

Harness the Power of Projectors and Interactive Whiteboards to Improve Classroom Teaching and Learning



For 25 years Tom Snyder Productions has dedicated itself to the use of technology in the classroom to enhance teaching and learning. Our products are grounded in respect for the teacher and the realities of the classroom. We frame our products around best practices and methods that have been proven to work, making it easy for a teacher to integrate these successful instructional approaches into his or her classroom. We believe that projectors and interactive whiteboards, matched with our classroom software, can go even further supporting teachers and students achieve educational excellence.

Interactive whiteboards and computers with projectors are educational technologies with incredible promise and the potential to enhance teaching and improve learning. Educational technology has historically put computers directly into the hands of students. Interactive whiteboards and projectors are different: they directly support teachers in the act of teaching. Empowering teachers with these tools creates the potential to enhance teaching and improve learning in wonderful new ways.

Teachers have a powerful role in student learning, so give them a powerful tool for teaching.

Researchers have teased apart the variables in effective classroom instruction and – not surprisingly – have found that a teacher in a single classroom has a significant and lasting impact on student achievement (Rivers and Sanders 2002). Teacher quality is as strongly related to student academic performance as student background characteristics. “As the qualitative literature suggests, student learning is a product of the interaction between students and teachers, and both parties contribute to this interaction” (Wenglinsky 2002).

Wenglinsky found that **classroom practices** had the greatest effect on student performance, even greater than teacher backgrounds and professional development. Classroom practices – the everyday actions teachers do – are a critical element in the learning endeavor. One perspective comes from a decade of work by the Center for Research on Education, Diversity and Excellence (CREDE), which formalized five standards for effective teaching practices:

- *Joint Productive Activity: Teacher and Students Working Together.*
Use instructional group activities in which students and teacher work together to create a product or idea.
- *Developing Language and Literacy Skills Across the Curriculum.*
Apply literacy strategies and develop language competence in all subject areas.
- *Connecting Lessons to Students' Lives.*
Contextualize teaching and curriculum in students' existing experiences in home, community, and school.
- *Engage Students with Challenging Lessons.*
Maintain challenging standards for student performance; design activities to advance understanding to more complex levels.
- *Emphasizing Dialogue Over Lectures.*
Instruct through teacher-student dialogue, especially academic, goal-directed instructional conversations, rather than lecture.

CREDE 2002

In a similar undertaking, Marzano et al. (2001) from the Midcontinent Research for Education and Learning (McREL) categorized teaching practices shown to increase student achievement, for example, using nonlinguistic representations, reinforcing effort and providing recognition.

Interactive whiteboards and projectors support effective classroom practices.

These classroom practices are a natural fit with interactive whiteboards and projectors, giving these tools the power to enhance teaching because they support instructional practices that research has shown to be successful. Consider these scenarios:

- *A teacher uses a whiteboard or projector for video multimedia to anchor real-world contexts in the classroom and provide (or activate) important background knowledge for a science or math lesson.*
- *A teacher explicitly models her own construction of a graph on an interactive whiteboard and demonstrates a step-by-step process, then calls on students to come up to construct graphs.*
- *A teacher sets up a dynamic classroom discussion by using a social studies simulation to engage students in making decisions guided by historical events.*
- *A teacher uses a projector and a computer with the class to collaboratively produce a graphic organizer about cause and effect themes from a literature selection, effectively conducting an instructional conversation and keeping everyone involved.*

Interactive whiteboards offer some specialized utilities that support teaching, such as screen highlighting, spotlighting, and printing the screen, but the hardware is inert until a teacher deploys it while teaching.

Many teachers use projectors and whiteboards to show Internet teaching resources, such as videos, animations, and websites. Others use software tools, such as concept mapping software and virtual math manipulatives. These resources can be well suited to interactive whiteboards but often require more time and preparation by a teacher.

Another way to harness the power of projectors and whiteboards is **classroom software** – programs designed for specific curriculum areas, designed for the classroom environment, optimized for student participation, and ready to use with modest teacher preparation. In the examples cited above, the teacher relies on classroom software instead of making each lesson herself.

Multimedia — video, animation, graphics, and sound —anchors the context of classroom instruction.

The power of multimedia to improve student learning and retention has been demonstrated many times. Researchers at the Cognition and Technology Group at Vanderbilt spearheaded the development and analysis of several programs that used video-based “anchored instruction” to improve conceptual learning (Bransford, et al, 1990; Cognition and Technology Group at Vanderbilt (CTGV), 1993a). Presenting a video context for the acquisition of new content, the researchers found that students, particularly low-performers, had greater access to new learning. Mayer, et al, specifically compared multimedia-enhanced instruction to text-only instruction. The results showed a significant improvement in knowledge retention among “low-knowledge” learners (Mayer, et al, 1995; Mayer & Gallini, 1990).

In these studies, multimedia plays two important roles. First, it provides contextual grounding for those students who have little prior knowledge of the content. The videos or visual animations give these students access to worlds and ideas that might otherwise be unavailable through text only. Second, the visualizations help to reinforce and give meaning to textual explanations. The multiple representations provided through multimedia help reach the range of student learning styles that typically occupy the classroom.

Interactive whiteboards and projectors are great tools for using multimedia in the classroom. First and foremost, these technologies provide a format large enough for all students in the classroom to watch and listen at the same. Second, because the teacher is moderating the use of the multimedia program, she is also controlling the instructional pace. (We’ve all seen students who are “click-happy” and eager in their independent use of software without being truly engaged in learning.) Third, the teacher is the person who understands and connects the multimedia context with the students’ own world experiences.

Here are examples of classroom software from Tom Snyder Productions that provide an anchored context for instruction and are well suited for use on projectors and whiteboards.

Science Court is a CD-ROM series that combines multimedia and hands-on science for the classroom. *Science Court* uses a compelling and humorous animated story to provide all students, regardless of their prior knowledge, with a contextual base for learning each targeted science concept. The stories prepare students to address each concept (and related naïve conception) in a meaningful and accessible situation.

In *Science Court: Water Cycle*, for instance, a story develops around seemingly leaky pipes in a humid subway station. Are the pipes really leaking, or is condensation the culprit? The case is taken to Science Court where expert witnesses employ animations and diagrams as part of their testimony. During breaks in the trial, students have the opportunity to examine each concept in more depth as they review print diagrams, perform hands-on experiments, and answer specific questions. As students work in small groups, sharing information and

working through the hands-on activity, the teacher circulates among the groups to listen, question, and clarify.

When each group has answered all the questions, the class reconvenes to watch the whiteboard again. The program asks each question one at a time, and the teacher uses a software feature called the Random Student Picker™ to call on students to share their answers. The class works as a group to answer at least four questions correctly. The teacher determines the validity of student answers, with the support and modeling of the software. The *Science Court* trial continues through several more parts.

The storylines, diagrams, animations, and experiments help deconstruct students' naïve conceptions, provide a contextual basis for learning, and present information in multiple formats. All of these elements have been shown to improve performance and retention of learning.

PrimeTime Math is a CD-ROM series that combines multimedia and real-world problem-solving. *PrimeTime Math* uses dramatic video stories to anchor the problem-solving experience in situations such as a hospital emergency room, a search and rescue effort, or firefighting. In each case there are lots of mathematics happening.

The computer projects a dramatic scenario for the whole class to watch on an interactive whiteboard, projection screen, or even a blank wall. Embedded within the video is crucial information that students will need to solve the problems. Students assume one of four different roles as part of a small team, each with different worksheets. Students must use the video and worksheets and work cooperatively to solve the math problems.

For example, in *PrimeTime Math: Fire*, firefighters are called to an abandoned

building blaze. Within moments the firefighters need to select the correct length and size of hose and then set the appropriate pressure best to attack the fire. The dramatic video places students in the role of those firefighters making mathematical decisions and calculations (hose diameter, water pressure, building dimensions, etc.) The multimedia sets up the mathematical problems, and students work to solve them. A teacher may gather students to work through similar problems. Students spend a fair amount of time explaining, sharing, and confirming their work with each other, before the teacher gathers the class for an Answer Round on the whiteboard.

The Answer Round helps a teacher call upon students to share not only their answer but an explanation of the answer. As in *Science Court*, the teacher uses a software feature called the Random Student Picker™ during this class assessment.

Students need explicit modeling and guided practice as they confront new concepts and difficult skills.

Research in reading and math supports specific teaching practices that are shown to improve student learning. Among them are explicit modeling and guided practice. Although technology is not necessary for these teaching methods, they are enhanced by classroom software used with interactive whiteboards and projectors.

The National Reading Panel (NRP) concluded that explicit instruction in cognitive strategies is absolutely necessary to improve students' reading comprehension. Palinscar and Brown (1984) determined that improvement occurs when teachers demonstrate, explain, model, and guide interaction with students as they move through the text. In fact, the NRP determined, "readers who are not explicitly taught these procedures are unlikely to learn, develop, or use them spontaneously" (p 4–40). Thus, students' comprehension strategies can improve, but only with explicit instruction, modeling, and scaffolding.

The NRP Report calls for the explicit teaching of the comprehension skills and strategies (such as summarization, question and answering, and identifying the main idea) that good readers have internalized and employ without conscious effort. Both struggling and accomplished readers need to build a repertoire of comprehension strategies that they can call on when attacking new text. All students benefit from learning and practicing these skills discretely. However, research by Judith Langer, from the National Research Center on English Learning & Achievement, suggests that teaching these skills solely in isolation limits their value (Langer, 2000). Langer found that in the most successful classrooms, teachers first modeled the comprehension skills, simulating what the students should be doing in their own reading. Teachers then gave students opportunities to practice the skills as an integrated part of their regular reading and core literature lessons. Students could then clearly see and employ these skills within the context of their normal reading experiences.

A reading comprehension program from Tom Snyder Productions enables this kind of explicit modeling and practice in a whole-class setting.

Reading for Meaning targets reading comprehension through whole-class instruction and guided practice. Students develop skills in five key areas: main idea, inference, sequence, cause & effect, and compare & contrast. Students read authentic literature selections in fiction and non-fiction, complete graphic organizers, and answer comprehension questions.

The whole-class experience is perfectly suited for a projector or whiteboard, as a teacher leads students through step-by-step lessons. Together, the class listens to narrated excerpts, reads the excerpts, and

responds to guiding questions. Collaboratively students and teacher construct a graphic organizer to help visually represent the meaning of the text. The program uses a specifically designed graphic organizer for each skill area (for example, compare & contrast uses a Venn diagram).

Each electronic organizer in *Reading for Meaning* is a dynamic tool when projected for the class: students participate by building the on-screen organizer, and a teacher engages the whole class in constructing a visual representation that can be saved, recalled, and printed.

Researchers at the University of Oregon reviewed 110 high quality studies on mathematics teaching, reporting on the contrast between “conventional mathematics instruction” and more effective teaching methods. In the conventional model, students passively observe teacher demonstrations, and then work independently. In the more effective lesson model, three phases occurred:

In the first phase, teachers not only demonstrated, but explained, and asked many questions, checked for understanding, or conducted discussions. In sharp contrast to the conventional model, students were almost always quite actively involved in the instruction during the initial phase. (Dixon et al. 1998)

The second phase was termed a “help” phase and described a stage between learning something new and applying that new knowledge independently. This phase is often the bulk of the lesson and takes many forms: teachers actively involved in helping students understand and apply concepts, students helping one another collaboratively, teachers providing additional explanations when students falter, etc. The third phase was a short independent assessment activity, usually asking students to generalize or demonstrate a transfer of knowledge to new applications.

In mathematics, students apply their knowledge and skills when they are asked to solve problems. A program from Tom Snyder Productions teaches students to understand and solve common kinds of word problems using explicit modeling and guided practice.

GO Solve Word Problems is a program that teaches students to recognize mathematical situations in word problems, comprehend problems with the aid of graphic organizers, and plan solutions with addition, subtraction, multiplication, and division.

The program includes instruction and practice. A teacher can use an interactive whiteboard to introduce each topic and engage the class in a guided practice activity.

For example, the instruction on Equal Parts problems begins with an animation to anchor the context of this kind of word problem in familiar ways. After the class watches the animation, the teacher engages the class in using an Equal Parts graphic organizer to show the information and relationships in a given word problem. Students then practice independently, following the model outlined in whole-class instruction.

Students benefit from showing and explaining, and from seeing and hearing the approaches of other students.

Research on how to improve student understanding repeatedly shows that having students articulate their understanding in their own words leads to the most marked gains in comprehension (see Chi, et al, 1994; Siegler, 1995). These findings appear across domains, grade levels, and abilities. In teaching practice, this is expressed as an emphasis on academic, goal-directed instructional conversations, rather than lecture (CREDE 2002).

Engaging students in a metacognitive discourse about their understanding leads to significant gains in comprehension. It is important here to distinguish between independent explanation and repetition of information. Students who could simply repeat a memorized explanation did not demonstrate lasting understanding of concepts. For students to be able to apply their conceptual understanding, they had to be able to verbalize the concept in their own words. Indeed, one study in the science domain concluded: "Perhaps fewer misconceptions would persist after science lessons if the children, rather than the teachers, did most of the talking in class" (Pine & Messer, 2000).

One example of a classroom software program designed specifically to foster academic conversations in the classroom, with participation from every student, is described below.

Decisions Decisions is the name of a series of role-playing software packages designed specifically to help generate informed discussion and decision-making in the classroom. The titles in the series deal with topics ranging from colonization to feudalism to town government to prejudice. A minimum of four students must participate.

Decisions Decisions is at its best when used with small-group and large-group discussions. Each student on a team of four has a different booklet, filled with advice drawn from historical and contemporary analogies. Students share and debate the conflicting advice in the booklets as they work their way through the scenario.

Student participation is structured so that everyone participates. In their small groups, students read the advice, share the information with their teammates, and then debate which action to take. Then teams share their decisions, and the class must reach a consensus.

This classroom software sets up the scenario, points students to passages in the booklets that offer conflicting advice, records decisions as they are made and presents new decisions as a consequence of past choices. Its design was made specifically to spark student interactions and conversations on a given topic.

It's how you use your projector and interactive whiteboard that will make a difference in teaching and learning.

Technology in the classroom has the capacity to engage and motivate students, which in turn has positive effects on achievement. Several large-scale studies (Sivin-Kachala 1998, Kulik 1994) report that students' attitudes toward learning and classes improve when computers are used in instruction.

Interactive whiteboard manufacturers have documented the positive themes of student engagement, motivation, and appeal to students with different learning styles (SMART Technologies 2004). Qualitative research and field research confirms that the use of interactive whiteboards has a positive effect on student engagement and can have positive effects on teacher attitudes (see, for example, Beeland). Teachers benefit from the effects on students, and they enjoy bringing a wider variety of modalities to students (visual, auditory, tactile).

Experimental design research is lacking, but the British Educational Communications and Technology Agency has documented the benefits of whiteboard use for teachers and students. Also cited are practical considerations, and the cautions that teachers may feel pressure to spend time creating materials to use with the technology and that training and professional development are important considerations (BECTA 2003).

The effectiveness of educational technology is influenced by the software design and the educator's role. The mere presence of an interactive whiteboard or projector has no effect until a teacher does something with it. Harness the power of your technology by supporting classroom practices that research has shown to be effective and by using classroom software made for whole-class instruction.

Sources

BECTA [British Educational Communications and Technology Agency] (2003). ICT and pedagogy. Department for Education and Skills. Queen's Printer.

BECTA (2003). What the research says about interactive whiteboards. Becta ICT Research series. Available from www.becta.org.uk/research.

Beeland, W. (Undated). Student engagement, visual learning, and technology: Can interactive whiteboards help? Retrieved 12/10/2005 from <http://www.prometheanworld.com/uk/html/training/research.shtml>.

Bransford, J. D., Sherwood, R., Hasselbring, T., Kinzer, C., & Williams, S. (1990). Anchored instruction: Why we need it and how technology can help. In D. Nix & R. Spiro (Eds.), *Cognition, education, and multimedia: Exploring ideas in high technology* (pp. 115-142). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Center for Research on Education, Diversity and Excellence (CREDE) (2002). The Five Standards for Effective Pedagogy. Retrieved 12/28/2005 from http://www.crede.org/standards/stand_indic.shtml.

Chi, M.T.H., deLeeuw, N., Chiu, M.H., & LaVancher, C. (1994). Eliciting self-explanations improves understanding. *Cognitive Science*, 18, 439-477.

The Cognition and Technology Group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher* 19, 5, 3-10.

Dixon, R., Camine, D., Lee, D., Wallin, J., and Chard, D. (1998). Report to the California State Board of Education: Review of High Quality Experimental Mathematics Research.

Kulik, J.A. (1994). Meta-analytic studies of findings on computer-based instruction. In E.L. Baker, and H.F. O'Neil, Jr. (Eds.). *Technology assessment in education and training*. Hillsdale, NJ: Lawrence Erlbaum.

Langer, J. (2000). *Beating the Odds: Teaching Middle and High School Students to Read and Write Well*. Albany, NY: National Research Center on English Learning & Achievement, 2000.

Marzano, R., Pickering, D, and Pollock, J. (2001). Classroom instruction that works: Research-based strategies for increasing student achievement. Association for Supervision and Curriculum Development.

Mayer, R. E., & Gallini, J. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology*, 82, 715-726.

Mayer, R. E., Steinhoff, K., Bower, G., & Mars, R. (1995). A generative theory of textbook design: Using annotated illustrations to foster meaningful learning of science text. *Educational Technology Research and Development*, 43(1), 31-43.

National Reading Panel (2000). *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction*. Washington, DC: National Institute for Literacy.

Palinscar, A. S. & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 2 (1984): 117-175.

Pine, K., & Messer, D. (2000) The Effect of Explaining Another's Actions on Children's Implicit Theories of Balance. *Cognition and Instruction*, 18 (1), 35-51.

Rivers, J. and Sanders, W. (2002) Teacher quality and equity in educational opportunity: Findings and policy implications. In L. Izumi & W. Evers (Eds.), *Teacher Quality* (pp. 13-23). Hoover Institution Press.

Schachter, J. (1999). The Impact of Education Technology on Student Achievement: What the Most Current Research Has to Say. Milken Exchange on Educational Technology, Santa Monica, CA.

Siegler, R.S. (1995). How does change occur: A microgenetic study of number conversation. *Cognitive Psychology*, 28, 225-273.

Sivin-Kachala, J. (1998). *Report on the effectiveness of technology in schools, 1990-1997*. Software Publisher's Association.

SMART Technologies, Inc. (2004). *Interactive whiteboards and learning: A review of classroom case studies and research literature*. April 2004.

Waxman, H., Lin, M., Michko, G. (2003). *A Meta-Analysis of the Effectiveness of Teaching and Learning with Technology on Student Outcomes*. Learning Point Associates, for North Central Regional Educational Laboratory. Retrieved 12/28/2005 from <http://www.ncrel.org>.

Wenglinsky, H. (2002, February 13). How schools matter: The link between teacher classroom practices and student academic performance. *Educational Policy Analysis Archives*, 10(12). Retrieved 12/10/2005 from <http://epaa.asu.edu/epaa/v10n12/>.

Tom Snyder Productions

Tom Snyder Productions, a Scholastic company, is a leading developer and publisher of educational software for K–12 classrooms. The company was founded more than 25 years ago by Tom Snyder, a former science and music teacher, who pioneered the utilization of technology in the classroom to enhance teaching and learning. Today we are proud to carry over 100 award-winning software titles covering each curriculum area, developed with strict adherence to our high standards for quality and innovation. Our products help teachers meet curriculum goals in over 375,000 classrooms, improving student performance and understanding.

Our mission is to create innovative products and services to inspire great teaching and improve student learning.

For more information, please visit www.tomsnyder.com or call 800-342-0236.