

From **Medicine** to **Microbes**

A Project Investigation of Health

Joan Youngquist

When four-year-old Hailey asked, “Can we make a doctor’s office?” I thought it was a great idea. Like many early childhood educators, I wanted to support the children attending my family child care program in learning about health and avoiding germs. I have a strong interest in the project approach, and I wondered how it might be applied to this topic.

Helm and Katz (2001) state that projects should be based on children’s interests, involve concrete concepts, and have materials available for firsthand investigation. The teacher assistant and I had observed over the past year that *doctor* and

emergencies were recurring themes in the children’s play. The

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Photos courtesy of the author.

See *Caring for Our Children*, standard 2.021, Health, Nutrition, and Safety Awareness for 3–5 Year-Olds, and standards 2.044, 2.060, and 2.061

recent birth of one child’s sibling and the death of another child’s grandfather stimulated an interest in hospitals. Several parents were health professionals who might be willing to act as resources. Health seemed like a topic that would lend itself to a project investigation.

The doctor’s office: Children in charge

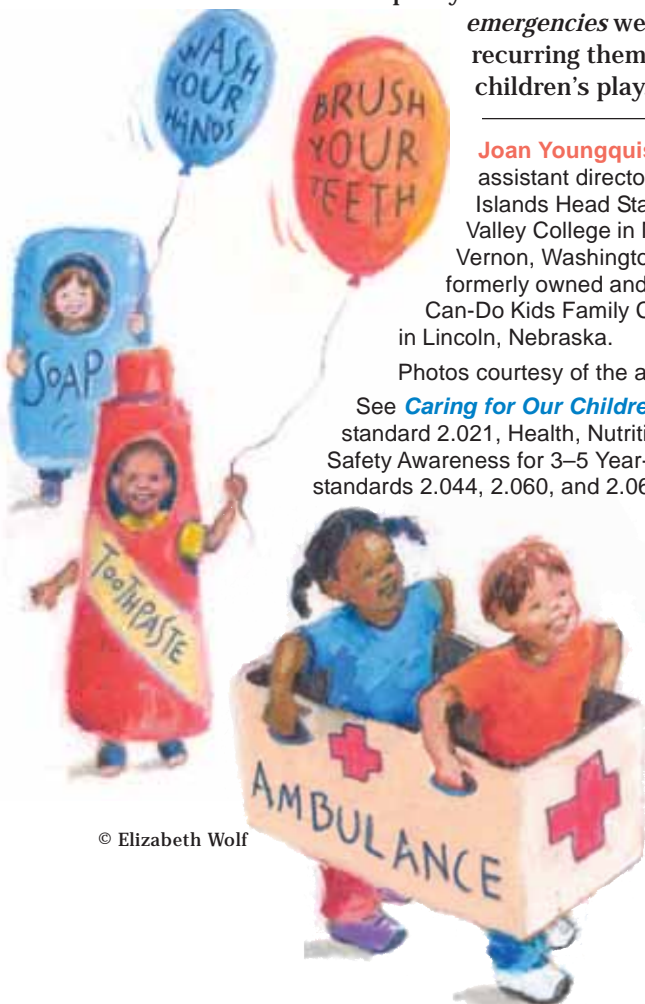
Fifteen children, ages two-and-a-half to five, were enrolled in my family child care program. Some children attended full-time and some part-time. From the beginning the children guided the direction of the investigation. Their suggestions and questions initiated activities and discussions. It was the children who suggested the idea of a doctor’s office and then worked to transform the drama corner.

As they worked and played, the children’s understandings about health became evident. Mallory and Hailey drew a plan for a doctor’s office that included expected items such as an examining table, lights, bandages, medicine, books, and needles. It also included a fish tank like the one Hailey had observed at her doctor’s office.

Children’s doctor play soon expanded beyond the drama corner. A cardboard box ambulance zoomed through the room carrying desperately ill teddy bears. Of course, this vehicle needed proper equipment. Children requested axes, hoses, blankets, gloves, medicine, tongue depressors, and first aid kits. They explained why each item was essential. I was surprised by the children’s knowledge.

Our inquiry into health and safety continued over the next two months. We started each day with a planning

The children guided the direction of the investigation. Their suggestions and questions initiated activities and discussions.



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A paramedic dad demonstrates how to splint a broken leg.

time when the children, the teacher assistant, and I all had a chance to suggest activities for the day some related to health and safety, some not. Children would select the activities they wanted to participate in first during free choice.

A core group of four or five children was intensely involved in the project. This group usually chose activities specifically related to health and safety. Their engagement in other activities was often project related as they explored and represented their growing understandings through drawings, block constructions, and dramatic play. Others in the group participated in project-related activities to varying degrees, depending on their interest in the topic, the specific activity, their

desire to interact with the core-group children, and their interest in alternative experiences.

As the investigation progressed, more children chose health and safety activities, although other typical preschool play occurred at the same time. At any given moment several children might be engaged in block play, playdough activities, or painting. Some would use their chosen medium to explore the project topic while others would use it in other ways. For instance, while building with blocks during choice time, Joshua and Marcus built a hospital while Nicole made a house and Jack, a racetrack. Some days everything we did seemed project related—small and large group activities as well as free choice investigations. Other days there might be little happening related to the project topic.

Families extend the learning

As children's knowledge moved to a deeper level, providing firsthand opportunities for investigation took some creative thinking. As commonly happened at our child care program, families played a key role. Perhaps because a number of them worked in the medical field, family members met this topic with enthusiastic interest and support from the beginning. They were eager to share their knowledge. One father

Families and health professionals were valuable resources in contributing hands-on experiences for our investigation of health and safety.

Children's Understandings of Microbes

After investigating microbes and expressing their understandings in a variety of media, children dictated a list of what they had learned:

- We can see them [microbes] with a microscope.
- We can see them with our eyes.
- They are bad.
- They cause fevers and things.
- They are in our bodies. They are everywhere.
- They are in our ears and nose.
- They are on our bottoms.
- They are big and slimy.
- These germs fight with guns and cannons.

- Good bacteria fight bad ones. They fight inside the body. Good germs are winning.
- White blood cells eat bacteria.
- Washing germs makes them dead. Then they go down the drain. They won't come back and cause infection.
- There are good microbes. They eat bad ones, dead things, and make bread.
- Good ones shoot poison into bad.
- Germs can get sick too.
- They go in our blood.
- They smell. I don't like them.

demonstrated first aid and talked with children about his job as a paramedic. Another parent invited us to visit his medical practice. During our visit some children became interested in the x-ray machine. Studying, planning, and building an x-ray machine for our drama corner became the focus of our investigation for about a week. This led to questions about our bodies.

Books with pictures of internal systems stimulated discussion and speculation. One family donated a stethoscope that allowed children to listen to each other's heart. Another provided boiled and bleached chicken bones so children could learn about the skeleton.

Families' contributions were not limited to activities at the child care program. They played a key role in facilitating continued learning at home. One Mom related, "Marcus remembered when I was in the hospital getting my tonsils out, and he asked me all about that. I thought he was too young to understand

much, but he really understood a lot!"

I was feeling successful in using the project approach to support children's study of health-related topics. Then our investigations took us in a surprising direction. As children developed a better understanding of how doctors and health professionals work to keep people healthy, they became more interested in how people become ill.

Children were inspired to make an X-ray machine for their doctor corner after visiting a medical clinic.

Real science

After our field trip to visit a doctor and his medical laboratory, children began asking more questions about sickness and germs. As we talked and read children's books about germs, their questions became more sophisticated: "Do germs get sick?" "How does medicine fight the germs?" "Do bacterias have babies?" "Are there germs in volcanoes?" I wondered how we could investigate germs firsthand, and just how much young children would understand. I was concerned that this was not a very concrete concept for children—germs

are invisible. However, I felt it was important to follow the children's lead.

I wanted to provide an opportunity for children to make real observations using real science. I remembered growing bacteria cultures in college biology, and I wondered how to make it feasible for preschoolers. I already had plastic petri dishes (from a science surplus company) that we had used to sort and collect insects in a previous project. The Internet provided a recipe for agar that grew harmless bacteria colonies. Knowing that the materials were available, I shared my idea with the children.

They were enthusiastic but felt that, to do the work properly, they should have a laboratory. Recalling our visit to the doctor's office, we planned and set up a similar laboratory in a corner of the room. Children felt it was important to have a microscope. They remembered the lab technician looking through a microscope at the doctor's office. A resourceful parent helped us locate

an old light microscope. To complete the laboratory, we added the petri dishes, writing and drawing materials, books, magnifying glasses, cups and eyedroppers, cotton balls, and a couple of old white shirts for lab coats. We were ready to begin our germ hunt.

Germs, germs, everywhere

I asked children where they thought germs might be in our family child care home. "The toilet!" "Our noses!" "Dirty plates!" "Mike's room!" (My son Mike had the typical room-cleaning habits of a 10-year-old.)

Children carefully sought out places where germs might lurk. They took samples by swabbing surfaces with a cotton swab and then rubbing the swab on the agar in the petri dish. When they were finished, we sealed the



X-ray machine is up and running!



Matching chicken bones to a picture of a human skeleton helped children learn about the inside of their bodies.

petri dishes with tape and labeled each with the location from which the sample was taken. We placed them in a foil-lined box (the foil reflects the heat—and looks more scientific than a plain shoebox) and set them under a lamp for warmth. Then we waited.

The children checked the petri dishes daily and made predictions about which one would grow the most germs. We were all sure the toilet would be the worst! As we waited, we read more about germs. The children began using scientific vocabulary—*microbe* instead of *germ*, for example. They learned that there are many kinds of microbes—bacteria, fungi, and viruses—and that not all of them are bad. Through hands-on experiments involving growing yeast and watching leaves decay, they found out about beneficial microbes.

After a few days we began to see results in the petri dishes. Not the slick, slimy bacterial colonies I had expected but rather something fuzzy! The petri dishes were growing fungi. Now it was time for the young scientists to get to work.

The laboratory became the hub of activity. Children carefully placed petri dishes under the scope to examine each fungus. They drew pictures of what they saw and discussed their findings. They counted fungal spots on the dishes and made a chart showing the locations in the house that resulted in the most fungi. The value of daily cleaning became clear as we observed very little fungus growing from the toilet sample but abundant growth in the sample taken from Mike's bedroom!

Representing the learning

Children demonstrated their growing knowledge through their play, artwork, conversations, and questions about what germs look like. Children's books, science magazines, old college microbiology texts, and Internet Web sites provided pictures of different

types of bacteria, fungi, and viruses. Children were fascinated by the pictures of viruses that look like spaceships, bacteria shaped like bunches of

Using authentic laboratory methods allowed children to make real observations.



This three-year-old draws what she observes when looking at a fungus through the microscope.

grapes, and hairy fungi. As children discovered what different microbes look like, they also discovered how and why some microbes make people sick by invading cuts or traveling with a sneeze.

I wanted to give the children an opportunity to represent what they were learning. I invited them to create their own microbes from paper and junk materials.

Children's creations were somewhat whimsical. One boy explained how good and bad germs battle each other with

clubs. Another child described good germs as being "sparkling and colorful." However, their descriptions also impressed me with how much they understood. They described different classifications of microbes. They created microbes that had specialized structures. They discussed how some microbes make other microbes sick. They knew that different microbes cause different illnesses and that our bodies have natural defenses against germs. And they created a variety of helpful microbes. I would never have guessed that three-, four-, and five-year-old children could understand so much about germs! (See "Children's Understandings of Microbes," p. 29.)

Recipe for Agar

Harmless bacteria and fungi will grow on this homemade agar in a shallow dish with a lid. The following recipe is enough for about 10 small dishes.

- 1 cube vegetable stock
- 1 packet of gelatin (or other jelling agent)
- ½ cup boiling water

- Dissolve vegetable stock and gelatin in the hot water.
- Pour enough into a shallow dish to cover the bottom.
- Cover and leave until jelly is set. Store upside down until used to prevent water condensation on the agar.
- When ready, collect a sample from a common surface using a cotton swab, and rub it gently onto the agar. Tape the dish shut to prevent contamination.
- Store in a warm place (such as a foil-lined box set under a lamp), checking daily for colonies.

Note: This recipe is from *Making Agar in a Kitchen*, from Science Education Partnerships, online at www.seps.org/oracle/oracle.archive/Life_Science.Biochem/2002.02/001014265704.22960.html.

Final phase

Inevitably there came a time when the children's interest in health and safety topics waned. Fewer children chose to engage in doctor play, create microbes, or work in the laboratory. Children's conversations and questions moved on to other topics. This was a signal that it was time to wrap up the project with a culminating activity.

Deciding on this culminating activity was a process in itself. We brainstormed ideas on how to share all that we had learned during our investigation of health and safety. "A book!" "A show!" "A sculpture!" children suggested. I asked if they might like to make up a story to act out and turn into a book. This suggestion was met with enthusiasm.

Working in teams allowed children to engage in ways that matched their interests and abilities. Some children participated on multiple teams, others on only one. Every child chose to be part of the effort in some way, and every contribution was valued by the group. The story team (guided by teacher questions) dictated a story that was acted out by the drama team. The prop team created germs and costumes. The germ team created a giant germ out of balloons, paper, and string. The camera crew took pictures of the drama—enacted again and again, with different people in key roles.

Creating our book took about two weeks. It generated new enthusiasm for the topic and allowed the children to explore anew their understandings—and misunderstandings! Providing a copy of the book for each child extended the learning into the home. Families expressed their appreciation for the end product and their amazement at the children's learning. One mother reported, "I didn't know Mallory knew so much about germs—she knows way more than I do!"

Conclusion

Our investigation of health lasted almost two months. It culminated with a play and a book created by the children that explained how to stay healthy and fight bad microbes. The entire project investigation resulted in deeper learning than any standard health and safety curriculum could have provided. It went beyond group activities, book-based lessons, or mealtime discussions about hand washing and healthy foods. The resourcefulness and willing participation of families and members of the health community helped to make the

Every child chose to be part of the effort in some way, and every contribution was valued by the group.

investigation visible and concrete. While children's developing knowledge wasn't always scientifically factual, it was surprisingly sophisticated.

When the teacher assistant and I followed the children's lead, listened to their questions, and avoided putting artificial limits on their learning, we all gained a real understanding of healthy bodies—and microbes—through the project approach.

Reference

Helm, J., & L. Katz. 2001. *Young investigators: The project approach in the early years*. New York: Teachers College Press.

Resources for Preschool Science Investigations

Equipment such as petri dishes, eyedroppers, disposable pipettes, plastic test tubes, magnifying glasses, microscopes, and dissecting scopes can support young children in doing real science and inquiry into health and safety. Here are possible sources of science equipment:

- local doctor, veterinary, and other medical offices
- college or university science departments (biology, microbiology, agriculture, nutrition, pharmacy . . .)
- science surplus or discount stores, many available online
- medical supply companies

Informational resources

- Photographs of viruses and bacteria can be viewed online at The Big Picture Book of Viruses (www.virology.net/Big_Virology/BVHomePage.html) or at BioMedia Galleries (www.ebiomedia.com/gall/bacteria/#).
- Local libraries are a good source for children's books about microbes, germs, health, and the body. Look also in the adult section for photos of microbes in microbiology texts and in issues of science magazines such as *Science*, *Scientific American*, *Nature*, and *National Geographic*.
- Field trip destinations that support investigations of health and safety include doctor offices, veterinary offices, hospitals, nursing homes, college or university science laboratories, and ambulances or fire stations.
- Visits by health professionals bring hands-on learning experiences to the classroom. Ask doctors, nurses, medical technicians, veterinarians, veterinarian technicians, nutritionists, paramedics, and firefighters to come and share.

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