

Snapshot #20

Math Problem Solving Improvement: Troutdale Elementary School

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RESEARCH FINDINGS

Work to improve students' math story problem solving skills at Troutdale Elementary School has been based on findings from the effective schooling research. The Northwest Regional Educational Laboratory publication, **EFFECTIVE SCHOOLING PRACTICES: A RESEARCH SYNTHESIS/1990 UPDATE** (NWREL 1990), describes those findings as follows:

Relevant research-based practices at the CLASSROOM level include:

1.1.1 INSTRUCTION IS GUIDED BY A PREPLANNED CURRICULUM

1. Learning goals and objectives are developed and prioritized according to district and building guidelines, selected or approved by teachers, sequenced to facilitate student learning, and organized or grouped into units or lessons.
2. Instructional resources and teaching activities are identified, matched to objectives and student developmental levels, and recorded in lesson plans.
3. Resources and teaching activities are reviewed for content and appropriateness and are modified according to experience to increase their effectiveness in helping students learn.

1.3.2 INSTRUCTION IS CLEAR AND FOCUSED

d. Students have plenty of opportunity for guided and independent practice with new concepts and skills.

1.4.2 INCENTIVES AND REWARDS FOR STUDENTS ARE USED TO PROMOTE EXCELLENCE

1. Excellence is defined by objective standards, not by peer comparison. Systems are set up in the classroom for frequent and consistent rewards to students for academic achievement and excellent behavior.

Supportive effective practices at the SCHOOL level include:

2.3.2 ADMINISTRATORS AND TEACHERS CONTINUALLY STRIVE TO IMPROVE INSTRUCTIONAL EFFECTIVENESS

d. Programs and practices shown to be effective in other school settings are reviewed for their potential in helping to meet school needs.

g. Implementation is checked carefully and frequently; progress is noted and publicized; activities are modified as necessary to make things work better. Everyone works together to help the improvement effort succeed; staff members discuss implementation and share ideas and approaches.

SITUATION

Troutdale Elementary School is located along the scenic Columbia River in Troutdale, a suburb of Portland, Oregon. It is one of nine elementary schools in the Reynolds School District. The school has been in operation since 1868, and there is a strong sense of identity and history in the surrounding community. Predominantly agricultural until recently, the community has become primarily a bedroom community for middle class families with parents who commute to the nearby city.

Troutdale's 41 staff members -- 16 teachers, 1 administrator, 9 certified support personnel and 15 classified staff -- serve 435 students in grades K-5. There is a small population of minority students, and about 50 students are involved in the free and reduced lunch program. In 1983-84, student mobility was 35 percent: since that time the figure has continually declined, so that currently fewer than 25 percent of students move in or out of the district each year.

CONTEXT

Troutdale Elementary students have historically been quite successful, with the majority completing high school and going on to college. In 1985, with the advent of the research-based school improvement process ONWARD TO EXCELLENCE (OTE) in the district, staff began work to find ways to improve, because "a good school can get better." At the time, the school included students in grades K-6, and the district was experiencing major population growth. The sixth grade was moved to the middle school at the end of the 1988- 89 school year.

Using the team-managed OTE process, the staff collected student performance data in the areas of behavior, academic achievement and attitude. Initially, they thought attendance and discipline referrals were problem areas, but when they collected and analyzed the student data, this was not the case, so they continued data review.

With the help of the school's central office OTE liaison, the team and staff examined the spring 1985 results of the Portland Levels Test (PLT), a criterionreferenced test in basic skills with scaled items that indicate the level of difficulty of each item so that student growth can be measured. The test had been administered yearly to students in grades 3, 4, 5 and 6.

School staff discovered that, in all but one grade, more than 15 percent of students had scored in the low range in math story problem solving on the PLT. This score is equivalent to the 15th

percentile and below on a normal curve.

By the spring of 1986, the entire staff had discussed these results and agreed that they would focus on meeting the following goal:

To improve story problem performance as measured by the Portland Levels Test in grades 3 through 6. The longrange goal for the next three years is to decrease the percentage of students in the low range ... to 10 percent. The target for the 1986-87 school year will be to decrease the percentage of students in the low range ... to 13 percent.

The first step toward that goal was to develop a common vocabulary all teachers would use in math development, especially as related to story problems. To develop this list, teachers met with staff from the middle school Troutdale students would attend and adopted the math terminology students would hear when they moved to the other school.

Troutdale teachers then met by grade levels and developed an extensive list of outcome goals for students that would be used to guide instructional changes at all grade levels. Based on these learning outcomes, the team and staff devised a prescription for improvement, including changes in practice at the classroom and school levels to move students toward the schoolwide goal.

The first schoolwide innovation was the introduction, teaching and mastery by students of steps in story problem solving, stated as "Questions to Use in Solving Story Problems":

1. What is the question?
2. What are the important facts?
3. Do you have enough information to solve the problem?
4. Do you have too much information?
5. What operation will you use?
6. Label your answer.
7. Is your answer reasonable?

Posters of these steps were made and displayed in every classroom in the building and all teachers taught students the steps.

Other changes in practice followed:

- The introduction of a daily story problem time, usually using story problems created by students, as part of the regular math instruction in each classroom every day.
- A daily morning announcement of two story problems - - one primary, one intermediate - - over the intercom with morning announcements; problems are then solved in each class.
- Purchase of supportive instructional materials, including response cards and slates to facilitate quick teacher assessment of student responses: students write and display answers, and teachers quickly scan to assure students are correct.
- Development and wide usage of two levels of a board game called "Tiger Trivia," featuring story problem solving as the means for moving around the board and using cards printed with story problems written by students.
- Schoolwide reinforcement of student achievement in story problem solving by teachers' awarding "I Love Story Problems" buttons or "Super Story Problem Solver" pencils as students show progress in the skill.
- Staff development with a visiting consultant for all teachers in story problem instruction.

- Collection of resources to support story problem instruction, including the establishment of a file in the school's Media Center with resources keyed to grade level objectives; the researching and listing of programs featuring practice for story problems; and the purchase of several instructional packages focused on story problems.

Troutdale teachers implemented the new approaches during the 1986-87 school year, working to meet the goal. In the spring of 1987, following the administration of the Portland Levels Test, staff were delighted to discover that, in all but one grade, the school had already reached its long-term goal for student performance in story problem solving. Work continued on the area and results of the PLT continue to demonstrate their success:

PERCENTAGE OF STUDENTS IN PLT LOW RANGE: STORY PROBLEMS

	Spring 1985	Spring 1987	Spring 1990
Grade 3	11	7	8
Grade 4	22	16	6
Grade 5	18	10	8
Grade 6	17	8	-

Low Range = 15th percentile in normal curve

PRACTICE: DAILY STORY PROBLEM SOLVING

Every day in this third grade classroom students apply the seven steps for solving story problems. As students arrive each morning, three exercises are projected on the wall: a language problem, a factual recall question and a set of two math story problems created by students. Following the morning bell, students settle in and begin work on the exercises. Administrative matters are conducted meanwhile by the teacher, who takes roll or meets individually with some students to collect special assignments or answer questions.

At 9:15 class begins with the morning flag salute, and then students volunteer to work on the language and factual questions. They then address the two story problems. This day, the first story problem is:

DEANDRE HAD 9,808 GHETTO BLASTERS. HE SOLD 57 GHETTO BLASTERS. HE ALSO HAS 34 TAPES. HOW MANY BLASTERS DOES HE HAVE LEFT?

Teacher Dea Potts asks for a volunteer to read the first problem, and Tiffany reads it aloud. In a question and answer session, the students identify the operation that is necessary (subtraction) and the key words that cue that operation ("have left"). Peter volunteers to work the problem, walks to the overhead projector and does the problem on the transparency film. In another question and answer session, students report that information about the tapes is extra and that there is often too much information in story problems.

The class then works on the second story problem:

KELLY HAS \$150.00. STEPHANIE HAS \$162.00. WHO HAS MORE? HOW MUCH MORE?

This time, Amy reads the question aloud and there is a short discussion when there is a difference of opinion about the operation necessary. Once all agree on subtraction, Pepper volunteers to do the problem and completes it on the overhead projector. Once the problem is completed correctly and discussed, the teacher moves directly into the first full unit of the day, the spelling lesson.

For further information about the Troutdale program, contact Julie Moyer, Principal, Troutdale Elementary School, 648 S.E. Harlow, Troutdale, Oregon 97060-2164 (503/665-4182).

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