



TRAINING MATERIAL

# Zoom into Nano **Science Outside of School**



# Overview

- Science outside of school
- The Explore Science kit
- Leading science activities

The background features several decorative hexagons in orange, blue, and green, some overlapping and some partially cut off by the edges of the slide. The text "Science outside of school" is centered in a bold, black, sans-serif font.

# Science outside of school



# Hands-on science

**Science**

**Technology**

**Engineering**

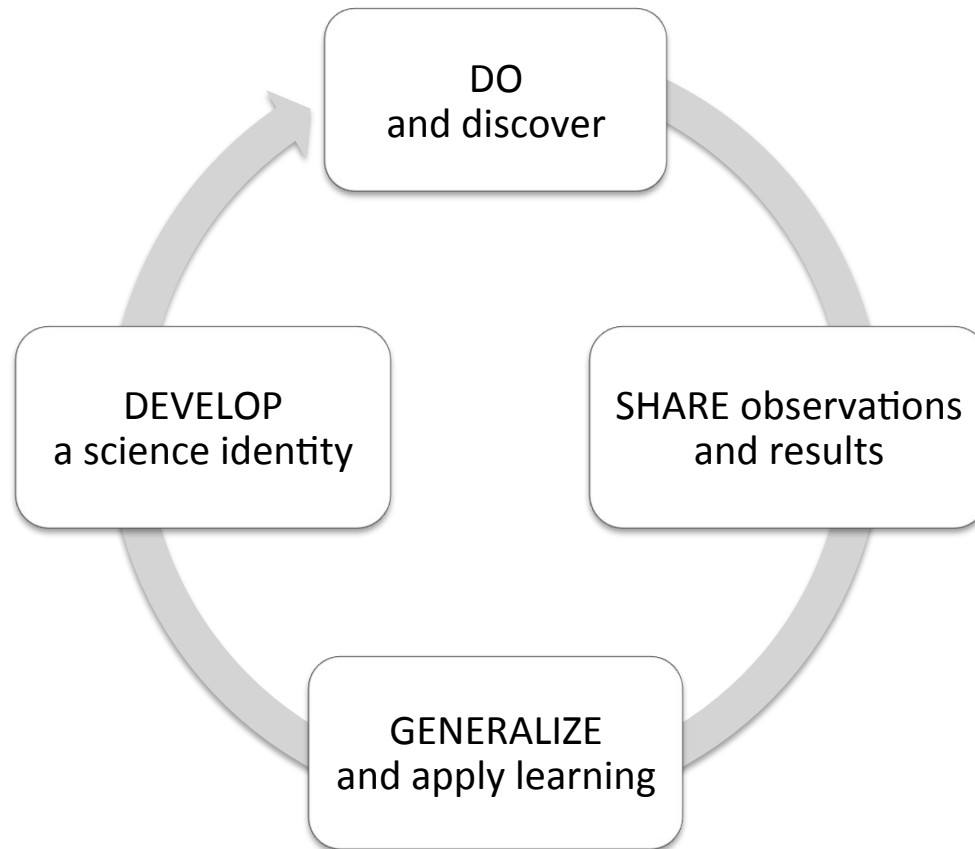
**Mathematics**



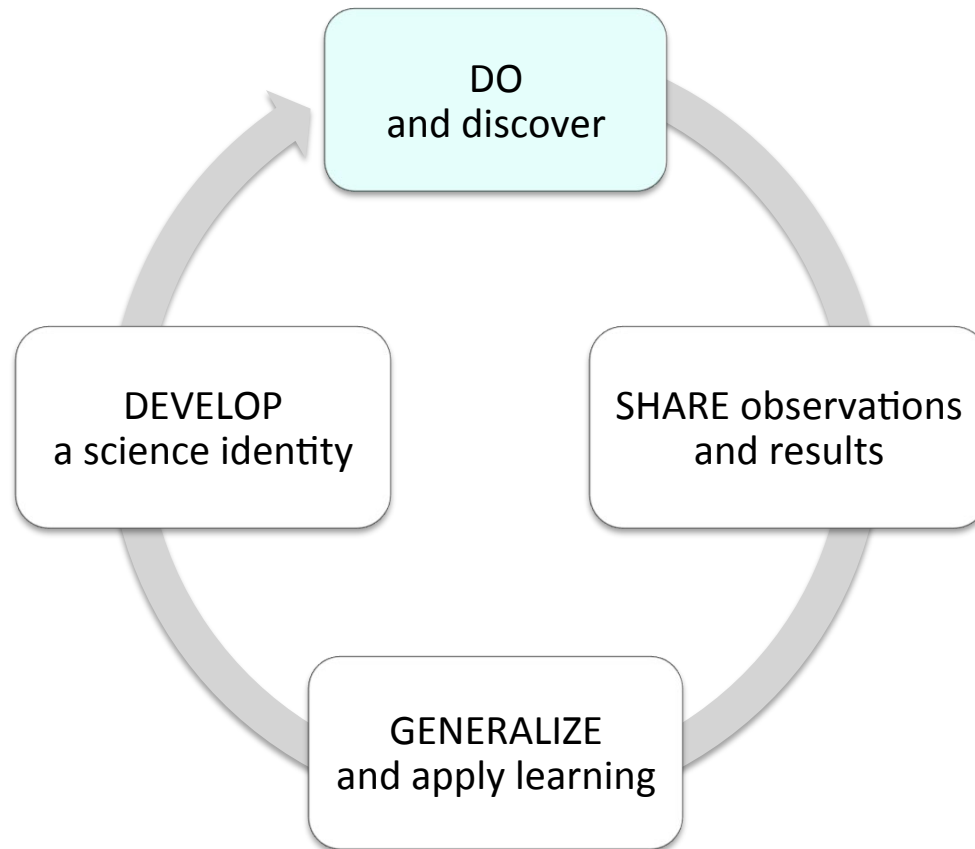
# Hands-on science

- Complements and reinforces other learning
- Fosters positive relationships
- Provides opportunities for involvement
- Is fun and challenging

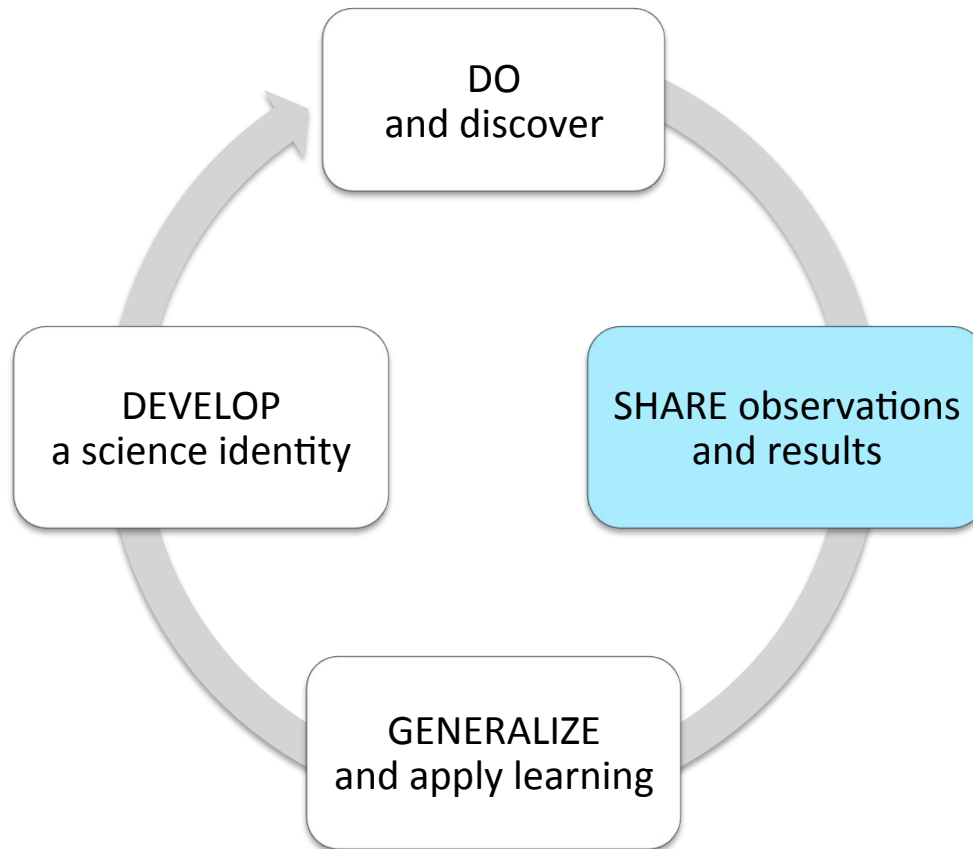
# Learning by doing



# Learning by doing

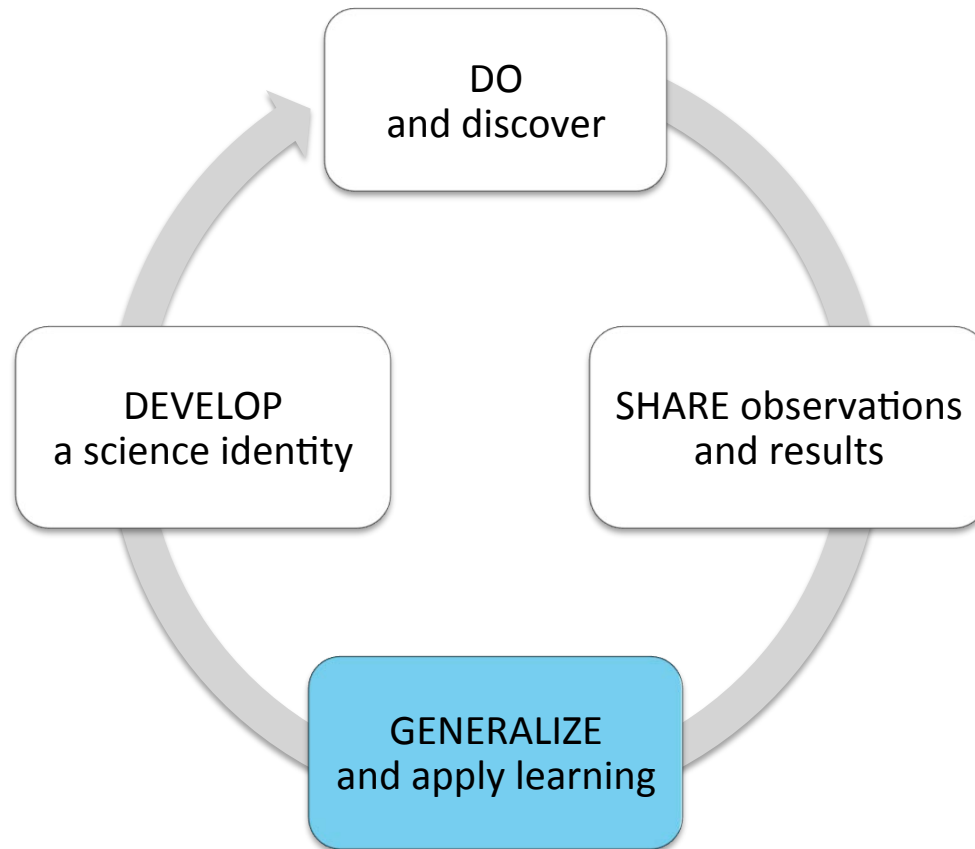


# Learning by doing

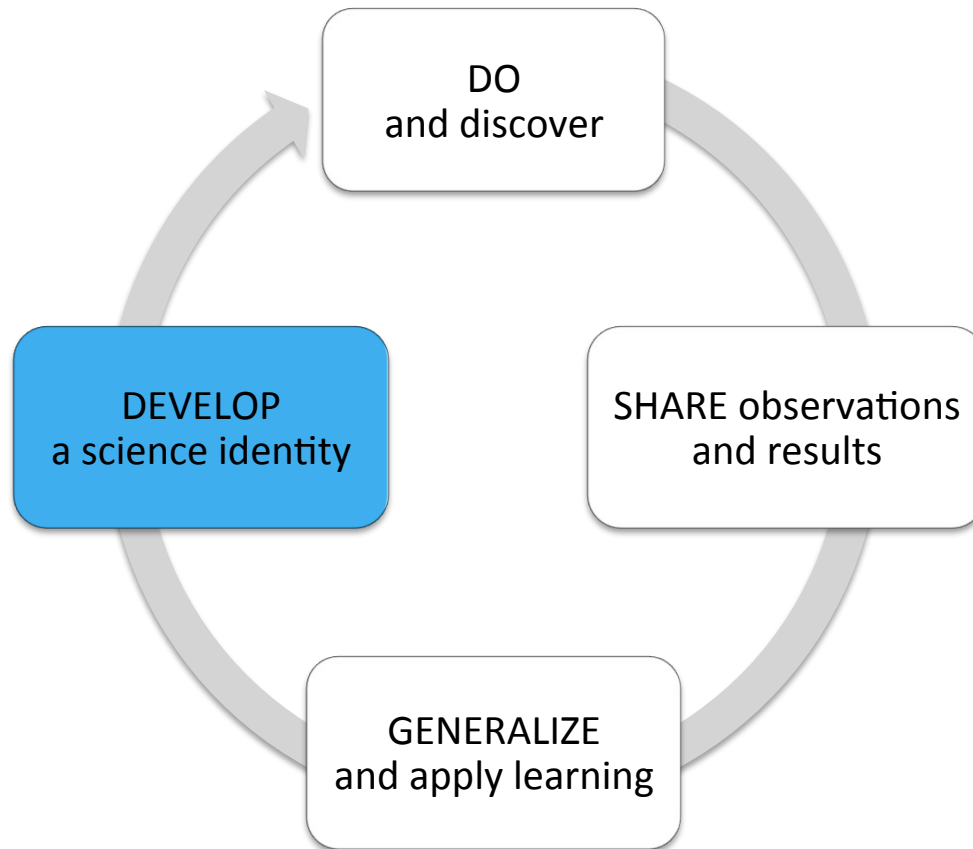




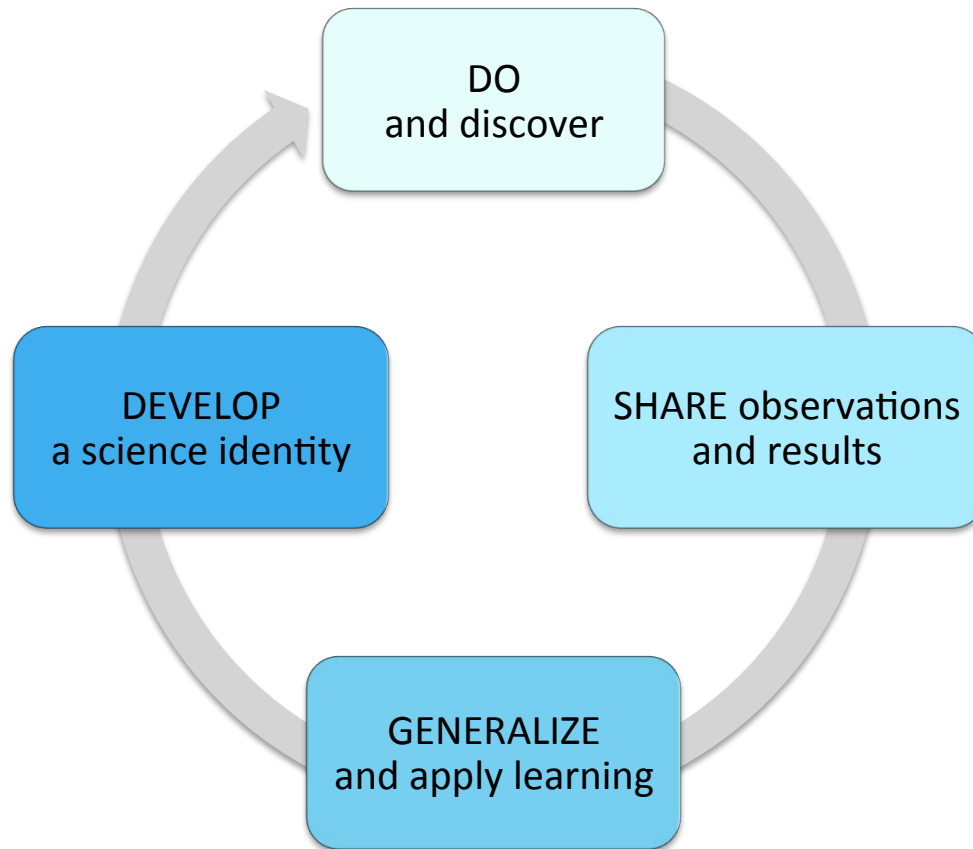
# Learning by doing



# Learning by doing



# Learning by doing





# **The Explore Science kit**



# Explore Science kits

- Designed for learning by doing
- Adaptable to different settings and learners
- Five units, each with several activities
- Everything you need is in the kit!

# Activities



## Smelly Balloons

How can we detect things too small to see?

### Try this!



Smell the balloons. Can you figure out what scent is hidden in each balloon?



Now, match them up! Color in the balloons, and next to each one, write the scent that's hidden inside.

Tiny scent molecules are leaking out of the balloon. They're too small to see, but you can smell them!

### What's going on?

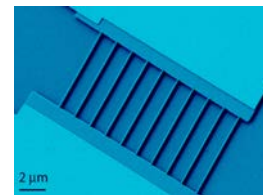
Scent molecules are so small that they can travel through the balloon. In fact, they're so tiny that they're measured in nanometers!

A nanometer is a billionth of a meter. That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.

Your sense of smell works by identifying the shape of scent molecules. Molecules are made of atoms bonded together. Everything in the world is made of atoms, including the balloons and the scented air inside them.

### How is this nano?

Nanotechnologies include new materials and tiny devices so small they're sometimes built from individual atoms and molecules!



Nano-sized biosensor



For example, researchers are creating nano-sized sensors that can sniff out very small amounts of chemicals in the air. Some of them work the way your nose does, by detecting the different shapes of molecules in the air.

# Try this!



## Smelly Balloons

How can we detect things too small to see?

### Try this!



Smell the balloons. Can you figure out what scent is hidden in each balloon?



Now, match them up! Color in the balloons, and next to each one, write the scent that's hidden inside.

# Try this!



## Smelly Balloons

How can we detect things too small to see?

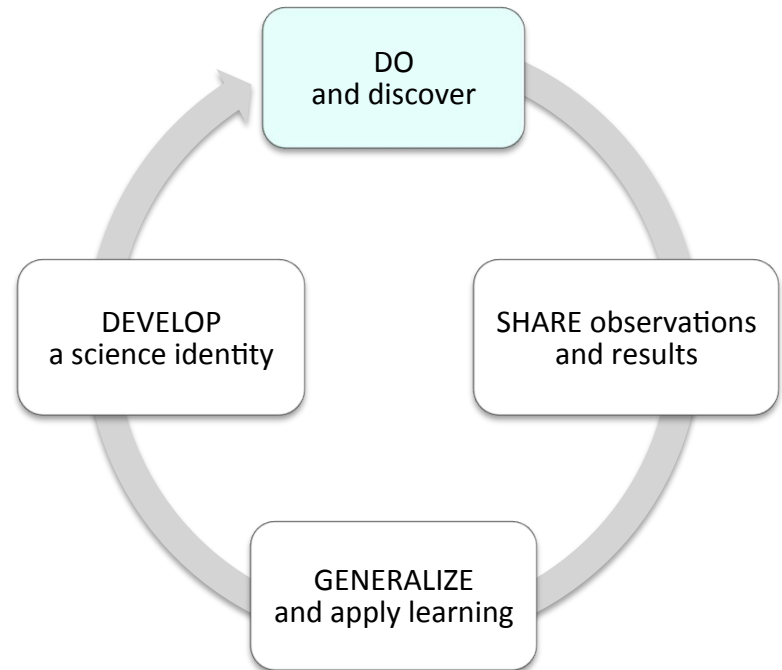
Try this!



Smell the balloons. Can you figure out what scent is hidden in each balloon?



Now, match them up! Color in the balloons, and next to each one, write the scent that's hidden inside.





# What's going on?

Tiny scent molecules are leaking out of the balloon. They're too small to see, but you can smell them!

## What's going on?

Scent molecules are so small that they can travel through the balloon. In fact, they're so tiny that they're measured in nanometers!

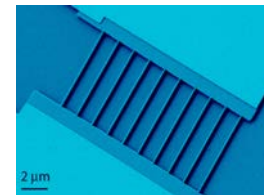
A nanometer is a billionth of a meter. That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.



Your sense of smell works by identifying the shape of scent molecules. Molecules are made of atoms bonded together. Everything in the world is made of atoms, including the balloons and the scented air inside them.

## How is this nano?

Nanotechnologies include new materials and tiny devices so small they're sometimes built from individual atoms and molecules!

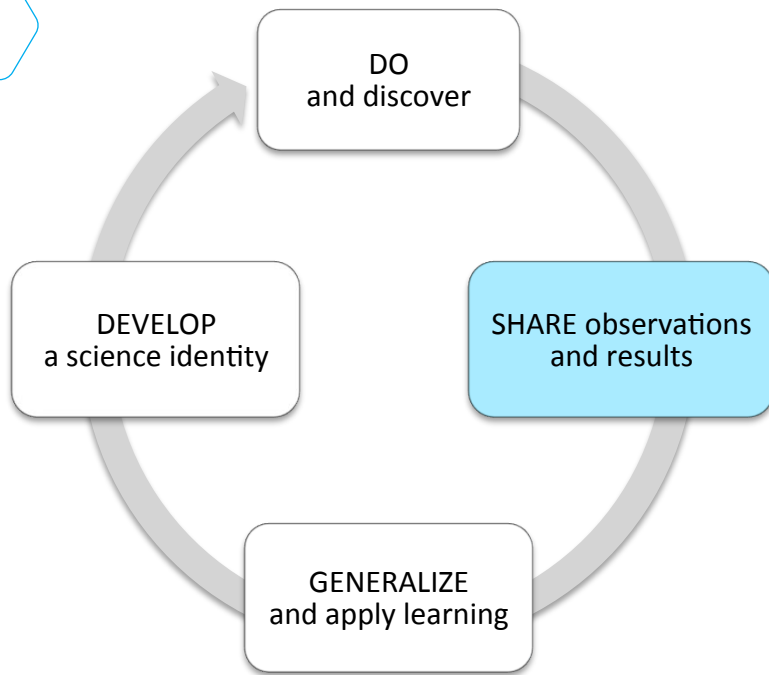


Nano-sized biosensor

For example, researchers are creating nano-sized sensors that can sniff out very small amounts of chemicals in the air. Some of them work the way your nose does, by detecting the different shapes of molecules in the air.

Photo of biosensor, Raj Mohanty, Boston University.

# What's going on?



Tiny scent molecules are leaking out of the balloon. They're too small to see, but you can smell them!

## What's going on?

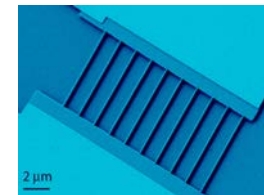
Scent molecules are so small that they can travel through the balloon. In fact, they're so tiny that they're measured in nanometers!

A nanometer is a billionth of a meter. That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.

Your sense of smell works by identifying the shape of scent molecules. Molecules are made of atoms bonded together. Everything in the world is made of atoms, including the balloons and the scented air inside them.

## How is this nano?

Nanotechnologies include new materials and tiny devices so small they're sometimes built from individual atoms and molecules!



Nano-sized biosensor



For example, researchers are creating nano-sized sensors that can sniff out very small amounts of chemicals in the air. Some of them work the way your nose does, by detecting the different shapes of molecules in the air.

Photo of biosensor, Raj Mohanty, Boston University.

# How is this nano?

Tiny scent molecules are leaking out of the balloon. They're too small to see, but you can smell them!

## What's going on?

Scent molecules are so small that they can travel through the balloon. In fact, they're so tiny that they're measured in nanometers!

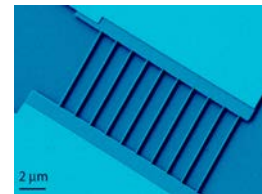
A nanometer is a billionth of a meter. That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.



Your sense of smell works by identifying the shape of scent molecules. Molecules are made of atoms bonded together. Everything in the world is made of atoms, including the balloons and the scented air inside them.

## How is this nano?

Nanotechnologies include new materials and tiny devices so small they're sometimes built from individual atoms and molecules!

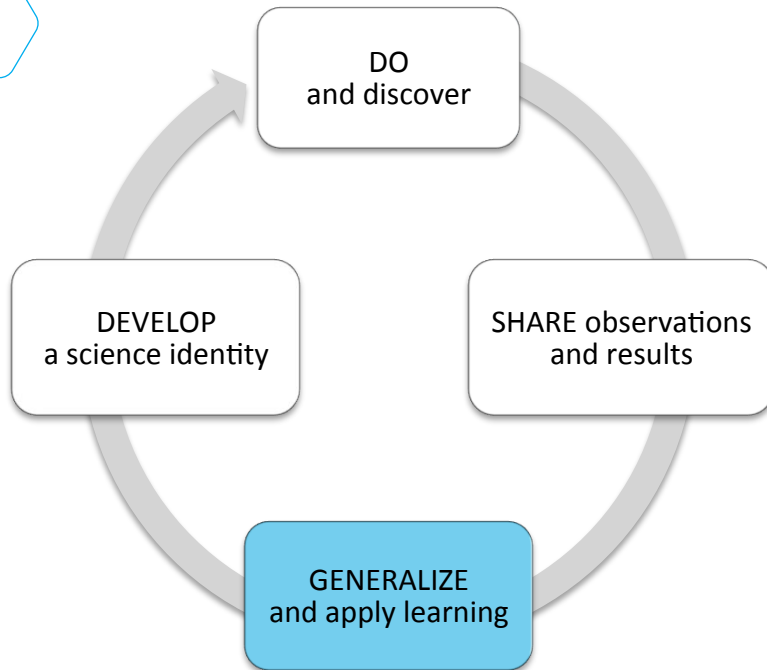


Nano-sized biosensor

For example, researchers are creating nano-sized sensors that can sniff out very small amounts of chemicals in the air. Some of them work the way your nose does, by detecting the different shapes of molecules in the air.

Photo of biosensor, Raj Mohanty, Boston University.

# How is this nano?



Tiny scent molecules are leaking out of the balloon. They're too small to see, but you can smell them!

## What's going on?

Scent molecules are so small that they can travel through the balloon. In fact, they're so tiny that they're measured in nanometers!

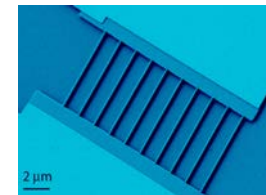
A nanometer is a billionth of a meter. That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.



Your sense of smell works by identifying the shape of scent molecules. Molecules are made of atoms bonded together. Everything in the world is made of atoms, including the balloons and the scented air inside them.

## How is this nano?

Nanotechnologies include new materials and tiny devices so small they're sometimes built from individual atoms and molecules!

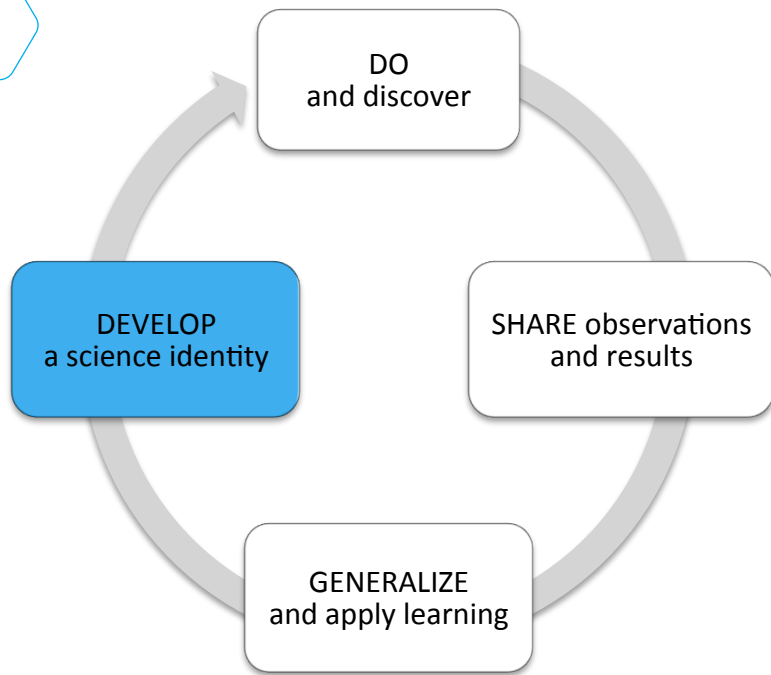


Nano-sized biosensor

For example, researchers are creating nano-sized sensors that can sniff out very small amounts of chemicals in the air. Some of them work the way your nose does, by detecting the different shapes of molecules in the air.

Photo of biosensor, Raj Mohanty, Boston University.

# Outcomes



The background features several decorative hexagons of varying sizes and colors (orange, blue, and green) scattered across the page. Some hexagons are partially cut off by the edges of the frame. The text is centered horizontally and vertically.

# Leading science activities



# Tips for success

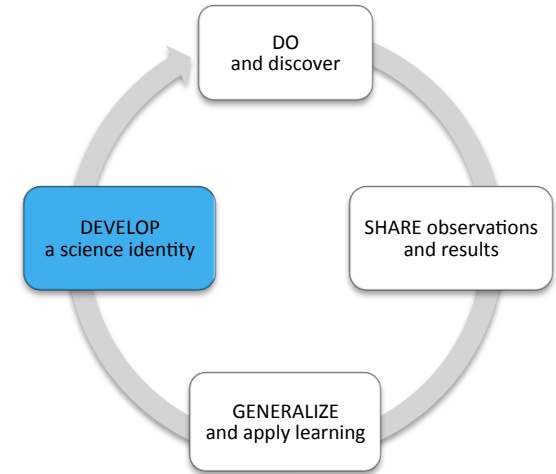
- Develop a science identity
- Do and discover
- Share observations and results
- Generalize and apply learning

# Explore Science

Encourage everyone to participate

Present science as a fun activity

Avoid stereotypes



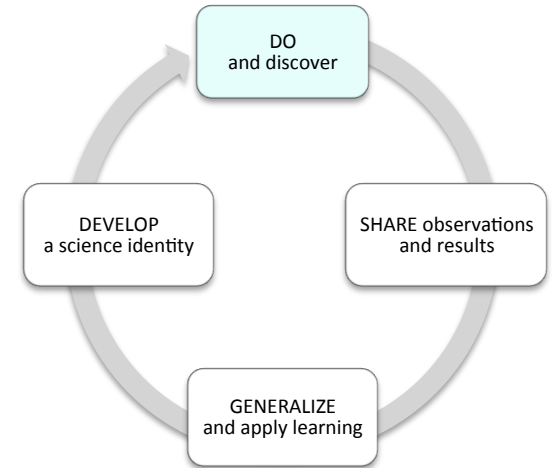


# Try this!

Provide clear instructions

Let learners do the activity!

Ask open-ended questions:  
“What do you think will happen?”



# What's going on?

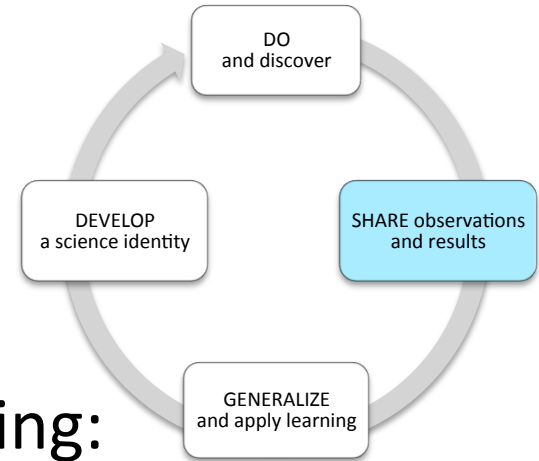
Ask questions about what happened:

“What did you notice?”

“Why do you think that happened?”

Model that it's ok not to know something:

“That's a great question! I don't know the answer.  
How do you think we might find out?”



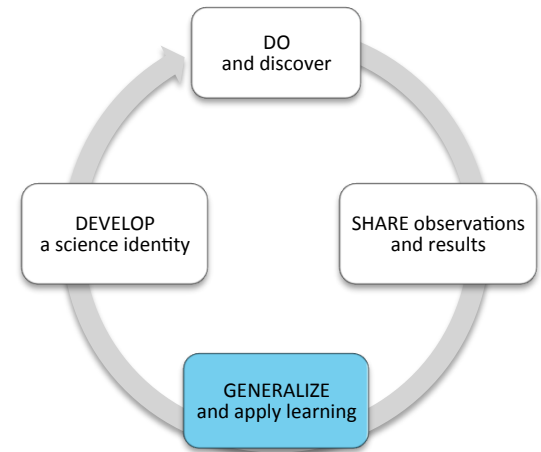
# How is this nano?

Ask questions that help learners make connections:

“What does this remind you of?”

“Where else could you use this?”

Suggest ways the activity relates to other interests



The slide features several decorative hexagons of varying sizes and colors (orange, blue, and green) scattered around the central text. Some hexagons are partially cut off by the edges of the slide. The central text is in a large, bold, black font.

**Wrap up**

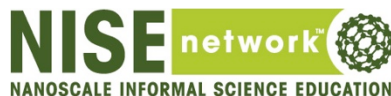


# Review

- Science outside of school
- The Explore Science kit
- Leading science activities

Thank you!





Experiential learning diagram adapted from 4-H Afterschool, *Guiding Growth*. Photo of Stained Glass Art activity by Emily Maletz for the NISE Network. Photo of teacher and students, iStock.com/all rights reserved.

This project was supported by the National Science Foundation under Award Nos. 0532536 and 0940143. Any opinions, findings, and conclusions or recommendations are those of the authors and do not necessarily reflect the views of the Foundation.

Copyright 2015 Sciencenter