Stragegy revision

The tutors in the trial runs did not encourage students to use the process of revising their strategy. However, place-value adjustment is insufficient to produce a good estimate if the intermediate solution is inappropriate. In this example, Gerri worked with a student, Melissa, who struggled with mental computation when estimating 62 × 23. Melissa would have benefited from revising the strategy. Gerri begins the conversation.

Sixty-two × 23. [*Melissa hesitates and does not answer.*] **What do we want to round the 62 to?**
Sixty.

Good.
And [*pausing*] 23 to 20.

OK. So, 60 × 20. What do we think that is?
[*Thinking*] 5. Well, 50.

OK. Let's try 50 [*typing*]**. Oops. Way too low. So, what are we going to do when it's too low?**
Add another 0.

Let's try again. Add another 0 [*typing in 500*]**. Oops. Wow. We're too low again. But not *that* low. Hmm. What do we want to do?**
Add another 0 [*laughing*].

OK. That makes it 5000 [*entering 5000*]**. Oops. Way too high. So, we know that it's between 500 and 5000. Can you give me a number? Wanna make an estimate between 500 and 5000?**
Umm, 4000 is probably between it, but, probably 50 [*pausing*]. And 50's too low. So, I don't really know.

So, we were at 500 and that was too low, and 5000 was too high; so we could maybe try 1000. That's in the middle. Try that?
OK.

OK, let's just try. I don't know what the answer is either [*typing in* 1000]**. So, we're getting closer. We're in the box.** [*The error bar is actually outside the box.*] **So, what's a little bit more than 1000 but not as big as 5000?**
Two thousand?

OK. Let's try 2000. [*This estimate is too large by 40 percent.*] **All right. Now we're between 1000 and 2000. So, what's between 1000 and 2000?**
Um, I don't know what's in between it.

Maybe, hmm. So, 1000 can be said as *ten-hundred*, and 2000 can be said as *twenty-hundred*; so what's in between 10 and 20?
Nineteen.

OK. Let's try 1900. Oops. Still too high. So, now we need a number between 10 and 19.
Fourteen.

OK. Let's try 1400 [*entering 1400*]**. Good! Good estimate! We got it.**

Between the two of them, Gerri and Melissa made seven estimates before arriving at a reasonable one. After Melissa's first estimate of 50, she added 0s, which had worked for her on previous problems. Unfortunately, this strategy is only efficient if the front-end digits are chosen carefully. Once the place-value adjustment strategy failed, Gerri encouraged Melissa to find a number between 500 and 5000. An adult might have chosen a number near 3000 to "split the difference," but Melissa felt more comfortable subtracting incrementally from the higher number, reducing her estimate of 5000 to 4000.

Teachers teaching with the calculator will be best served to focus on the elements of the problem itself to help students arrive at an estimate. In this case, Gerri could have worked with Melissa to develop another strategy. Building on Melissa's initial reformulation of the numbers, Gerri could have suggested $6 \times 2 = 12$.

With a little encouragement, Melissa might have been able to use front-end estimation to reach a reasonable estimate. We suggest that students using the estimation calculator on their own will come to the conclusion that strategy revision is actually more efficient than random guessing. If Melissa had been trying to solve for an estimate for this problem on her own, she might have chosen to start over after her estimate of 5000.