

WHY USE OPEN-ENDED PROBLEMS IN MATHEMATICS?

- OPEN-ENDED PROBLEMS PROVIDE MULTIPLE ENTRY POINTS FOR STUDENTS
- DIFFERENTIATE INSTRUCTION FOR MANY DEVELOPMENTAL LEVELS
- MEET NEEDS OF BOTH STRUGGLING LEARNERS AND PROMISING STUDENTS WHO NEED CHALLENGES
- MAINTAINS A LEVEL FOR ALL TO SUCCEED AND ABILITY TO DISCUSS MATHEMATICS

	TYPE OF OPEN-ENDED PROBLEM	EXAMPLE
1	ASK FOR MORE THAN ONE STRATEGY	"CAN YOU SHOW TWO DIFFERENT WAYS TO ADD 24 AND 37?"
2	SHOW MORE THAN ONE REPRESENTATION	"USE NUMBERS, PICTURES, AND WORDS TO SHOW YOUR ANSWER"
3	REQUIRE AN EXPLANATION	"PLEASE EXPLAIN HOW YOU KNOW YOU HAVE THE CORRECT SOLUTION."
4	ASK FOR MORE THAN ONE SOLUTION	"FIND THREE WAYS THAT THE SISTERS CAN SPEND TEN DOLLARS."
5	ASK FOR A STORY PROBLEM AND SOLUTION	"WRITE A STORY PROBLEM USING THE NUMBERS 3, 5, AND 15. SOLVE THE PROBLEM."
6	BEGIN WITH THE ANSWER AND ASK FOR POSSIBILITIES.	"FIND ALL THE NUMBER COMBINATIONS THAT MAKE 16." OR "WHAT ARE THREE DIFFERENT WAYS THAT HENRY COULD SPEND \$15 ON CARNIVAL RIDES?"
7	CREATE MANY POSSIBILITIES BY USING DICE, NUMBER CARDS, OR SPINNER	"USE TWO DICE AND THREE NUMBER CARDS TO MAKE AN ADDITION PROBLEM. SOLVE THE PROBLEM"
8	PUT A CONSTRAINT ON THE PROBLEM	"THE 5 KEY ON THE CALCULATOR IS BROKEN. HOW COULD YOU SOLVE THE PROBLEM WITHOUT USING THE 5 KEY?" OR "HOW COULD YOU FIND THE AREA OF A TRAPEZOID WITHOUT USING THE FORMULA?"
9	USE A RANGE OF NUMBERS IN THE PROBLEM	"USE THE NUMBERS 5, 6, 7, AND 8 TO MAKE AS MANY ADDITION PROBLEMS AS YOU CAN SOLVE."
10	USE A DEVELOPMENTAL PROGRESSION IN THE PROBLEM	"FIRST DRAW A PICTURE OF THE SHAPE, IDENTIFY THE SHAPE BY NAME, AND DESCRIBE THE SHAPE USING AS MANY PROPERTIES AS YOU CAN"
11	CONNECT PROBLEM SITUATION TO REAL WORLD AND ASK FOR EXPERTISE.	"DESIGN THREE DIFFERENT SIZED BOXES TO HOLD 24 CHOCOLATE CANDIES. TELL WHICH BOX IS THE BEST DESIGN AND WHY."

12	ASK FOR SIMILARITIES AND DIFFERENCES	"HOW ARE THE NUMBERS 75 AND 100 ALIKE? HOW ARE 75 AND 100 DIFFERENT?" "HOW ARE THE NUMBERS 3.007 AND 8.002 ALIKE? DIFFERENT?"
13	REPLACE A NUMBER WITH A BLANK	"MR. ALVARADO'S CLASS HAS ____ STUDENTS. MS. KYOTO'S CLASS HAS ____ STUDENTS. HOW MANY STUDENTS ARE THERE ALTOGETHER?"
14	ASK FOR A NUMBER SENTENCE	"USE THE NUMBERS 8 AND 7 AS WELL AS THE WORDS 'PRODUCT' AND 'EQUAL' TO CREATE A NUMBER SENTENCE. CAN YOU FIND MORE THAN ONE SENTENCE?"
15	CHANGE A TEXTBOOK QUESTION	TEXTBOOK: WHAT NUMBER HAS 4 HUNDREDS, 5 TENS, AND 3 ONES? CHANGE TO: "YOU CAN USE 8 BASE TEN BLOCKS TO MODEL A NUMBER. WHAT COULD THE NUMBER BE?"
16	STUDENT CHOICE IN WORKING WITH NUMBERS	"THE DIAMETER OF A SUGAR COOKIE IS BETWEEN 2 AND 3 INCHES. GIVE THE DIAMETER AS A FRACTION USING TWO DIFFERENT WAYS."
		"YOU MULTIPLY TWO NUMBERS AND THE PRODUCT IS ALMOST 600. WHAT COULD THE NUMBERS HAVE BEEN? EXPLAIN."
		"DRAW A SMALL RECTANGLE. DRAW A BIGGER RECTANGLE THAT THE SMALLER ONE IS PART OF. TELL WHAT FRACTION OF THE BIG RECTANGLE THE SMALL ONE IS."
		"CHOOSE A FRACTION AND A PERCENT. TELL WHICH IS GREATER AND HOW YOU KNOW."
17	USE PARALLEL TASKS THAT EXPLORE SAME IDEA BUT FIT DIFFERENT DEVELOPMENTAL LEVELS	"WHAT COIN COMBINATIONS CAN YOU USE TO SHOW YOUR AMOUNT?" OPTION 1: 12 CENTS OPTION 2: 60 CENTS
		"CHOOSE ONE OF THE MEASUREMENTS BELOW. ESTIMATE HOW MANY YEARS OLD A PERSON IS WHO HAS LIVED. 1000 DAYS 10,000 HOURS 1 MILLION SECONDS

RESOURCES

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KIBERI, M. S., & SMITH, N. L. (2003). TURNING TRADITIONAL TEXTBOOK PROBLEMS INTO OPEN-ENDED PROBLEMS. *MATHEMATICS TEACHING IN THE MIDDLE SCHOOL*, 9(3), 186 - 192.