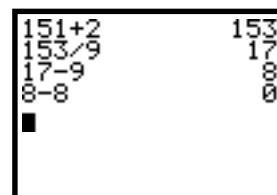


# THE MULTI-LINE-SCREEN CALCULATOR AND THE EMERGENCE OF NUMERICAL STRATEGIES IN SECONDARY 1, 2, AND 3 STUDENTS

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The graphing calculator with its multi-line screen served as a tool of exploration in a week-long sequence of activities developed around the "Five steps to Zero" problem.

*"Take any whole number from 1 to 900 and try to get it down to zero in five steps or less, using only the numbers 1 to 9 and the four basic operations  $+$ ,  $-$ ,  $\times$ ,  $\div$ . You may use the same number more than once."*



Three classes of Secondary 1, 2, and 3 students, aged 13-16 years, participated. The analysis focused on the interaction between the epistemological power of the technology and the emergence of mathematical strategies. In all three classes, the main initial strategies observed were S1: Decrease or increase the number so that it ends in 0 or 5, and then divide by 5, and S2: Decrease or increase the number to bring it to the form  $abc$  such that one can identify a divisor of  $abc$ , either from  $ab$  or from  $bc$ . For Secondary 1, S2 gained in importance over the study. For Secondary 2, S2 became more complex; furthermore, many students moved toward S3: Decrease or increase the number to make it divisible by 9. For Secondary 3, S3 became the dominant strategy.

The multi-line-screen calculator, with its suppression of calculation details, thus keeping a proximity--physical as well as temporal--between the numbers and results of the operations, served to heighten students' number sense along several important dimensions. But it played a different role at each grade level. For Secondary 1 and 2, the calculator was used as a tool for calculating and as a medium favoring the formulation of conjectures. Reasoning in a local manner, these pupils based their judgments on an analysis of the form of the numbers. In contrast, for Secondary 3 pupils, who reasoned in a global manner, it also served as a search tool. This allowed them to develop more powerful algorithms than were seen in Secondary 1 and 2.

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A longer version of this paper is available from the first author at [jguzman@mail.cinvestav.mx](mailto:jguzman@mail.cinvestav.mx)