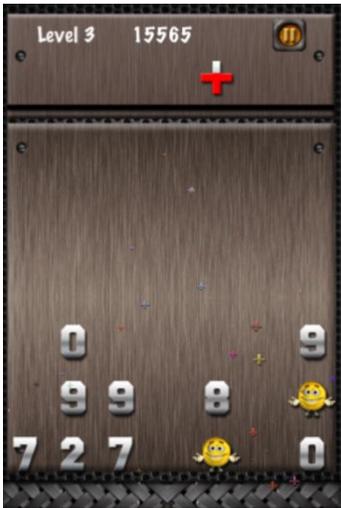# TENSER

Connections to Classic Mathematical Research & Common Core Standards

Classic mathematical research identifies different categories of addition and subtraction problems: 1) joining actions; 2) separating actions; 3) part-part-whole actions; and 4) comparing actions (Carpenter, Fennema, Peterson, Chiang, & Loef, 1989). In essence, researchers believe that students should gain experience with all four categories in situations involving unknown values in various positions. For example, consider joining actions as illustrated in the table.

Joining Actions with Varying Unknown Positions*

Result Unknown	Change Unknown	Start Unknown
Examples such as: $2 + 7 = \square$	Examples such as: $2 + 7 + \square = 10$	Examples such as: $\square + 9 = 10$
This is illustrated in the bottom row. This is the first step in determining a digit to drop into the open slot to result in an explosion due to making a sum of 10.	This is illustrated in the bottom row. This is the second step in determining a digit to drop into the open slot to result in an explosion due to making a sum of 10.	This is illustrated in the middle row. This is the step in determining a digit to drop into the open slot on the left to result in an explosion due to making a sum of 10 across the middle row.

* While the examples here focus on rows, Tenser allows sums of 10 to be formed across rows and columns.

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As play progresses, the digits (at random) may be replaced by "varia-bullies" (smiley faces) that represent unknown digits. By testing and witnessing explosions, the player can determine their values. Since sums of 10 can be formed across rows and columns in either direction, the positions of the unknown values are constantly varying as the game board changes. Furthermore, at its most advanced level, Tenser involves two varia-bullies. Imagine all the various open number sentences involving multiple addends!

This same concept is illustrated in the Common Core Standards State Standards for Mathematics. For example, consider the following grade 2 standard (2.OA):

Represent and solve problems involving addition and subtraction.
    1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

These skills are foundational to algebraic success and are at the heart of Tenser.

References

Carpenter, Fennema, Peterson, Chiang, and Loef (1989) cited in Gutstein, E., Romberg, T., *Teaching Children to Add and Subtract*, Journal of Mathematical Behavior, 14, 283-324 (1995).

Common Core State Standards Initiative. (2010, June). *Common core state standards for mathematics*. Retrieved September 24, 2012 from http://www.corestandards.org.

New Hampshire Department of Education. (2006). K-12 Mathematics Curriculum Framework. Author.

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