Handout 3: Five principles for effective questioning

1. Plan to use questions that encourage thinking and reasoning

Really effective questions are planned beforehand. It is helpful to plan *sequences* of questions that build on and extend students' thinking. A good questioner, of course, remains flexible and allows time to follow up responses.

Beginning an inquiry	• What do you already know that might be useful here? • What sort of diagram might be helpful? • Can you invent a simple notation for this? • How can you simplify this problem? • What is known and what is unknown? • What assumptions might we make?
Progressing with an inquiry	• Where have you seen something like this before? • What is fixed here, and what can we change? • What is the same and what is different here? • What would happen if I changed this ... to this ... ? • Is this approach going anywhere? • What will you do when you get that answer? • This is just a special case of ... what? • Can you form any hypotheses? • Can you think of any counterexamples? • What mistakes have we made? • Can you suggest a different way of doing this? • What conclusions can you make from this data? • How can we check this calculation without doing it all again? • What is a sensible way to record this?
Interpreting and evaluating the results of an inquiry	• How can you best display your data? • Is it better to use this type of chart or that one? Why? • What patterns can you see in this data? • What reasons might there be for these patterns? • Can you give me a convincing argument for that statement? • Do you think that answer is reasonable? Why? • How can you be 100% sure that is true? Convince me! • What do you think of Anne's argument? Why? • Which method might be best to use here? Why?
Communicating conclusions and reflecting	• What method did you use? • What other methods have you considered? • Which of your methods was the best? Why? • Which method was the quickest? • Where have you seen a problem like this before? • What methods did you use last time? Would they have worked here? • What helpful strategies have you learned for next time?

THE ART OF QUESTIONING IN MATHEMATICS

From The NCTM Professional Teaching Standards

HELP STUDENTS WORK TOGETHER TO MAKE SENSE OF MATH

- "What do others think about what_____said?"
- "Do you agree? Disagree? Why or why not?"
- "Does anyone have the same answer but a different way to explain it?"
- "Would you ask the rest of the class that question?"
- "Do you understand what they are saying?"
- "Can you convince the rest of us that that makes sense?"

HELP STUDENTS TO RELY MORE ON <u>THEMSELVES</u> TO DETERMINE WHETHER SOMETHING IS MATHEMATICALLY CORRECT

- "Why do you think that?"
- "Why is that true?"
- "How did you reach that conclusion?"
- "Does that make sense?"
- "Can you make a model and show that?"

HELP STUDENTS TO LEARN TO REASON MATHEMATICALLY

- "Does that always work? Why or why not?"
- "Is that true for all cases? Explain?"
- "Can you think of a counter example?"
- "How could you prove that?"
- "What assumptions are you making?"

HELP STUDENTS LEARN TO ANALYZE, INVENT, AND SOLVE PROBLEMS

- "What would happen if _____? What if not?"
- "Do you see a pattern? Explain?"
- "What are some possibilities here?"
- "Can you predict the next one? What about the last one?"
- "How did you think about the problem?"
- "What decision do you think he/she should make?"
- "What is alike and what is different about your method of solution and his/hers?"

HELP STUDENT CONNECT MATHEMATICAL IDEAS AND APPLICATIONS

- "How does this relate to _____?"
- "What ideas that we have learned before were useful in solving this problem?"
- "Have we ever solved a problem like this one before?"
- "What uses of mathematics did you find in the newspaper last night?"
- "Can you give me an example of _____?"