

## What Research Says About the CPSPulse™ Student Response System

CPSPulse™ is the latest version of the “Classroom Performance System™”, the market-leading student response system pioneered by eInstruction® founder Dr. Darrell L. Ward in the late 1980s.

The most salient benefits of CPSPulse™ are: (1) the ease of engagement of all students in frequent formative assessment, and (2) the resulting empirical data and analysis that enables both educators and students to clearly understand each student’s academic progress. The empirical data supporting the use of strategic assessment as a learning tool to raise student achievement is overwhelming.

The efficacy of this approach has been proven in at least 29 independent scientific studies across a wide range of subject areas and grade levels. The main benefits reported include:

- Helping learners practice retrieval and application of information to answer questions (20 studies)
- Increasing discussion and interactivity (20 studies)
- Increasing achievement levels by involving students in the learning process to inform and adjust instruction (16 studies)
- Providing targeted feedback in a corrective manner essential to the learning process (10 studies)
- Improving learning through repetition by offering multiple question variations on a single learning point (8 studies)
- Increasing teacher awareness of student difficulties (6 studies)
- Increasing the likelihood of learning by motivating students (3 studies)
- Enabling students to understand why they answered specific questions incorrectly (3 studies)
- Deepening higher-order thinking (1 study)

### FORMATIVE ASSESSMENT

The extensive collection of literature on questioning and feedback provides well-established best practices in classroom instruction. Significant learning gains can occur when teachers’ questions are used to deepen students’ higher-order thinking and when feedback is provided to students on how they can improve. (Dillon & Wittrock, 1984; Gall, 1984; Redfield and Rousseau, 1981; Samson, Strykowski, Weinstein, & Walberg, 1987). Additionally, higher achievement levels are reported when students are involved in checking their own understanding of concepts and assessment data are used to inform and adjust classroom instruction. (Black & William, 1998; Fuchs & Fuchs, 1986).

Butler and Winne further established the importance of self-correction when they found that students are better able to engage with and make sense of feedback when it is on something they have thought about first and when they have a personal stake in the outcome (1995). Additionally, engaging with cognitive conflict (making prior knowledge problematic) is known to be an important prerequisite to conceptual change (Posner, Strike, Hewson, & Gertzog, 1982; Webb & Palincsar, 1996).

### COLLABORATIVE LEARNING

CPS™ enables collaborative learning in the classroom by establishing “positive interdependence” (the promotion of interaction and commitment to group learning goals), and enabling teachers to maintain both individual and group accountability (Johnson & Johnson, 1989; Slavin, 1990; Webb & Palincsar, 1996). This collaboration has been proven to significantly affect both the quality of students’ discussions and what they learn from the discussion (Cohen & Scardamalia, 1998; Hsi, 1997; Pea, 1993; Ryser, Beeler, & McKenzie, 1995; Suthers & Hundhausen, 2003).

## REFERENCES

- Bangert-Downs, R.L., Kulik, C-L. C., Kulik, J.A., and Morgan, M. (1991). The instructional effect of feedback in test-like events, *Review of Educational Research*, 61, 213-238.
- Boyd, W.M. (1973). Repeating questions in prose learning. *Journal of Educational Psychology*, 64, 31-38.
- Delaney, R. (2002). Unpublished study.
- Frase, L.T., Patrick, E., and Schumer, H. (1970). Effect of question position and frequency upon learning from text under different levels of incentive. *Journal of Educational Psychology*, 61, 52-56.
- Guthrie, J.T. (1971). Feedback and sentence learning. *Journal of Verbal Learning and Verbal Behavior*, 10, 23-28.
- Hake, Richard R. (1998). Interactive Engagement vs Traditional Methods: A Six Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. *American Journal of Physics*, Vol, 66, pps 64-74.
- Irby, T. and Ward, D. (1981). An educational environment model based on a micro implementation of Hypertext. *Proceedings of ADCIS*, March 1981.
- Massen, C., Poulis, J., Robens, E., Gilbert, M. (1998). Physics lecturing with audience paced feedback. *American Journal of Physics*, Vol 66, May 1998.
- Mazur, E. (1995). *Newton, One-on-One*. Harvard Journal.
- Mazur, E. (1996). *Peer Instruction: A Users Manual*. Prentice Hall, 1996.
- Sanders, William F. (1999). *Teachers, Teachers, Teachers*. Blueprint Magazine.
- Thalheimer, W. (2003). *The Learning Benefits of Questions*. A Work Learning Research Publication ([www.work-learning.com](http://www.work-learning.com)).
- Ward, D. (1977). A Computerized Lecture Preparation and Delivery System. *Journal of Educational Technology*, Vol. 6(1).
- Ward, D., and Bush, S. (1980). Hypertext – a generalized educational computer tool. *Proceedings of the National Educational Computer Conference*, pp. 19-24, 1980.
- Ward, D. (1991). *A Quantitative Analysis of Interaction in the Classroom*. Unpublished study.
- Ward, D. (2003). *Interactive Data Driven Instruction*. A Professional Development Seminar.
- Black, P. and William, D. (1998). *Inside the Black Box: Raising Standards Through Classroom Assessment*, Phi Delta Kappan. & Wiliam, 1998.
- Paschal, C., (2002). *Formative Assessment in Physiology Teaching Using a Wireless Classroom Communication System*, *Advances in Physiology Education* 26: 299-308.
- Guthrie, W. and Carlin, A., (2004). *Waking the Dead: Using interactive technology to engage passive listeners in the classroom*.
- Woods, H., and Chiu, C., (2002). *Wireless Response Technology in College Classrooms*, University of Texas at Austin.
- Bransford et al, (1999). *Classroom Response and Communication Systems: Research, Review, and Theory*, from *How People Learn*, National Research Council.
- Horowitz, H.(1988). *Interactivity in a classroom environment*, presented at the Sixth Conference of Interactive Instruction Delivery for the Society of Applied Learning Technology.
- Fuchs, L., and Fuchs, D., (1986) *Effects of systematic formative evaluation: A meta-analysis*, *Exceptional Children*, 53(3), 199-208.
- Dillon, J. and Wittrock, M, (1984). *Research on questioning and discussion*, *Educational Leadership*, (42(3), 50-56.
- Gall, M, (1984). *Synthesis of research on teachers' questioning*, *Educational Leadership*, 40-47.
- Redfield, D., and Rousseau, E., (1981). *A meta-analysis of experimental research on teacher questioning behavior*, *Review of Educational Research*, 51(2), 237-245.
- Samson, G., Strykowski, B., Weinstein, T., and Walberg, H., (1987). *The effects of teacher questioning levels on student achievement: A quantitative synthesis*, *Journal of Educational Research*, 80(5), 290-295.
- Butler, D. & Winne, P., (1995). *Feedback and self-regulated learning: A theoretical synthesis*. *Review of Educational Research*, 65, 245-281.
- Posner, G., Strike, K., Hewson, P., & Gertzog, W., (1982). *Accommodation of a scientific conception: Toward a theory of conceptual change*. *Science Education*, 66, 211-217.
- Johnson, D., & Johnson, R., (1989). *Cooperation and Competition: Theory and Research*. Edina, MN: Interaction Book Company.
- Slavin, R., (1990). *Cooperative learning: Theory, Research, and Practice*. Englewood Cliff, NJ: Prentice Hall.
- Webb, N., Palincsar, A., (1996). *Group processes in the classroom*. In D.C. Berliner & R.C. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 841-873). New York: Macmillan.
- Cohen, A., & Scardamalia, M., (1998). *Discourse about ideas: Monitoring and regulation in face-to-face and computer-mediated*

learning environments. *Interactive Learning Environments*, 6(1-2), 114-142.

- His, S., (1997). *Facilitating Knowledge Integration in Science through Electronic Discussion: The Multimedia Forum Kiosk*. Unpublished dissertation. Berkeley, CA: University of California.
- Pea, R., (1993). Practices of distributed intelligence and designs for education. In G. Solomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp 47-87). New York: Cambridge University Press.
- Ryser, G., Beeler, J., & McKenzie, C. (1995). Effects of a computer-supported intentional learning environment (CSILE) on students' self-concept, self-regulatory behavior, and critical thinking ability. *Journal of Educational Computing Research*, 13(4), 375-385.
- Suthers, D. and Hundhausen, C., (2003). An empirical study of the effects of representational guidance on collaborative learning. *Journal of the Learning Sciences*, 12(2), 183-219.