Instructional Scenarios for Benchmark 1A (3-5)#1

Instructional Scenario A

"I see the pond!" Anne-Marie ran down the wooded hill. The rest of Mrs. Jacobs' 5th-grade class followed her along the nature center trail toward the shallow pond.

"Last time we were here it was frozen," said Mark.

"Yeah," agreed Alfred. "Remember sliding on it?" He took long sliding steps along the edge of the pond.

"It sure is warmer now," said Beth. "I'm taking my jacket off." She carefully placed her jacket at the foot of a tree.

"I wonder what temperature the water is now," said Mark.

"We can find out," said Mrs. Jacobs, swinging her backpack down. "Fortunately I have some thermometers in our kit here. Let's find out what temperature the water is now."

She gave out thermometers to four students, who carried them carefully to the edge of the pond. They stooped down, holding the thermometers so that the bulbs were several centimeters below the water's surface.

"How long do I have to hold it here?" asked Jeff, wiggling.

"Five minutes," responded Beth. That's what my mother says when I'm sick and she puts a thermometer in my mouth."

They waited a few moments longer.

"All right," called Mrs. Jacobs. "Let's see what we've found out. Everybody needs to take the thermometer out at the same time."

As their friends looked over their shoulders, the students examined the thermometer readings.

"Mine is 18 degrees," said Mark.

"Mine is 19," said Beth.

"Hey! Mine is a little over 64 degrees!" said Jeff. "I was really in hot water!"

"Let me see that thermometer," demanded Alfred. Jeff handed it to him.

"What is your reading, Anne-Marie?" asked Mrs. Jacobs.

"I have a little over 17 degrees Celsius," Anne-Marie replied.

"How can we explain these differences?" asked Mrs. Jacobs.

"I know how to explain Jeff's," said Alfred. "He needs to say 64 degrees WHAT. It's 64 degrees FAHRENHEIT."

"Good for you, Alfred," said Mrs. Jacobs. "And I know that next time Jeff will be more careful to notice what units his thermometer shows."

"Mine is Celsius," said Anne-Marie.

"Yes," responded Mrs. Jacobs. "How can we explain that one of us got 17, one got 18, and one got 19 degrees Celsius?"

"That's pretty close," said Amparo.

"I'd like each of you to have a friend check your thermometer reading," Mrs. Jacobs said.

"I don't see how you got 19, Beth," said Amparo. "It's right on the 18 degree line."

"No, it's not," said Beth. "It's on the line right below 20, so it's got to be 19."

"No, it's not. Look," said Amparo. "There are four lines between the 10 and the 20. That means each line is for two degrees. Look. I'll show you with my fingernail. There's the next line after 10. That's 12. Then comes 14, then 16, and then 18. You really got 18 just like Mark."

"Mine has one line for each degree," said Mark.

"And you're right. I say it's 18 also," said Jack, handing back Mark's thermometer.

"So you've learned how important it is to check what each line on the thermometer means. Let's consider the last difference. How can we explain the difference between 17 and 18 degrees Celsius?" asked Mrs. Jacobs.

The students considered this.

"Maybe the thermometers aren't just exactly the same," suggested Jack.

"Perhaps," agreed Mrs. Jacobs.

"Maybe the water really was a little cooler where Allison was," suggested Jeff.

"What would be evidence that that is true?" asked Mrs. Jacobs.

"We could take the temperatures again," said Alfred.

"Yes," said Mrs. Jacobs. "Let's have other people try this time."

"Mrs. Jacobs," Amparo said softly. "Why did you bring all different thermometers?"

"They're not ALL different," replied Mrs. Jacobs, smiling at her. "They're just different enough."

Instructional Scenario B

"Forty-two minutes!" said Allison. "I predicted ten minutes."

"Mine took only thirty-three minutes," called Benjy from across the room."

Mrs. Gupta raised her hand, and in a moment everyone in her 3rd-grade class was silent, watching her. "Do I understand that everyone's ice cube has now melted completely?" asked Mrs. Gupta. "If you have finished your observation, you need to calculate how long it took your ice cube to melt. Please place your results on the class chart."

When all the students had recorded their data, Mrs. Gupta invited the students to look carefully at the chart. "What interests you about these numbers?" she asked.

Keisha spoke first. "I'd like to know why Benjy got thirty-three minutes and the rest of us got over forty."

"What does Benjy's figure of thirty-three minutes **mean**?" asked Mrs. Gupta.

"It means it took his ice cube thirty-three minutes to melt," said Miguel.

"That's right," said Benjy. "I watched it very closely." As he spoke, he picked up the bowl, now containing water, and rotated it gently, so that the water swirled around.

"I saw you doing that before, too," commented Melissa. "While your ice was melting, you kept picking up the dish and swirling it around. But we just left our dish on the desk while the ice melted. I'll bet that's why yours melted sooner."

Benjy looked puzzled. "Would moving it around make it melt sooner?" he asked.

"How could we find out?" Mrs. Gupta asked quickly.

The students thought for a moment.

"We could do another experiment," suggested Allison. "This time half of us could leave our dishes on the desk and the others could swirl their ice around."

"We'd have to all swirl the same amount," said Miguel.

"Please work with a partner to design an experiment to test Melissa's idea," said Mrs. Gupta.

Instructional Scenario C

For six weeks Dr. Dolde's 5th-grade class had been carrying out an experiment to determine whether a plant fertilizer made bean plants grow taller than they would have grown without any fertilizer. Today they would take their final measurements of the height of the plants. But first Dr. Dolde asked the students to look at all the plants lined up on the window sill.

"The two on the end are ours," said Joanne. "Our fertilized plant is taller than any of the others."

"About three centimeters taller," added her partner, Cierra, somewhat smugly.

"And your control plant, that didn't get the fertilizer, is about the same as everybody else's control plant." Dr. Dolde turned to the class. "Why do you suppose their fertilized plant is so much taller than everyone else's?"

"Maybe they used extra fertilizer," said Emory.

"Or maybe they gave their plant more water," added Louis.

"We did not," Cierra said indignantly. "We followed the procedures **exactly**. We did exactly the same things the rest of you did."

"That's right," affirmed Joanne.

"Then how can this difference be explained?" asked Dr. Dolde.

The students thought for a moment.

"Maybe their plant got more sunlight," said Al.

"When we're ready to leave in the afternoon, that part of the windowsill is still sunny, but the other end is in shade."

"If it was the sun, wouldn't their control plant be taller, too?" asked Emory. "It was right next to the one that got fertilized."

Dr. Dolde waited. "Are there any other ideas?" she asked.

Louis spoke slowly. "Maybe the seed they planted was a kind that would get bigger than the others," he said.

"We planted exactly the same kind of seed as the rest of you did," said Cierra, her voice rising slightly. "**Exactly** the same kind. Out of the same seed packet."

"Sure you did," said Louis. "But it could still be a seed that would grow bigger. Look. We're all people, but some of us grow bigger than others."

"Or think about cocker spaniels," said Emily, who had brought her pet to school the previous week. "Sometimes one cocker spaniel will be bigger than others. Not **much** bigger, but a little bigger. Maybe your bean plant is just a bigger bean plant than most."

"We've heard three ideas about why Joanne's and Cierra's plant might have grown taller than the other fertilized plants," said Dr. Dolde. "One idea was that

a mistake might have been made in the amount of fertilizer or water used. Joanne and Cierra do not think they made a mistake, but, as we've found out lots of times, **anybody** can make a mistake. Another idea was that this plant got extra sun. The third idea was that the seed from which this plant grew carried information that made this plant grow taller. How could we test these ideas?"

"I **guess** we could do the experiment again," said Cierra, "though I'm **sure** we didn't do it wrong."

"This time we could have Joanne's and Cierra's plant at the other end of the window sill," suggested Al.

"What would be evidence that it was the sun that made the difference?" asked Dr. Dolde.

"If the plant that's where Cierra's and Joanne's was grows taller in the second experiment," answered Emory.

"But wait a minute," said Louis. "We started this experiment in early March. Now it's the middle of April. The sun is going to be different."

"That won't matter," said Joanne.

"Won't it?" asked Dr. Dolde.

"I don't think so," Joanne said slowly, "because we'll be comparing the plants in the new experiment to each other, not to the plants in **this** experiment."

"Next year's class could do it again, starting in March, and see whether they have the same thing happen," suggested Emily.

"They **certainly** couldn't do it as well as **we** did," said Cierra.

"There's another problem," said Louis. "If this plant really grew taller because of the seed it came from, there's no way we can test that, because we can't ever be sure we'll get another seed that is for a tall plant."

"What if more than one thing made it get taller?" asked Joanne.

"Sometimes it is really hard to find out why results are different in an experiment," said Dr. Dolde. "I think we **do** have time to conduct this experiment again before the end of the year, and, while we won't be able to find out for sure what made Joanne's and Cierra's plant grow taller, we can probably get some evidence about whether an experimental error or extra sun caused the difference."

"For now," she continued, "I'd like you to complete your measurements so that we have our measurements from this experiment accurately recorded. For homework, I'd like you each to assume we're going to repeat this experiment to test whether the amount of sun made the difference. Please write a paragraph in which you tell me whether in this new experiment Joanne and Cierra should place their plants in the same place or a new place or whether it doesn't matter. Of course, you must include a justification of your decision."

Instructional Scenario D

In November Mr. MacCauley's 5th-grade class took a trip to the nature center.

There the students found some interesting things hanging on some bushes. They were about two centimeters long and brown in color.

"They look like they're made of the dried up twigs from this bush," said Consuela.

"You can squeeze it a little bit," said Paul.

Mr. MacCauley told the students that the objects were bagworm egg cases.

"What's inside them?" asked Eddie.

"We can collect them and find out," responded Mr. MacCauley. "If we leave them on this bush, they will kill it, so it's okay for us to collect them."

The next day in class he showed the students, working in pairs, how to cut carefully to split the egg case down one side.

"Write down our description of what's inside it, Jenny," Alonzo said to his partner. "It's black and hard and shiny and it has lines on it."

"How big is it?" asked Jenny, handing Alonzo a ruler.

"Twelve millimeters," responded Alonzo.

"I wonder what's inside that shiny black thing," said Jenny.

"Your turn to investigate," Alonzo said, handing Jenny the scissors.

"Look!" she said. "Look at this fluffy yellow stuff that's inside the black thing. And here! These look like tiny little beads. You can write down that they're cream colored, not as yellow as the fluffy stuff."

"How big are they?" asked Alonzo.

"They're **tiny**," responded Jenny. She measured one. "Less than a millimeter."

"I wonder if the others found the same thing," said Alonzo.

The first eight pairs of students to report described finding the same thing inside the egg case as Alonzo and Jenny had found.

But, when it was Paul's and Matthew's turn, they reported something different.

"Ours wasn't like that," said Matthew. "We cut our egg case open and there was this gray, oozy stuff inside."

"And we saw tiny, fat little things wiggling in it," added Paul.

"Interesting," Mr. MacCauley said. He picked up the egg case dissected by Paul and Matthew and showed it to each student in the class.

"There is a kind of wasp," Mr. MacCauley went on, "that lays its eggs in bagworm egg cases. That might be what has happened here," the teacher speculated.

"Tell me something," he continued. "Suppose we go to the nature center again and find some more bagworm egg cases. Suppose a 4th grader asks you what is inside them. What would you say?"

“I’d say, ‘Open it and see’,” said Eddie.

“That would be a good answer,” said Mr. MacCauley. “But what if the 4th grader couldn’t do that? What would you tell him is inside the bagworm egg case?”

“I’d say it’s got a black thing and inside that is yellow fluffy stuff and some tiny, tiny beady things,” answered Jenny.

“But you can’t say that,” objected Paul. “You have to say that most are probably like that, but one could be different. Like ours was different.”

“How many of the rest of you found the same thing inside the bagworm egg case that Jenny and Alonzo did?” asked Mr. MacCauley.

All the others responded that their findings were the same as Jenny’s and Alonzo’s.

“Paul is right,” said Mr. MacCauley. “We would have to say that in our investigation we found that most bagworm egg cases contained the fluffy material and the cream colored eggs you have described. However, we would also have to say that one was very different.”

“I think today you have learned something very important about science,” Mr. MacCauley continued. “Suppose Paul and Matthew had not opened the egg case they did. Suppose they also had found the yellow fluffy material and the cream-colored eggs. We might have concluded that all bagworm egg cases would always have those same things inside. Now we know that in science we can say what we have found, but that the next time we look at something, it’s possible that we will find something different.”