

Seating Arrangement

Christina	Ogechi	Martha	Sarah	Mick	Bernadette
Liz	Lin	Shekira	Jillian	Benny	Rania

Charles	Safriman	Kip	Pravin
Shea		David	

Monday, September 11, 1989
This is the first day of mathematics class.

The students come into the classroom after lunch and sit in their assigned seats. There is a brief discussion of when it is appropriate to go to the bathroom during math class and a discussion about the notebooks and pens that they will be using for their mathematics work. Ball then introduces the first math problem that the students will be working on.

Ball: Okay, we're going to work on a problem today that involves some money. And I want to talk to you a little bit about it. Then I'm going to give you a chance to work on the problem by yourself or talking to somebody near you if you want to. Here's a bunch of money in this tray here. Okay? I'm going to hold up some coins and see if you can t--see, I don't know if you'll be able to see. See if you can tell me what they are. What's this one? Shekira?

Shekira: A penny.

Ball: A penny. Do you know how much a penny is?

Shekira: 1 cent.

Ball: One cent. Okay. Here's another coin that's in there. Anybody know what this one is? I know it's kind of hard to see from where you are. Ogechi?

Ogechi: A dime.

Ball: A dime. And do you know how much a dime is?

Ogechi: 10 cents.

Ball: How did you know it was a dime? How could you tell?

Ogechi: Because it's little and silver.

Ball: What about this one? Kip, can you see this one? Jillian, what do you think that is? Do you want to see it?

Jillian: Nickel.

Ball: And how much is a nickel worth?

Jillian: 5 cents.

Ball: 5 cents. There are pennies, dimes and nickels in here. Comment Christina?

Christina: No. I thought there would be quarters in there.

Ball: No, there's just-- no, you thought there were going to be quarters, good thinking, but there aren't. Okay so there are three kinds of coins in here, okay? I'm going to take some of these and put them in my pocket. I'm going to take some pennies, I'm going to take some nickels, I'm going to take some dimes. There are some of each in my pocket. Now suppose I reach into my pocket and take out three coins. Let's say I just take out two coins. How about if I take out two. How much money would I pull out? How many cents? I'm going to pull out two coins. How much money could I pull out? Like this, like I'm not even looking and I'm going to reach in and pull out one coin and reach in and pull out another. How much money could I pull out? (pause) Liz?

Liz: 10 cents.

Ball: How could I pull out 10 cents?

Liz: Two 5's.

Ball: What do other people think about that? If I pulled out two nickels would I have 10 cents?

Students: Yeah.

Ball: How do you know that? How do you know that that would be 10 cents? Ogechi?

Ogechi: Because 5 plus 5 is 10.

Ball: Okay. Everyone--everyone agree with that?

Students: Yeah.

Ball: You sure? Okay. Does anybody have a different idea of what I could pull out of my pocket? Christina?

Christina: You can just pull out a dime.

Ball: I have to pull out two coins.

Christina: Oh, um (*long pause*). Well then you can't pull out more-- you can't pull out any more money.

Ball: Why? Why, Christina?

Christina: If you had a nickel and you pull out some pennies and you have 5 more pennies, you could have . . .

Ball: Remember that I'm only going to pull out two coins. Okay? I think you're trying to find other ways to make 10 cents right?

Christina: Yes

Ball: We aren't trying to find other ways to make 10 cents, I want to know what else could I pull out? If I pulled out two coins, how much money would I have? (*long pause*) Rania, what do you think?

Rania: You could have 11 cents.

Ball: How could I have 11 cents?

Rania: You could pull out a ten cent and a one cent.

Ball: Let's see if I can do that. Here's a 10 cent and a 1 cent. Is that two coins?

Students: Yeah ... No ...

Ball: Is it 11 cents?

Students: Yes.

Ball: Okay, so so far you said I could get 10 cents out of my pocket or I could get 11 cents out of my pocket. Is there anything else I could get out if I took two coins out? (*pause*) Pravin, can you think of something else I could get out? (*long pause*) Do you remember what coins are in my pocket?

Pravin: Pennies.

Ball: Pennies, what else?

Pravin: Nickels.

Ball: Nickels, what else?

Pravin: Quarters.

Ball: No quarters. What was the third kind of coin that was in there? Kip, remember what it was? What?

Kip: Dimes.

Ball: Dimes. I have pennies, nickels and dimes. If I take two coins out of here, what might I have?

Pravin: Pennies?

Ball: If I take two pennies, what would I have?

Pravin: Nickel?

Ball: What?

Pravin: Ten?

Ball: Oh, a penny and a dime?

Pravin: Nickel?

Ball: Well which is it? You have to tell me two. Can you tell me--

Pravin: . . . a dime and a nickel.

Ball: A dime and a nickel. Okay, there's a dime and a nickel Pravin. How much money is that? (*long pause*) Do you know how much this one is?

Pravin: 10 cents.

Ball: This one is 10 cents and how much is this one? (*pause*)
Kip, can you tell him?

Kip: 5 cents.

Ball: 5 cents. Do you know how much that is together?

Kip: 15.

Ball: 15 cents. Bernadette?

Bernadette: You could put a 5 and a 1 and you'd get 6 cents?

Ball: Is that right? If I get a 5 and a 1 is that 6 cents?

Students: Yeah.

Ball: Is that two coins?

Students: Yeah.

Ball: Here's a tough question for you and I'm going to let you work on this a little bit alone. What's the *most* money I can pull out of my pocket? If I can only get two coins? What's the *most* I could get? Kip, are you thinking about it too? The *most* money I could get out of my pocket. I have dimes and nickels and pennies. What's the *most* I could get? If I'm very, very lucky. (*pause*) Mick, what do you think?

Mick: Two dimes.

Ball: And how much money would that be?

Mick: 20 cents.

Ball: Why do you think that's the most?

Mick: Because you have to take out two, two cents, two, um two-- if you pull out two nickels, two pennies or two dimes--

Ball: Uh huh.

Mick: --and um and you don't got quarters, so and you got pennies and nickels and those aren't higher than dimes.

Ball: What do other people think about what Mick said? Do you agree with it or disagree with it? Charles, what do you think?

Charles: I agree with it.

Ball: You agree with it? Why do you agree with it?

Charles: Because a dime is the highest um a dime has the most, worth the most than the pennies and nickels and dimes. And the, and if you have two dimes it's more than any of those if it has two, two, um, two pennies or two nickels or two dimes. And the highest would be two dimes.

Ball: Okay. What's the *smallest* amount of money I could get out of my pocket. If I was unlucky, what would be the *least* amount of money I could get if I pulled two coins out? (*pause*) Jillian?

Jillian: 2 cents.

Ball: How would I get 2 cents?

Jillian: Take out 2 pennies.

Ball: Why would that be the least, Jillian? How do you know that?

Jillian: Because--

Ball: There they are.

Jillian: --that is the lowest, the penny is the lowest thing that you have in your pocket.

Ball: Liz, what do you think about that?

Liz: I think that I agree with her.

Ball: Lin?

Lin: I agree with her.

Ball: Why?

Lin: Because a penny like is the like less is the coin that only cost 1 cent.

Ball: I'm going to pull this shade up for a moment and I want you to copy down the problem that's there. I want you to read it first. This is what we've been talking about. Could somebody read it? Safriman, can you read that?

Safriman: I have some pennies, nickels, and dimes in my pocket. Suppose I--

Ball: That's right. Suppose I--

Safriman: pulled?

Ball: pulled

Safriman: out two co--

Ball: What are these?

Safriman: Coins?

Ball: Coins.

Safriman: How--

Ball: Shekira, what is it?

Shekira: money.

Ball: Before money.

Shekira: How much money would I have.

Ball: Okay, that's the question we've been talking about, right? So, I'd like you to copy that problem into your notebook and then I'm going to give you some money and I want you to see if you can figure out what you think about that problem. How much money would I have if I got two coins out. We've talked about some answers haven't we? Do you think we've found all the answers yet?

Lin: No.

Ball: I don't know. See if you can find out and you can work with money or you can make drawings, or you can write, however you want to do it to figure out the problem. Don't start using the money or whatever you're going to do until you've copied down the problem so you can remember what you were working on if you look at it later.

Ball: We have 15 cents, 20 cents, 6 cents, 11 cents, 2 cents and 10 cents. Any more? Look at your lists and see if you have anything that we didn't put on the board. *(pause)* No, Ogechi? You don't have anything else in your notebook? *(pause)* Jillian, do you have anything else in your notebook? Rania, do you? Does anybody? How many different possible answers did we find for this problem? How many answers did we come up with here? Ira, how many answers?

Ira: Six.

Ball: Six answers. How do we know that we have them all though? How do we know there isn't a seventh one? Or an eighth one that we didn't find yet? Ogechi?

Ogechi: There aren't any quarters.

Ball: Why would that matter?

Ogechi: Because you can only use um, pennies, um . . .

Students work on the problem alone or with the people sitting nearby for most of the remaining class time.

A little before the end of class, Ball brings the whole class together to discuss their solutions; as a group, they generate a list of six solutions that they have found .

Ball: Ogechi thinks--maybe somebody can pick up on what you're saying--Ogechi thinks that because we don't have any quarters, this is all we can make. (*pause*) Lin, what do you think about that?

Lin: I think we have them all 'cause we had lots of them already and all the people at my table had six.

Ball: So this is what everybody else got, but how do we know that we just didn't find the seventh one yet? Is there any way we could be sure? Sarah?

Sarah: Well, we don't have, we can only pick up two coins and if--

Ball: Talk so that other people can hear you though. Listen to Sarah you guys.

Sarah: We can only pick up two coins and if we pick up 7 then we would be picking up 3 or 4.

Ball: So to get a seventh answer we'd have to pick up 3 coins?

Sarah: Um hum

Ball: How do you know that? How do you know we can't think of another possible way of picking up two coins?

Sarah: Well, ya see, six is a dime-- a nickel and a penny and if we add another penny it will be 7 and it will be 3 coins.

Ball: Oh, you think I'm asking if you could make 7 cents. I'm saying could we find 7 answers? We found 6 answers. And I'm saying, how do you know there isn't a seventh answer? (*pause*) Shekira?

Shekira: I've been trying this out. If you keep picking them up you're just going to get the same answers.

Ball: If you keep picking them up you'll get the same answers? How many people solved this problem by picking up coins until they got the same ones again? Raise your hand so we can see. How many people reached into the box or onto their pile and kept picking them up until they had found--'til they started to repeat? Who used a different strategy? Who didn't do it that way? Did anybody do it differently? Kip and Pravin, could you guys not play with your coins right now? What's another way to do this problem besides picking up the coins until you start getting the same thing again? Lin?

Lin: Um, that you can--you first think of what you can make from, you can make out of nickels, dimes and pennies and then you take, and then you write them down and you think about it some more until you're--(*pause*) then you'll get them all.

Ball: Okay, I want everybody to try very hard to think, before math tomorrow, if you can find another answer for this problem. What else besides 15 cents, 20 cents, 6 cents, 11 cents, 2 cents or 10 cents? Okay? I don't want you to think right now and think very hard to see if you can find still another thing that I could pull out of my pocket if I pulled out 2 coins.

The class period ends.
