



A White Paper on Effective Whole Class Instruction with Technology

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Executive Summary

Tools such as the interactive whiteboard show great promise for whole class learning and are ideally suited for activities such as the introduction of a new concept, review and reinforcement of key skills, or in-depth class discussions. This white paper explores how programs such as Orchard Software can be utilized with such tools to help realize their fullest potential in the classroom.

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The Role of Whole-class Instruction

It has long been recognized that diversity in culture, experience, and learning style fosters in every student a unique set of educational needs. The ideal response would be to provide every student with a totally individualized curriculum; but economic and other considerations have historically made this model impractical. Most of us grew up with the more common model: one teacher, presenting content and practice activities to student groups of ten or twenty or more all at once, typically with knowledge acquisition and skill-building as the primary outcomes and lecture as the primary means of delivery. This scenario and a number of variations of it are often referred to as “whole-class instruction.”

Technology is making it increasingly possible to envision the ideal of customizing instruction on an individual basis. Today schools can implement software that assesses student strengths and weaknesses, builds an individualized learning plan, delivers computer-based content using a variety of interactive methods, and then tests mastery of content standards. Yet the strategy of whole-class instruction is far from obsolete. In fact, it serves as one of several tools for assessment and instruction in a *differentiated learning* model (Hall, 2002) and has provided a context for new ways of thinking about how social interaction and creative expression are involved in learning (see McREL, 2006).

Most whole-class instruction is conducted according to one of two schools of educational thought. In a whole-class activity such as a test review, for example, the objective is to achieve mastery of a quantity of knowledge for the purpose of measurement on a test. This is typical of *behaviorist* thought. Behaviorist theory sees knowledge as a quantity and the teacher as the deliverer of that quantity to students. In

the behaviorist school of thought, skills and amounts of knowledge are considered discrete and, as such, ought to be taught incrementally. Measurable progress against established standards is a characteristic of behaviorist educational theory (McREL, 2006). *Constructivist* theory challenges the behaviorist notion that learning is the acquisition of a progression of measurable concepts. Instead, according to constructivist thought, a child builds—or *constructs*—understanding by interacting with his or her environment. Constructivist activities typically involve a student in applying his or her own experience and assumptions to a new concept (McREL, 2002). A constructivist activity in a whole-class setting might consist of a discussion that encourages students to compare the action in a literary text with their own experiences or to use inquiry to explore why a process in nature exists.

Researchers agree that often it is difficult to identify teaching that is purely behaviorist or purely constructivist. Much whole-class instruction incorporates a blend of both—a strategy referred to as *balanced instruction* (McREL, 2003)—as well as variations of both, such as cooperative learning and collaborative learning. Researchers also agree that the value of each strategy is in how effectively it provides instruction to students with diverse learning styles and various levels of skill and ability.

At a time when technology is altering the face of individualized instruction, it is not surprising to discover that it is also introducing change to the whole-class lesson plan. In recent years computers, multimedia projectors, and presentation software have made overhead projectors largely obsolete and brought a greater level of student involvement to whole-class activities. More recently, the combination of multimedia projectors and interactive whiteboards appears to be infusing increased engagement, interaction, and motivation into whole-class

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instruction. The intent of this white paper is to explore how the emerging technology of the interactive whiteboard can be used with existing educational software to impact the whole class learning experience. Examples will illustrate the effective use of whiteboard and software in behaviorist, constructivist, and balanced instruction settings.

The Interactive Whiteboard

An interactive whiteboard is a large touch-sensitive screen connected to a computer and a digital projector. The computer's display is projected onto the board and can be controlled by touching the board directly or with a pen-like electronic tool. In addition, most models also allow users to annotate their work on the board and save the notes to the computer when an activity is completed.

Whiteboards are being embraced by more and more schools—and not just as new equipment in computer labs, but rather as everyday teaching tools in regular classrooms. This is a natural fit of course in an environment that demands the teaching of 21st-century skills, but more than that, it is a practical response to diverse student needs—some of which cannot be met efficiently by individualized methods of instruction. Educators report the following whole-class benefits of interactive whiteboards:

- With a whiteboard display, a teacher can present concepts that are difficult to communicate without graphics.
- A whiteboard can facilitate the introduction of a new concept or necessary skill to an entire student group, as well as enhance teacher opportunities to assess whether students are grasping the material.
- Because they often encourage greater spontaneity during classroom activities, whiteboards can contribute

to the effectiveness of whole-class collaborative learning activities.

- Using a whiteboard can enhance the review or reinforcement of key skills.
- Incorporating an interactive whiteboard into a whole-class activity enhances motivation and appeals to a wide variety of learning styles and levels of understanding; whiteboard applications have been shown to increase the effectiveness of some activities for ELL learners and hearing- and sight-impaired students.

Whiteboards and Software

How effective an interactive whiteboard is as an instructional tool for whole-class learning depends upon the content displayed on it and the extent to which a teacher or student can interact with that content. Conventional office software offers one dimension for display in a whole-class context; software developed by whiteboard manufacturers and others specifically for use with whiteboard technology offers another. What about instructional software originally developed for use at individual workstations in computer labs and classroom centers?

Effective instructional software programs are developed to meet rigorous curriculum standards and offer learning activities in a variety of engaging interactive formats. Whiteboard manufacturers recognize this and often approve existing software for use in whiteboard-based strategies. Much of what makes an instructional software product effective in a whole-class setting is what makes it effective for individualized instruction:

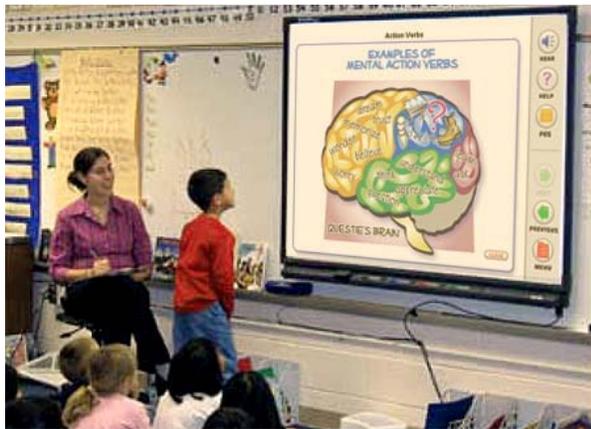
- Rich content that provides many alternatives for in-depth discussions and learning
- A wide variety of options for student interaction and input

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- Screen graphics that are conducive to being displayed in a whole class setting (i.e., sufficient white space, colorful graphics, limited text, etc.)
- Easy navigation, including the ability to move fluidly from one section of the program to another as needed

may assign students to work individually with manipulatives to try to solve the displayed problem.

Illustrations Using Orchard Software



What might whole-class learning look like using Orchard and an interactive whiteboard?

Orchard Software provides engaging interactive computer-based instructional content in reading, language arts, math, and science. In addition to providing individualized assessment and targeted instruction for one or two learners at a workstation, it offers some exciting possibilities to the educator interested in putting it to use in a whiteboard-enabled whole-class setting. Below are four scenarios that illustrate Orchard's adaptability and scope in whiteboard applications.

Scenario 1: Examples from the Orchard K-3 Math Concepts Series

One of the activities in the Numeration Skill Tree module of Orchard's K-3 Math Concepts series is called *Sharing Marbles* (see illustration). At the outset, the teacher



The *Sharing Marbles* activity from Orchard's Numeration Skill Tree

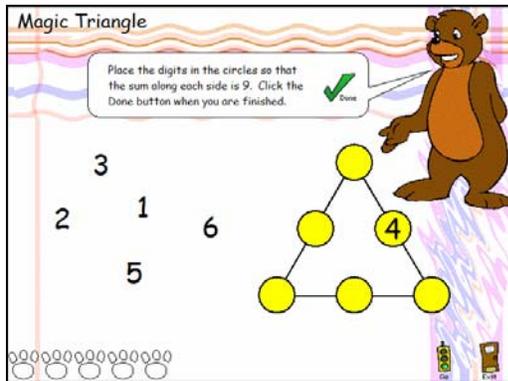
One student might be selected to come up to the whiteboard to select and drag marbles into the appropriate bags while explaining his or her thought process (e.g., "First I tried to put four marbles in each bag, but I didn't have enough..."). When the student has finished, the teacher can use Orchard's immediate instructional feedback to spark a whole-class discussion.

This is a typically behaviorist application in that there is a quantifiable result. However, the teacher has blended it with a constructivist approach by asking for student experience and by inviting discussion in response to Orchard's feedback. The large display and Orchard's engaging graphics serve to focus the class' attention and motivate them to track their classmate's progress and participate naturally in the group discussion.

Another activity in the Numeration Skill Tree of Orchard's K-3 Math Concepts is a critical thinking lesson called *Magic Triangle* (see illustration). One strategy for presenting this activity for whiteboard-enabled whole-class instruction is to have students work in small groups to discuss the best answer to the problem, and then call upon a representative from one group to input their answer. At this point, the teacher may choose to pause the

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lesson and discuss a key concept in detail, annotating essential points on the screen for clarity. For example, in this case, the teacher may stop to discuss the possibility that a problem can have more than one solution.



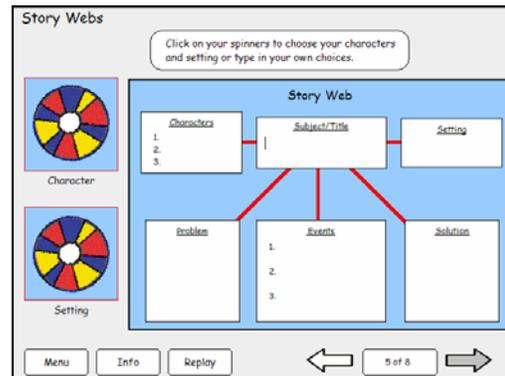
The *Magic Triangle* activity from Orchard's Numeration Skill Tree

In these two examples, the whiteboard is a tool that helps introduce two different problem-solving strategies to every member of the class. In addition to involving students directly and indirectly in practice and feedback, the whiteboard helps to accentuate the learner-friendly characteristics of the software: colorful but straightforward graphics, as well as user interface features such as drag and drop input.

Scenario 2: Examples from the Orchard Language Concepts Series

The *Story Webs* activity from the Writing & Media Literacy 4 Skill Tree module of Orchard's Language Concepts series lends itself to whole-class presentation in a constructivist framework. *Story Webs* provides practice in the prewriting skill of brainstorming; by transferring the activity to an interactive whiteboard display, a teacher can involve the entire class in the creative process. Students can take turns coming up to the whiteboard to "spin" the wheel (see illustration) in order to determine the characters and setting. Students can then

brainstorm ideas individually for the title, problem, events, and solution.



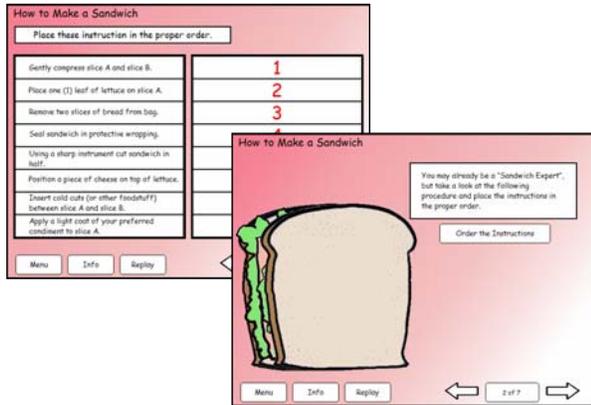
Story Webs activity from Orchard's Writing & Media Literacy 4 Skill Tree

Next, the class can share their ideas and decide which to use for the class story web. These can be written directly onto the web in the whiteboard's "digital ink" or typed in via a wireless keyboard, and then printed out for each student. Students can then use these webs to begin a creative writing story.

In this illustration, students collaborate as a whole group, offering their own experience and insights to reinforce the skills involved in the process of writing. As with the activities from the Math Concepts series, the whiteboard helps maintain student focus and encourage active participation. The lesson's display works together with the whiteboard interface to invite student interaction.

Other activities integrated throughout Orchard's Language Concepts series can be useful for reviewing a variety of concepts with the entire class. For instance, completing an activity such as *How to Make a Sandwich* (see illustration) as a class can be a powerful way to review the importance of sequential order in expository writing. Students may work either individually or in groups to order the events. Next, one student (or group spokesperson) may input his or her response via the interactive whiteboard, explaining his or her choices along the way.

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How to Make a Sandwich activity from Orchard's Reading, Research, & Language Skills 7 Skill Tree

At any point, the teacher may pause the activity to discuss why a particular order makes more logical sense than another, making annotations on the screen as needed. Students may then move on to choosing their own topics and instructional steps for an expository writing piece using this whole class experience as a reminder of the importance of sequential order.

Orchard's Language Concepts series builds essential communication skills through the use of dynamic tutorials and a variety of instructional strategies that lend themselves to whole-class instruction as well as to individualized instruction. In addition, the lessons of the Language Concepts series are designed to be accessed randomly rather than in linear fashion—flexibility that gives considerable control to the teacher if extension or exploration is appropriate for the whole class.

Scenario 3: An Example from Orchard's Biology Concepts Series

Orchard's Biology Concepts Skill Tree modules use video and inquiry-based activities to help students explore key science concepts. These features, developed for thought-provoking individual instruction, may be easily transferred to an interactive whiteboard for effective use in a whole-class

setting. A good example is the Biology Concepts Photosynthesis Skill Tree.

A teacher may display the initial inquiry question (see illustration) on the whiteboard and assign it for students to respond to individually. Next, students may take turns sharing their responses with the class. After comparing responses, students may watch the related video as a group. At critical points throughout the presentation, the teacher can pause the video, either to highlight important concepts on the whiteboard or to ask probing questions that help assess student understanding. Students may then work together as a class or in small groups to respond to the post-viewing inquiry question and review questions.



Inquiry video from Orchard's Photosynthesis Skill Tree

What is important about an illustration such as this is how it highlights Orchard's adaptability for diverse learning styles and skill levels in a whiteboard-enabled whole-class setting. Orchard's audio and video features strengthen the ability of the presentation to appeal to ELL learners and students with disabilities, and the teacher's ability to stop the presentation at critical moments to reinforce a point or annotate a detail adds the ability to clarify or elaborate. Another feature of Orchard, the Video Vocabulary, offers an additional resource to help students deepen their understanding of concepts presented in science Skill Trees.

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Scenario 4: Examples of Orchard Review and Reinforcement Activities

Repeated practice and structured review are two characteristics of behaviorist approaches to learning. Teachers have developed a variety of whole-class activities to assist students in reinforcing the discrete knowledge presented in regular instruction, as well as to provide interventions for students struggling with certain concepts.

One method of practice and review developed for Orchard is the two-player learning game. An interactive whiteboard can turn a two-player activity into an effective whole-class learning strategy.



Orchard's Fractions: Mixed Practice and Math Word Problems: Intermediate

The class can be divided into two teams. Each student can then be responsible for working out the problems individually, and the teacher can call on students randomly to answer for their team; only one student may enter a solution on the whiteboard, but all students will be actively engaged in solving the problem. If students are struggling with an answer, the teacher can pause the game to review the concept or display the program's help function (such as the Time Out feature in Orchard's Mixed Practice series) to explain the process, adding notations on the whiteboard as needed.

Conclusion

The interactive whiteboard is an adaptable, flexible instructional technology whose impact is yet to be fully understood. Since whiteboards first appeared in the 1990's, educators have come to agree that they are an agent of engagement, interaction, and motivation in whole-class activities, and that they increase the number of options available to a teacher who needs to appeal to a diversity of learning styles and abilities. Software is a key factor in the use of whiteboards in whole-class settings; the more naturally an instructional program can be integrated into strategies using whiteboards, the more effective it is likely to be for whole-class learning. Many programs developed for use in individualized instruction, such as Orchard, incorporate design features that make them well suited for whole-class applications with interactive whiteboards.

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Appendix A

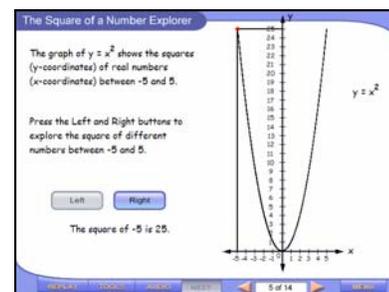
Multimedia Projectors

Schools and districts that do not have access to technology such as interactive whiteboards may instead choose to utilize a multimedia projector in conjunction with a classroom computer to create an impactful whole class learning experience. Of course, choosing appropriate software for use with the projector is crucial to success. An important feature to consider is the format in which the content is presented in. To be conducive to display in a whole class setting, the content should include:

- Colorful graphics
- Easy-to-read text
- Helpful animations
- Simple navigation

Orchard and Multimedia Projectors

Orchard Software's robust content includes many Skill Trees which are well-suited for use with a multimedia projector. For instance, Orchard's Advanced Algebra Skill Trees include a wide variety of lessons and activities that can be successfully utilized in a whole class setting. The interface is simple and easy to navigate, while the rich content provides many opportunities for whole class discussion. For example, teachers can display a lesson such as *Squares & Square Roots* from Orchard's Algebraic Foundations Skill Tree (pictured below) using a multimedia projector to help students visualize graphing the square of a number. This dynamic lesson allows the teacher to change the graph with the click of a mouse, something that could not be easily accomplished without the powerful combination of quality software content and a tool such as a multimedia projector. In addition, completing this lesson as a class opens up the possibility for whole class discussions that support in-depth learning of the topic.



Squares & Square Roots activity from Orchard's Algebraic Foundations Skill Tree