Mrs. Forest wanted to plan how to contact her students by phone in case the field trip they were going on the next day needed to be canceled. She decided to call 1 student who would then call 2 other students. Each of these students would then call 2 other students. This would continue until all students had been called.

Mrs. Forest has 31 students. How many students will need to make phone calls if Mrs. Forest calls the 1st student?
Calling All Students

Suggested Grade Span

3–5

Grade(s) in Which Task Was Piloted

4

Task

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Alternative Versions of Task

More Accessible Version:

Mrs. Forest wanted to plan how to contact her students by phone in case the field trip they were going on the next day needed to be canceled. She decided to call 1 student who would then call 2 other students. Each of these students would then call 2 other students. This would continue until all students had been called.

Mrs. Forest has 15 students. How many students will need to make phone calls if Mrs. Forest calls the 1st student?

More Challenging Version:

Mrs. Forest wanted to plan how to contact her students by phone in case the field trip they were going on the next day needed to be canceled. She decided to call 1 student who would then call 2 other students. Each of these students would then call 2 other students. This would continue until all students had been called.

Mrs. Forest has 31 students. How many students will need to make phone calls if Mrs. Forest calls the 1st student? Find a rule for determining how many phone calls will be made for any number of students.
NCTM Content Standards and Evidence

Algebra Standard for Grades 3–5: Instructional programs from pre-kindergarten through grade 12 should enable students to ...

Understand patterns, relations and functions.

• NCTM Evidence: Describe, extend and make generalizations about geometric and numeric patterns.

• Exemplars Task-Specific Evidence: Most students will create a tree diagram to solve this task to identify and extend the growing pattern.

Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This is a short- to medium-length task.

Links

This task could link to a class field trip, to a unit on weather (the cause of the canceled field trip) or to a unit on the history of the telephone.

Common Strategies Used to Solve This Task

Most students will use a tree diagram to solve this task.

Possible Solutions

15 callers

More Accessible Version Solution:

Seven callers

More Challenging Version Solution:

If an odd number of students: \((n – 1) ÷ 2\), where \(n\) = number of students who need to be called.

If an even number of students: \(n ÷ 2\), where \(n\) = number of students who need to be called.

Task-Specific Assessment Notes

General Notes
Most students will create a tree diagram to solve this task. This task does not lend itself to eliciting a lot of mathematical language.
Novice
The Novice will not have an approach that works.

Apprentice
The Apprentice will attempt a tree diagram, but it will be incorrect or incomplete.

Practitioner
The Practitioner will have a correct and systematic approach to solving the task. S/he will have a correct solution and may make observations about patterns in the solution.

Expert
The Expert will analyze the solution, identifying patterns and rules for solving the problem.
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The strategy of using this type of chart will not work as the student has set it up.

Math reasoning is unclear.

Everyday familiar language is used such as "total" and "answer."
Apprentice

Some awareness of audience is present as the student identifies “t.”

The student has a partially completed strategy, but the lack of labels makes it difficult to follow.

Some correct reasoning is present.

The diagram is used to communicate problem solving.
I need to know how many students will make a phone call for Mrs. Forest. I will make a diagram to show all the calls.

Key:

Mrs. = Mrs. Forest
O = Student
Calling All Students

I numbered each student and stopped at 31 for 31 students. This was fun to do. If a person doesn't do the call, then it stops. If 6 doesn't call, then 6 students will show up for the field trip.

This math representation portrays the student’s problem solving.

The student chooses a strategy that is clearly communicated.

A correct answer is achieved.

A systematic approach is used.

The student makes an observation about the solution.
Labeled diagrams are used to communicate the solution.

Phone Call tree

Mrs. Forest

Call levels

1

2

3

4

5

The number of kids called in each level is a power of two. The one child is \(2^0\). The people he calls are \(2^1\), the people they call are \(2^2\) and so on. This is because every kid calls two more. If every kid called three others, this problem would be about the powers of three. With the call levels, each time you increase the exponent to the next consecutive number. The number of students in the last call level is 16. 16 times two minus one is 31, or the number of kids she needs to inform. This formula is: \(2^n - 1\).

A correct answer is achieved.

Relevant observations are made throughout the solution, including a rule determining the “next number of informed students.”

Accurate and precise math language is used throughout to communicate the solution.
In order to inform all 31 students, Mrs. Forest must make one call and 15 students must make two calls each. 16 people make one call, and 31 calls were received. Since all 15 children made 2 calls, that equals 30, plus the one call Mrs. Forest made. Each time calls are made, the level of informed kids doubles, plus one for the first kid.

To find the next consecutive the "informed" number, you double the previous number and add one: \(2x + 1\). This would help any teacher needing to inform their students: they would be able to know the "informed"