NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Beginning to Problem Solve with "I Notice, I Wonder"™

I. What are some ways to get students started?

Activity 1: Basic "I Notice, I Wonder" Brainstorm

The obstacles: Students don't know how to begin solving word problems. They don't trust or make use of their own thinking. They freeze up or do any calculation that pops into their head, without thinking, "does this make sense?" They don't have ways to check their work or test their assumptions. They miss key information in the problem. They don't understand the "story" of the problem.

The solution: Create an safe environment where students focus on sharing their thoughts without any pressure to answer or solve a problem.

> Display a problem scenario or complete problem at the front of the room. If reading level is a concern, read the scenario to students or have a volunteer read it.
>
> Ask students, "What do you notice?"
>
> Pause to let as many students as possible raise their hands. Call on students and record their noticings at the front of the room.
>
> *As you record students' thoughts, thank or acknowledge each student equally. Record* all *student suggestions. Avoid praising, restating, clarifying, or asking questions.*
>
> Ask students, "What are you wondering?"
>
> Pause to let as many students as possible raise their hands. Call on students and record their wonderings at the front of the room.
>
> Ask students, "Is there anything up here that you are wondering about? Anything you need clarified?" If you or the students have questions about any items, ask the students who shared them to clarify them further.

Activity 2: Forget the Question – Access for All Students

The obstacle: Sometimes when we put a problem on the board, students notice the question and go into one of two modes:

> I don't understand, I'll never get this.
>
> I know exactly what to do, let me work as quickly as I can.

This can make it difficult to facilitate a whole-group brainstorm. The first student doesn't participate and doesn't connect to his own thinking, losing out on the power of noticing and wondering. The second student doesn't participate and narrows in too quickly on her own thinking, losing out on the opportunity to surface more interesting (and more challenging) mathematical questions and ideas.

The solution: Use the basic "I Notice, I Wonder" Brainstorm, but include only the mathematical scenario. Leave out the question, and even some key information for solving the problem. Only after all students have participated and understand the scenario thoroughly do you reveal the question. Or, ask students, "If this story were the beginning of a math problem, what could the math problem be?" Then solve a problem the *students* came up with.

Leaving off the question increases participation from struggling students because there's no right answer and no wrong noticings and wonderings. It keeps speedy students engaged in creative brainstorming rather than closed-ended problem solving. And having a question to solve that students generated increases all students' understanding of the task and their engagement.

Activity 3: Think/Pair/Share – Increasing Engagement and Accountability

The obstacle: Some students are shy or hesitant to participate in a brainstorming session.

The solution: Hold all students accountable by giving each a recording sheet.

Students spend a minute (or more depending on their stamina) writing their noticings and wonderings on the recording sheet.

Students work with the person next to them to compare their lists and see if they can add two more things.

Each pair chooses one item to share with the whole group.

Quickly go around the room hearing each pair's items. Students should add noticings and wonderings they didn't come up with to their own sheets.

Finally ask, "Did anyone have any other noticings or wonderings they wanted to share?" and collect those.

In this fashion, each student is accountable for noticing and wondering before hearing from others, and students who are thoughtful and move slowly get a chance to organize their thoughts before sharing.

II. We Noticed, We Wondered, Now What?

Noticing and wondering is a tool to help students:

Understand the story, the quantities, and the relationships in the problem.
Understand what the problem is asking and what the answer will look like.
Have some ideas to begin to solve the problem.

This means that at the end of a noticing and wondering sessions, students should be able to:

Tell the story of the problem in their own words.
Give a reasonable estimate or high and low boundaries for the answer.
Work independently on carrying out steps or generating more data toward solving the problem.

If students are not ready to do those things, we recommend any of the following activities:

PoW IQ: Describe the ***I****nformation* and ***Q****uestion*. Say what you are being asked to find, and estimate an answer. Give a high and low boundary for the answer, say whether it could be negative, fractional, zero, etc. Tell the key information given in the problem that you think you will use.

Act it Out: Have a group of students act out the problem while the audience looks at their list of noticing and wondering. The audience should be prepared to share new noticings and wonderings, as well as tell if the group missed or changed any noticings.

Draw a Picture: Have each student draw a sketch that they think shows what happens in the problems. They should sketch first and then label their picture. Students can then use their sketches to say the problem in their own words to a partner or small group.

III. Are We Done Noticing and Wondering Yet?

Noticings and wonderings are great tools for checking your work at the end of the problem. Students don't have to ask, "Am I correct?" They can look at their noticing, wondering, and estimates to make sure they were accountable to all the information in the problem.

And noticing and wondering is a skill students can get better at. That's why it's important to look back over your noticings and wonderings and ask, "Are we getting better?" After solving a problem, ask:

Which noticings and wonderings were really important to us?
Were there noticings and wonderings we didn't really use?
How do we come up with noticings and wonderings that are mathematical? What makes them mathematical?
Did we get stuck because we'd missed something? Why did we miss it? What could we do differently next time?

After noticing and wondering several times, ask:

Are there types of noticings and wonderings that are important? That we often miss?
Are we generating more noticings and wonderings each time? Are they getting more useful?
How do we go from noticings and wonderings to solution paths?

