. This knowledge will eventually connect to children's future work as scientists, technology specialists, engineers and mathematicians. Ramps & Pathways experiences give children endless possibilities to think and create. They build, test their systems, make adjustments, and try again until they are successful. We have found that children are motivated to engage in this process because of the intriguing nature of the materials. Ramps & Pathways provide contexts for children to feel success, and also a context to understand how mistakes are opportunities to learn.

Adults are often tempted to use science terms that may be challenging for young children, such as *acceleration*, *mass*, *velocity*, and *momentum*. These are technical definitions that we find many adults don't fully understand and believe it is best to use language that helps children form concepts. The science language will be more meaningful after the concepts are developed. The following will give you an idea of how we can categorize the vocabulary words when working with young children that will assist in conceptual development as well as expand children's use of language:

Positional Words and Phrases

Higher, lower, next to, between, on top of, under or underneath, beside, behind, in front of, below, above

Directional Words

Down, up, forward, backward, sideways, through, over

Descriptive Words for Movement (or lack of)

Fast, slow, stable, steady, solid, wobbly, roll, slide, jiggle, tumble, teeter, jerky, bumpy, bouncy, smooth

Descriptive Words for Properties

Hard, soft, flexible, metal, glass, wood, plastic, heavy, light, hollow, solid, round, cylinder, cube, sphere

General Vocabulary

Incline, ramp, pathway, track, object, speed, system

Ramps & Pathways seeks to **form the mind** with conceptual understanding, not merely **furnish the mind** with isolated facts and vocabulary with little to no conceptual understanding of their meaning.

FIVE TYPES OF MATERIALS NEEDED FOR RAMPS & PATHWAYS

1. Track

The materials used as the tracks or pathways in Ramps & Pathways can be wooden cove molding found in many building supply stores, or track created by students in the Department of Industrial Technology at the University of Northern Iowa. This track is made from hard maple wood and will not warp like pine wood cove molding. The size we recommend is 1 ¾ inches wide and flat on the back side. We have the cove molding cut into three different lengths: 1', 2', and 3'. (Email regents.center@uni.edu to enquire how to purchase this track at a cost comparable to the pine wood cove molding.)

2. Objects

Children can use a variety of objects on the ramps to learn about the properties of those objects in relation to inclined planes. The following is a list of suggested objects that can be used. This is not an exhaustive list.

Glass Marbles

-25mm to 35 mm (35 mm and larger only for young children who mouth objects)

(Visit www.megaglass.com for a wide selection of glass marbles.)

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Steel Marbles

-We recommend including steel marbles of the same sizes as the glass marbles so that children can compare the movement of spheres that are the same size but different weights on the ramps.

(Visit www.rainbowturtle.com for a selection of steel (chrome) marbles.)

Other Objects that Roll (many of these items can be found at www.orientaltrading.com)

Balls of various sizes, materials, and weights such as:

Ping pong balls	Pom poms
Rubber bouncy balls	Foam balls
	Wooden ball

Balls with different surfaces that are bumpy, rough, etc.

Objects that roll when placed one way and slide when placed another way such as cylinders and spools

Objects that Roll or Move Differently (many of these items can be found at www.orientaltrading.com)

Easter eggs	Tops	Jingle Bells
Cone-shaped objects	Jacks	Flat Glass Gems
	Craft sticks	Buttons

3. Containers

All of these items can be stored in divider boxes so that it is easy for children to select the item they want and sort them when putting them away. (<http://www.containerstore.com/shop/collections/hobby/partsBoxes?productl...>) Children also like to have containers for catching the marbles such as small galvanized buckets, tuna cans or recycled margarine tubs. (http://www.orientaltrading.com/galvanized-buckets-a2-3_1377-12-1.fltr?Nt...)

4. Supports

Children also need materials they can use to build the base of the ramp structure.

Unit blocks – These are by far the most superior type of block for children to use. They allow the construction of a much sturdier structure and also provide equal units with which the children can build fostering spatial thinking.

Cardboard, foam, or soft (baby) blocks – These are a more economical option for support materials, however, sometimes they can be more problematic as they are lighter and can fall more easily. This, however, can be a challenge for children to figure out how to use them effectively. They can also be used in combination with wooden unit blocks.

Sponges – These are great as part of a table top experience at a beginner level. Sponges can also be helpful in creating a cushion for the marble when it needs to slow down and bounce off of another surface.

Recycled materials – For teachers on a tight budget, you can use empty cereal and Kleenex boxes. Like the commercially-made cardboard blocks, these will be light and not as sturdy but we have seen teachers use them successfully. You can put some sort of filler inside these empty boxes to give them a little more weight just as long as the weight is distributed evenly. Material like old t-shirts or pillow stuffing could be used so that it is not too light and not too heavy. Experiment with this and be creative!

5. Storage

There are several ways you can store ramps so that they are accessible to children and easy to put away. We suggest placing the ramps in your block center. They can be stored in a tall container where they can be stood on end or in a long horizontal container and laid out flat. Here are suggestions:

Tall metal trash can (<http://www.homedepot.com/p/Behrens-31-Gal-Galvanized-Steel-Round-Trash-C...>)

These are heavy enough to hold many sections of cove molding without tipping over. You may want to store the shorter lengths (1- and 2-foot sections) in a shorter trash can or other container because they may be difficult for smaller children to reach inside the taller can.

Shelving – Some teachers choose to place the ramps flat on a shelf. If you have a shelf that is at least 4.5' wide and 1' deep, this should work well to hold several sets of ramps.

Object Containers Be sure to keep the marbles and other objects for children to use on the ramps near the cove molding. Marbles can be placed in recycled plastic peanut butter or mayonnaise jars with lids or stored in divider boxes such as the one mentioned above. Some teachers like to purchase a fishing tackle box or craft material box with lots of compartments.

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BEGINNING THE STUDY OF RAMPS & PATHWAYS

Before introducing Ramps & Pathways to children, it is important for **YOU** to take time to play with the ramps. This will prepare you for the complexity of what you are asking children to do and the potential problems that children may encounter. It will give you a clearer understanding of what children are doing and a healthy respect for the thinking that will take place.

Once you have spent some time playing with the ramps yourself, you can introduce Ramps & Pathways to children in one of several different ways. How you choose to do it is up to you in terms of what you think will be the best fit for the children in your classroom. The most important point to remember when introducing R&P is that this is intended to be an open-ended experience. Children should be encouraged to be creative, try out their own ideas, and set problems for themselves.

Group time – You can introduce the materials to the children as a large group class meeting or in small groups. Some suggestions for things you can discuss in this initial introduction include:

- What the materials are and how they can be used.
- Briefly demonstrating what they can do with the materials. (Caution – this is not to “teach” them that they should be used in only one particular way, but rather just to give them an idea of what they can do with the materials.)
- Asking the children for ideas about how the materials could be used.
- Discussion about safety and proper use of the materials.
- Having children demonstrate some of their ideas of what can be done with the materials.
- Setting up a simple ramp and asking children what will happen if a marble is released from the top.
- Placing a track flat on the floor with a marble in the middle of the track and asking children how they might get the marble to move to one end or the other.

Please note: These suggestions would not all be used in one group time. These are just different ideas for how R&P can be introduced to a large group. You can use any one of these suggestions or combine a few as you see fit. You may also have ideas not on this list, so feel free to be creative.

Center time – You can put the materials out during center time and see what the children do. You can choose to participate in the experience with them to start and then back off and let the children take it from there once they begin to have their own ideas.

Please note: If issues regarding safety come up that had not previously been discussed, call the children together for a class meeting and talk about the problems that are occurring. Have the children make rules about safety issues.

Rulemaking

All children want to feel safe and thrive in an environment where they can express themselves freely and work together in a peaceful atmosphere. When creating expectations for behavior or safe use of materials, children are most likely to adhere to rules when the ideas for the rules come from them. They feel a sense of ownership over their classroom and want to work together to maintain a harmonious environment. When children are involved in creating classroom rules, they will remind each other of the expectations. The necessity for you to give reminders of rules is reduced.

Questions to Ask

When engaging children in R&P experiences, it is important to provide opportunities for children to explore the materials in their own way and to pursue their own ideas for building ramp systems. One of the hardest things to do as a teacher is to back off and let children work. **Your job** is to facilitate the experience, guiding children as needed, **NOT** to direct what they do. R&P experiences will be far richer when you allow children the freedom to be creative. When you facilitate instead of direct teach, children will think of many things to try that never would have occurred to you!

Children can make a number of mental relationships when working with Ramps & Pathways. Some of these include cause and effect, seriation, comparative/classification, temporal, and spatial relationships. Questions and comments can help stimulate children's thinking, draw their attention to details, and assist them in constructing these mental relationships. Instead of solving children's problems for them (which stifles their learning), use questions and comments to promote deeper thinking. The following is a list of possible questions you can ask, depending on what children are doing and the problem(s) they are trying to solve. These questions are based on an article written by Mary Lee Martens entitled, *Productive Questions: Tools for Supporting Constructivist Learning*.

Martens, M. L. (May, 1999). Productive questions: Tools for supporting constructivist learning, *Science and Children*, pp. 24-27.

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Attention-focusing Questions

- Where do you notice the marble coming off the track?
- What have you noticed about the way this object moves down the track/along the pathway?
- Why did you decide to put it here?
- What did you do first?

Measuring and Counting Questions

- How far did the marble travel/roll across the floor after it left the ramp?
- How far did the marble fly off the end before it landed on the floor/hit the surface?
- How high do you need to elevate the start of your ramp to make the marble travel all the way to this target?

Comparison Questions

- How do these objects move differently on the track/pathway?
- Which marble travels the farthest off the end of the ramp?
- Is there a difference when you use a big marble versus a small marble? Heavy marble versus a light marble?
- Which marble goes faster- the big one or the little one?
- Which supports create a sturdier base?
- Which type of surface allows the marble to move the best/travel more smoothly/go farther? (Surface could be referring to the floor or on the track itself.)
- How does the marble travel differently when you make the start of your ramp higher? Lower?
- Why do you like this sphere better?
- What would happen if you moved the ramp to this part of the floor?
- What would happen if you moved it to this side?

Action Questions

- What do you think you could do with these things?
- What happens if you release the marble somewhere else on the ramp?
- What happens if you make your ramp higher (or lower)?
- What happens if you add (or take away) a block to the support? (This could be referring to any particular point on the structure – not just the beginning of the pathway.)
- What if you tried a bigger (or smaller) ball/marble?
- Show me how you did that.
- Can you do that again?

Problem-posing Questions

- How can you make the marble move along the (flat) track without touching or blowing on the marble?
- How can you make the marble stay on the ramp?
- How can you get the marble to travel farther off the ramp?
- How can you catch a marble when it flies off the ramp?
- Can you make a marble turn a corner?
- Are there any other ways you can make a marble turn a corner?
- What can you do to make the marble knock down this target?
- What can you do so the marble will travel all the way to the end of the ramp?
- Where will the marble go if you put the ramp this way?
- How can you make the marble go faster? Slower?
- Can you build a ramp within this (confined) space?
- Can you make a marble go uphill?
- Can you build a ramp so that the marble has to jump from one part of the track/pathway to another?
- Is there somewhere you could place the container so it will catch a marble as it leaves the ramp?
- Is there anything else you could use to make that work?
- What will happen if you put this one on first instead of that one?

Reasoning Questions

- I wonder why the marble comes off the track (right here)?
- Why do you think the marble won't go onto the next track? (Could be referring to a corner, jump, or straight pathway.)
- I wonder if it would work if you...?