Instructional Design & Implementation

Research by:

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Managing the Integration of
Technology into Instruction **with *Classworks*™**

The school landscape is littered with unused technology which fails to be integrated into a meaningful curriculum. One can safely argue that the last sector of society that remains "unwired and unchanged" is public education. (Bailey et al., 1996)

Increasingly as we approach the next century, technology is accepted not only as a resource for enhancing the existing K–12 curriculum, but also as a catalyst for transforming the very nature of teaching and learning. As Linda Roberts, Director of the U.S. Department of Education's Office of Educational Technology, has observed, "Evidence shows that the technology has enormous benefits for all of our kids" (Clopton, 1997). The importance of these benefits is reflected in the scope of the U.S. Department of Education's four goals for fostering technological literacy:

1. *Teachers will have the training and support they need to help students learn using computers and the information technology.*
2. *Teachers and students will have modern multimedia computers in their classrooms.*
3. *Every classroom will be connected to the information highway.*
4. *Effective software and on-line resources will be an integral part of every school's curriculum.* (Trotter, 1996)

Despite this emphasis, the promise of effective integration of technology into instruction remains largely unfulfilled, and technology has yet to become an "integral part" of instruction in most schools and classrooms. While teachers recognize the value of technology, the requirements of effective integration are often seen as a source of "anxiety and stress—an obstacle to overcome" (Picus, 1997). A wide range of software products and technology tools is available, but these are often underutilized and poorly integrated into the curriculum.

One significant reason is that unlike teaching with textbooks, which have a well-established classroom history of helping teachers "[make] the leap from intentions and plans to classroom activities" (Schmidt et al., 1996), there are few models for using computers in instruction. Research on the relationship between technology and education has revealed that "Technology in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction" (Grégoire et al., 1996). However, in all too many cases, teachers are left without useful guidance in how to intelligently combine technology with what they are already doing in their classes. As a result, educational software programs, even if used, are often provided "as is" to students, without creative implementation, adaptation, and instructional support. In this way, technology tools are often relegated to the periphery of teaching rather than effectively integrated.

This difficulty is compounded by the current emphasis on content-area educational standards. During the past ten years, professional groups in each major area of education, including the National Council of Teacher of Mathematics (NCTM), National Academy of Sciences, National Council of Teachers of English (NCTE), and National Council for the Social Studies (NCSS), have articulated new standards or goals in their discipline.[1] School districts expect teachers to be able to correlate their instructional goals to these standards, or to state or local standards derived from national standards, and to ensure that all students receive a standards-based curriculum linked to content and performance. When it comes to integrating software, however, teachers are often left on their own to determine how and where

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[1] *Curriculum and Evaluation Standards for School Mathematics* (1989); *National Science Education Standards* (1995); *Standards for the English Language Arts* (1996); *Expectations of Excellence: Curriculum Standards for Social Studies* (1994).

content standards are met and to ensure that performance is at appropriate levels. If technology is to play a meaningful role in meeting these standards, teachers must be supported in integrating technology in a

way that is consistent, equitable, substantive, instructionally sound, and adaptable to the specific circumstances of their classrooms and communities.

The sheer scope and variety of instructional technology products contribute to the problem by making the teacher's integration task more complex and time-consuming. Many teachers feel overwhelmed by the challenge of investigating a wide range of software titles from a standards-based perspective, judging their quality, linking learning outcomes to specific content and performance objectives, then developing a plan for tying each program into instruction and monitoring student performance. Faced with this challenge, teachers may rely on the reputation of well-respected software products and publishers to target their initial investigations; but effective implementation still requires a significant time and energy investment. Since many of the best-known software titles were not designed to fit together instructionally, teachers face the additional challenge of integrating these products with each other, as well as with other classroom materials and with the teacher's own practice. Fundamentally, if teachers do not have the curriculum support, knowledge, time, and resources to integrate technology into instruction easily and effectively, then it is unlikely their students will derive measurable benefits from this valuable resource.

CURRENT TECHNOLOGY MODELS

Many educational software publishers provide implementation suggestions describing how to integrate their products in the classroom to support a standards-based curriculum. These implementations typically fall into two broad contrasting models: stand-alone software and integrated learning systems. The remainder of this paper addresses the strengths and weaknesses of these two models and introduces a third alternative, *Classworks*, which has advantages of both models without their concomitant disadvantages.

STAND-ALONE PRODUCTS

One advantage of using stand-alone products is the wide variety of choices in virtually all curriculum areas and at all grade levels. This versatility runs the gamut from straightforward skill and practice software to content-based tutorials, logic puzzles, information resources, and sophisticated multimedia presentation tools. Although choosing from the many titles can be difficult, teachers are easily attracted to popular software titles that have been developed by established educational publishers. In particular, they are drawn to products that have earned awards of excellence and positive reviews from reputable organizations. School versions of quality stand-alone products typically include teacher's guides, correlations of the software to national standards, student activities, and suggestions for classroom implementation and integration. Some exemplary products even come with off-computer manipulatives designed to make it easier for teachers to integrate the computer with hands-on activities.

Unfortunately, teachers usually perceive stand-alone products as "add-ons" to the curriculum rather than as primary sources of knowledge, information, and instructional activity. There is little, if any, attempt to integrate these programs into daily instruction. In practice, most teachers assign students to these programs "outside" the regular curriculum to accomplish one of the two "Rs"—remediation or reward. In working with the various choices in the school's software library, teachers find it difficult to maintain the connection among the content of the software programs, the student's time on task, and the specific learning objectives of a subject area.

Furthermore, without a built-in management system, there is no way of knowing exactly where to place students in a software program or how much time they might need to derive its full benefits. Because there is no consistent monitoring and reporting of a student's progress and performance, teachers do not know what students may have learned (or not learned), and therefore cannot use ongoing assessment results to guide instructional planning. As a result, student work with the software becomes largely irrelevant to the main thrust of the teacher's instruction, thereby losing most of the benefits that come from an effectively integrated program.

INTEGRATED LEARNING SYSTEMS

Traditionally, an integrated learning system (ILS) provides curriculum within a carefully designed management system, removing from the teacher the burden of choosing and assigning appropriate software. Using an ILS curriculum manager, teachers can match lessons to particular objectives and assign parts or all of a sequence of units, lessons, and activities to individuals and/or groups of students. The progress and performance of each student is monitored and reported both electronically and in print. The system can also use adaptive strategies to adjust the activities that are made available to the student, deciding not only what kind of remediation or enrichment is appropriate, but also when to deliver it. Teachers can access information about student performance in a variety of ways and at any time. If necessary, they can adjust the curriculum that their students will receive.

Curricular offerings in an integrated learning system are typically well defined and reflect a scope and sequence for one or more disciplines and grade levels. The curriculum is usually correlated to textbooks and/or objectives based on national and state standards defined by groups such as the NCTM or the NCTE. These systems usually include print materials that can be used to complement the computer-based curricula.

One significant disadvantage of traditional integrated learning systems, however, is the relatively inflexible, comprehensive instructional model they impose on schools and teachers. Although most ILS programs allow customization of the electronic curriculum and limited use of third-party software, many teachers are hesitant to adjust the system, uncertain what will happen if they do.

Furthermore, such systems are generally designed to be self-sufficient, and are not well-suited to innovative repurposing and introduction of outside material. Similarly, the instructional value of individual program components may be reduced if they are resequenced or used outside their original environment. As a result, teachers often choose to use the system "as is" rather than adapting it to their own circumstances. They minimize their use of the ILS or compartmentalize it from the rest of their teaching instead of creating a true integration of the software with the teacher's best instructional knowledge and practice.

Another important disadvantage of traditional integrated learning systems is that they do not include a broad range of familiar and well-known educational software products, but are limited instead to the offerings of a single software development company. Integration of third-party products into the ILS may be supported technically, but only to the level of launching the product and reporting time on task. Rather than glean the best of what has been created in educational software, teachers must make do with whatever is included in the ILS—or if they expand the system's offerings with third-party software, they must be prepared to accept reduced usability and (in many cases) technical problems.

THE *CLASSWORKS* MODEL
Classworks, with its integrated library of popular and award-winning learning software products, combines the quality, flexibility, and variety of stand-alone programs with the computer-based management tools and integration support of an ILS environment. Students are directed to a sequence of activities that has been seamlessly woven together from many different programs to meet specific learning objectives.

For example, the fourth grade math unit *Adding and Subtracting Decimals* incorporates age-appropriate activities targeting the unit objective from both *Math Blaster®* and Knowledge Adventure's *JumpStart Adventures 4th Grade™*. In this way, the unit combines the instructional power of two proven software programs into an integrated, computer-managed content sequence. Thus, *Classworks* offers the primary advantages of both the stand-alone and ILS models without their corresponding disadvantages.

This example illustrates the effective combination of award-winning software and a flexible, open management system that is the hallmark of the *Classworks* approach. Software products used to design the *Classworks* curriculum sequences include a broad range of familiar, high-quality products that have already earned popularity and respect among educators due to their instructional effectiveness. Each unit consists of activities from products such as Knowledge Adventure's *JumpStart* Learning System™, Tom Snyder's *The Graph Club®*, and Roger Wagner's *HyperStudio®*.

These popular and well-respected products, with which teachers may already be familiar as individual stand-alone software, have been structured into learning activities that address specific curriculum objectives, then organized into an instructionally sound sequence. Thus, when teachers assign a *Classworks* sequence to their students, they can be sure that students are using some of the best products on the market to learn important skills and concepts, and to practice applying them in real-world contexts. Further, the rich array of instructional approaches presented by this range of software titles enhances learning for all students while supporting a wide variety of student learning styles.

Like an ILS, *Classworks* contains a sophisticated curriculum management system that can be used to modify existing *Classworks* sequences or to create a unique curriculum sequence. Modifying or creating sequences using the existing instructional units and activities is very easy: teachers simply copy a particular sequence of units and their activities, then use the cut and paste commands to reorder activities and units.
Similarly, teachers can easily include additional third-party software to the system and integrate activities from

these products right into the *Classworks* curriculum. For example, if teachers have been using a particular stand-alone product in their classrooms, such as *Microsoft® Word* or Claris's *FileMaker®*, they can add a network version of the program to the *Classworks* manager and be assured that it will run successfully and that it can be used in an integrated way as part of the curriculum.

Using *Classworks*, teachers can create a template file within the program, assign it to students, then open each student's work file and write comments to the student directly in the file. This openness and flexibility of the *Classworks* management system represents one of the program's major strengths in supporting the specific needs of individual schools, teachers, and students. As one technology coordinator whose school district uses *Classworks* explained,

> *We looked at a lot of different systems before purchasing Classworks two and a half years ago. We had an ILS system previously . . . and we were looking at another one . . . but we felt [the company] didn't offer the flexibility of Classworks. We also wanted to be able to integrate name-brand software—our teachers like to swap software in and out.*[2]

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[2] Comment by Kathy Clark, Technology Coordinator, Keystone Oaks School District, Keystone Oaks, Pennsylvania, in a *Classworks* user survey

ELEMENTS OF THE *CLASSWORKS* SYSTEM

How does *Classworks* solve a school district's need to manage easily the integration of computers into instruction? The secret lies in the more than 1,000 units of instruction in Language Arts and Mathematics. These units draw from more than 150 diverse software programs, including many award-winning titles. This core Language Arts and Mathematics curriculum can be further supplemented with cross-curricular units through the addition of other *Classworks* software titles, such as *Vital Links™*, a cross-curricular program with a Social Studies emphasis, and *English Express®* Deluxe, which provides a strong ESL focus. Because every instructional unit—whether predefined, modified, or uniquely created using a third-party product—addresses a specific skill or objective, the sequences can easily be linked to district or school curriculum objectives through the *Classworks* management system.

THE *CLASSWORKS* CURRICULUM

Classworks provides teachers with well-defined instructional units whose skills spiral through the elementary curriculum. The *Classworks* core curriculum includes a comprehensive sequence of over 1,000 units distributed among nine instructional sequences in Language Arts and nine sequences in Mathematics, covering grade levels K–8. Units and activities within sequences designed for students in kindergarten and first grade contain audio reinforcement.

A typical grade-level *Classworks* sequence contains sufficient instructional material to span an entire school year. Each sequence is based on the content of selected national and state standards and frameworks and nationally recognized standardized tests, and is designed to complement a variety of widely used textbooks. Resources consulted in the design of the *Classworks* sequences include:

- State frameworks from California, Florida, Texas, and New York
- NCTM and NCTE Standards

- Stanford Achievement Test (SAT-9), California Achievement Test (CAT), Comprehensive Test of Basic Skills (CTBS), and Iowa Test of Basic Skills (ITBS) objectives
- Textbook series published by Harcourt, Pearson, MacMillan-McGraw-Hill, and Houghton Mifflin

The units that make up a sequence provide a variety of activities pulled from one or more software titles. As students work in a unit, *Classworks* reports their progress and keeps a record of their performance.

Teachers who plan to have students work at their own pace and level can assign them to take a Placement Test before they begin an instructional sequence in *Classworks*. Depending on their Placement Test performance, students may be assigned to work in different grade-level sequences and may receive different unit assignments within a sequence. Items on the Placement Test are based on skill objectives of the units in the sequence. Taking the Placement Test is a one-time only event. From that point on, each student's path through a sequence is managed automatically by *Classworks* unless modified by the teacher.

Each instructional unit in a sequence focuses on the development of a discrete skill. The title of the unit reflects its objective. Each unit includes five interactive environments: a Mini-Lesson, two Activity Banks, a Quick Quiz, and a Project.

Mini-Lesson. The Mini-Lesson in each unit provides quick, didactic instruction on the skill being addressed in the unit. Each Mini-Lesson consists of three interactive parts: Learn, Apply, and Review. The Mini-Lesson presents the skills and concepts that will be tested in the unit Quick Quiz.

Activity Banks. Two sets of ten to thirty activities lie at the heart of every unit. These activities provide students with instruction, practice, and assessment on the skill of the unit. Activities are taken from individual software titles within the *Classworks* library, such as *Grammar Games*, *Spell It®* Deluxe, *Math Keys*, and *Math Blaster*.

Each activity in an Activity Bank generates a performance score that is reported to the student and the teacher. After completing the Mini-Lesson, students begin in the default Activity Bank but can be automatically branched to the remedial Activity Bank if their performance after three activities fails to meet a given criterion level, which can be set by teachers.

Quick Quiz. This ten-item assessment tool measures the student's proficiency in the skill of the unit. If students score less than a minimum criterion score on the Quick Quiz, they are automatically branched to the remedial Activity Bank for more instruction and practice. At the end of this second set of activities, students again take the Quick Quiz.

If teachers have elected to intervene after students fail a quiz, then students are stopped and a message appears within *Classworks* instructing them to speak to their teacher. The management system generates a report that allows the teacher to tell which students are at-risk. If teachers have not elected to intervene, then when students finish a quiz, they go on to the project or start the next unit in the sequence regardless of their scores. All scores and time-on-task are reported through the management system.

Project. This optional section provides an open-ended, interdisciplinary learning experience for students. Projects are described in an accompanying notebook of activities and black-line masters, and involve the use of software tools within *Classworks* such as *HyperStudio*, *The Cruncher*, *The Multimedia Workshop*, and *Kid Works Deluxe*. Internet resources are used throughout the projects. The notebook provides guidelines for each project to help teachers evaluate completed projects.

MANAGEMENT OF COMPUTER-BASED LEARNING

The strength of the *Classworks* solution lies not only in the depth and breadth of its curricular offering, but also in the flexibility it provides to teachers through its instructional management system. Any teacher who uses *Classworks* can adapt the program to perform any of the following tasks:

- Modify the existing learning objectives (i.e., units and activities) to match a local curriculum
- Integrate third-party courseware within the curriculum management system
- Individualize assignments
- Automatically manage a student's progress through the assigned courseware
- Obtain a variety of progress and performance assessment reports
- Evaluate student products on the computer (e.g., writing activities, spreadsheets, multimedia presentations) and store teacher assessments of those products within the curriculum management system

One experienced *Classworks* educator characterized the system's strength and flexibility in the following terms:

Because Classworks doesn't dictate the curriculum, we're able to custom-design the scope and sequence within the program to support the curriculum. The teachers feel that Classworks helps to fill in the gaps in the student's knowledge as well as reinforce new skills. It has something in it for all ages, ability levels, and learning styles, and it helps the teachers work with a wide variety of skills and instructional objectives.[3]

Using the *Classworks* Curriculum Editor, teachers can copy and then modify a predefined sequence. To modify a copy of a predefined sequence, teachers simply highlight particular units in a sequence and

click an Enable/Disable button that turns the selected unit(s) on or off. This same procedure can be used to modify the activities in a unit. Teachers can also modify the order of units in a sequence and of activities in a unit.

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[3] Comment by Kathy Clark, Technology Coordinator, Keystone Oaks School District, Keystone Oaks, Pennsylvania, in a *Classworks* user survey

In addition, teachers can create a new, custom sequence, then copy and paste units from existing *Classworks* sequences into the new sequence. This same copy and paste function can also be used to create a new, custom unit comprised of selected *Classworks* activities.

Teachers use a special feature within the Curriculum Editor, called the Ancillary Lesson Launcher (ALL), to add third-party software and associated documents (templates) to any sequence. These documents become activities within units. For example, teachers may add *Microsoft Works* to *Classworks* and create a template file that students will use as an activity within a unit. When students log into the system and choose this activity from the menu of activities in a unit, *Classworks* automatically opens the appropriate template in *Microsoft Works*. Thus, teachers can create unique curriculum sequences that meet specific instructional goals.

REPORTING AND ASSESSMENT OF STUDENT LEARNING

Research on the contribution of new technologies to learning emphasizes the benefits of computer-based assessment capabilities such as those found in *Classworks*. In a report on the assessment capabilities of computer-based learning systems, three researchers[4] noted that

> *It was the diagnostic function of the system that produced the most visible if not the most pronounced effects on the teaching staff. One member of this staff who was very skeptical at the start. . . . explained, "Lydia has word skills problems but I was identifying the wrong skills—the integrated learning system sorted that for me and I could direct my efforts to solving the child's problems." . . . In the opinion of the school's administration, the thought process that use of this system had triggered had benefited other aspects of [the teacher's] teaching.* (reported in Grégoire et al., 1996)

The purpose of computer-based assessment is to diagnose each student's strengths and weaknesses

so teachers can provide the most appropriate intervention, including meaningful remediation or enrichment. *Classworks* provides tools that enhance the ability of teachers to assess their students' learning in a variety of ways.

Management System Reports. Teachers can use the management system reports to access information about their students' progress through the curriculum units by means of the instructional management system. Information presented in these reports includes units that have been assigned to students, units they have started and completed, time on task, and scores they have earned on the activities and quizzes within a unit. These reports can be printed and shared with students and parents.

Management system reports and assessments provide teachers and parents with the means to assemble a continuous history of each child's progress and performance. As reported by a district technology coordinator,

> *I use the reporting features of Classworks a lot—at least eight times a year and on demand as teachers request. Our teachers are responsible for reporting on special students, and they often ask me for factual material. I can provide this for them from Classworks reports.[5]*

Feedback to Students. As students work through the mini-lessons, activities, and quizzes in a *Classworks* unit, they receive immediate feedback and ongoing guidance from the software. This empowers students to improve their own performance and become independent learners. As one teacher reported,

> *Classworks reporting features have been wonderful for us because [they give] kids the opportunity to become responsible for their own learning and to monitor and adjust their own learning as a result of that.[6]*

Classworks also provides effective tools for teachers to give feedback to students electronically. When students

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[4] Underwood et al. (1996)

[5] Comment by Tony Muller, Technology Coordinator, Island Park School District, Island Park, New York, in a *Classworks* user survey.

[6] Comment by Catherine House, Language Arts/Reading District Coordinator, Wilson Central School District, Wilson, New York, in a *Classworks* user survey.

complete a document on the computer, such as a spreadsheet or a word processing file, they can use *Classworks* to send the document to the teacher to be reviewed. Teachers can review the student's work on the computer and assign it a grade, then send it back to the student with attached comments. Additionally, teachers can use the e-mail function in *Classworks* to communicate with students about their performance. As teachers use the instructional management system to review their students' progress, they can identify those who require special attention—whether extra praise for a job well done or a reminder of work yet to be completed—and send an appropriate message. When students log into *Classworks* the next time, a message on their screen lets them know they have received e-mail from their teacher.

Grade Level Evaluation (GLE). The Grade Level Evaluation (GLE) program, published by Tudor Publishing, is an independent assessment tool designed to measure student mastery of appropriate skills and knowledge at each grade level. Thousands of test items in Language Arts and Mathematics correspond to topics presented in major textbooks and curriculum guides throughout the United States. These are not limited to the skills that represent a curriculum focus for *Classworks*. This means that teachers who use *Classworks* have access to a standardized assessment tool they can use to determine how well their students are doing in relation to skills that are particularly important to the school, district, or state.

Teachers can assign the GLE to students at any time. Items are pulled from the item bank according to the particular skills teachers want to assess. GLE results are available through the *Classworks* management system in a set of detailed electronic and print reports. These reports provide benchmarking information about the mastery levels of individuals or groups of students. Information is available in a variety of formats, including reports that are appropriate for sharing with students and parents.

Projects. Each of the culminating unit projects within *Classworks* involves the creation of one or more products that require students to apply the skill they have learned to solve real-life problems. Projects may involve the creation of documents on the computer, such as a spreadsheet in *The Cruncher* or a writing assignment in *KidWorks Deluxe*, as well as work off the computer. Projects provide both a means of assessing student knowledge in the unit as a whole and an additional teaching opportunity. Each project includes a list of assessment objectives teachers can use to evaluate student work.

***Classworks* and Portfolio Assessment.** *Classworks* provides a broad range of materials that can be included in a comprehensive portfolio of student work. Printed management system reports can be used to document how much work students have completed on the computer, as well as report their scores. Drafts of electronic documents created by students and submitted to teachers can be stored on the computer or printed out for portfolio inclusion, together with teacher comments and student revisions, providing a profile of each student's work over time. Other work created by students, including items from student projects, can also be included in portfolios. Together, these resources can be used to document what students have learned within *Classworks* and their progress toward mastering the skills that are taught in the *Classworks* units.

PROFESSIONAL DEVELOPMENT AND IMPLEMENTATION SUPPORT

Learning how to integrate any software application into instruction takes time and a commitment on the part of a school district and its teachers. The experience of large-scale technology-based projects suggests two types of training needs: (1) preliminary development activities that cover the product to be used and its associated pedagogical approach, and (2) ongoing support provided by software publishers and by other participating teachers (Grégoire et al., 1996). As one superintendent whose teachers are using *Classworks* puts it,

The success of any technology initiative is only as good as the support to sustain it. The support and training we have received from the Classworks people couldn't have been better. Concerns never had the time to become problems. Classworks help is only a phone call away. The numerous training sessions were geared to our staff's needs rather

than some "canned" process. The support really made the product work for us. [7]

The developers of *Classworks* provide both initial and ongoing support services through what is known as "Full-Circle Service™." Quoting a technology coordinator,

> *The support [from Classworks] has been wonderful. We really needed help in the beginning because we were setting up a new district-wide network, Internet access, e-mail, etc., along with Classworks, and they were very helpful with everything. We had had a lot of technical problems with [an ILS] system, and that hasn't been the case at all with Classworks.* [8]

Classworks provides its users with three levels of training and professional development, including both preliminary development activities and ongoing support:

- Immediately after the installation of *Classworks*, technical experts train local system administrators in preparing rosters of teacher and student names, assigning classes to teachers, placing students in classes, and assigning a *Classworks* curriculum sequence to a class.
- Soon after the system administrator training, teachers are provided hands-on training with the *Classworks* curriculum sequences and instructional management system, including demonstrations of how to use the product with students.
- Less formal follow-up training is provided for everyone using *Classworks*. Sessions may involve specific questions or advanced features, including customization of *Classworks* to meet the needs of individual students, creation of unique curriculum sequences, and use of the Ancillary Lesson Launcher (ALL).

BENEFITS FOR EDUCATORS

Using *Classworks* provides educators with several important benefits, including options for managing computer-based learning, linkage of instruction to objectives, and tools for tailoring instruction to specific students' needs. Each of these benefits is described briefly below.

Management of Computer-Based Learning. Reliance on a computer-managed instructional system changes the function and work of teachers in the classroom, in that

> *part of the transfer of information inherent in teaching is shifted from the teacher to the technological media, and the teacher has more time to support each student in the individual process of discovery and mastery of knowledge, skills and attitudes.* (Grégoire et al., 1996)

Teachers become more like facilitators and coaches, tailoring their assistance to the needs of individual children. As one superintendent recalled,

> *We have used Classworks in our district for the past four years, and I feel that one of the long-term effects of using this product will be to help change the way we teach our students. The teacher no longer stands in front of the class and lectures. Now we see our teachers moving about the classroom and acting as facilitators, working with students individually and in groups, both on and off the computers.* [9]

Instruction Linked to Objectives. In *Classworks*, the scope and sequence in Language Arts and in Mathematics reflects a set of objectives based on a review of major textbooks and various state and national standards. Each activity in a unit speaks to the particular objective being presented, thus making it easy for district personnel and teachers to correlate units to corresponding local, state, and/or national standards. As a Language Arts/Reading coordinator in a school district in New York State noted,

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[7] Comment by Dr. Donald Tylinski, Superintendent, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

[8] Comment by Kathy Clark, Technology Coordinator, Keystone Oaks School District, Keystone Oaks, Pennsylvania, in a *Classworks* user survey

[9] Comment by Dr. Donald Tylinski, Superintendent, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

We were looking for a package that matched the New York State standards and was a good instructional match with our curriculum, and we felt that Classworks fit the bill. . . . Out of 165 schools in the Western New York area, our sixth graders came [in] third in reading—it's hard to say how much of this we can attribute to Classworks, but we feel it has had an impact.[10]

Tailored Instruction. *Classworks* gives teachers the flexibility to tailor instruction to the needs of each student. Through the two-tiered activity banks, the program automatically adjusts the curriculum to meet the needs of individual students, based on the system's ongoing performance assessment. Additionally, teachers can adapt the existing units or create their own units to meet their individual instructional goals. As one educator noted,

Classworks accommodates students with all ability levels and varying learning styles. Classroom teachers are able to control the degree of difficulty and mastery level to meet the individual needs of gifted as well as special needs students.[11]

Because *Classworks* contains more than 150 software titles, a great variety of software is available to the teacher to help students learn particular skills:

Classworks seems to work well with students with different learning styles. From the early grades, we use a very hands-on program, and the Classworks combination of visual, auditory, and kinesthetic approaches fits very nicely. . . . Classworks is interactive—it takes the students back and helps them find and understand their mistakes. This requires students to do more thinking than just filling in the blanks on a worksheet.[12]

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[10] Comment by Cathy House, Language Arts/Reading District Coordinator, Wilson Central School District, Wilson, New York, in a *Classworks* user survey

[11] Comment by Joseph P. Malak, Assistant Superintendent of Curriculum, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

[12] Comment by Cathy House, Language Arts/Reading District Coordinator, Wilson Central School District, Wilson, New York, in a *Classworks* user survey

BENEFITS FOR STUDENTS

Just as *Classworks* provides benefits to educators, it also provides specific benefits to students. These include increased motivation, the capability for self-pacing, exposure to a variety of stimulating software products, and support for the special needs of individual students. Reflecting on his school's use of *Classworks*, one superintendent observed:

Everyone's bottom line is whether students' achievement improved as a result of using Classworks. The scores in our district, when compared to schools in the state with similar conditions, are well above expectations. We can't positively identify Classworks as the sole factor affecting student achievement scores; however, when no other variables within the school system have changed, it would be hard to argue against the fact that Classworks played a major role.[13]

Motivation. Research suggests that quality educational software can motivate students. In a three-year study on the use of technology by students in grades K–2 conducted by the Center for Research, Evaluation and Training (CREATE) in Burlingame, California, researchers concluded that students

are drawn to technology and are intrinsically motivated to use computers. At each site we visited, we saw students who were always eager to have their time at the computer, whether to complete an assignment from the teacher or to engage in activities of their choice. When children were offered a choice of many classroom activities, computers were always the most popular option. (Guthrie and Richardson, 1995)

A review of the literature finds positive effects of technology on attitudes toward all major subject areas (Sivin-Kachala and Bialo, 1996).

Linda Roberts, Director of the U.S. Department of Education's Office of Educational Technology, also

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[13] Comment by Dr. Donald Tylinski, Superintendent, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

attests the motivational value of well-designed computer software for basic tasks such as drill and practice:

> *The highly-effective drill and practice and tutorial software that is out there . . . shows very promising results for students who need more time practicing. The technology can really help us extend the practice time for these students . . . in highly-motivating ways.* (Clopton, 1997)

Similarly, the U.S. Congress's Office of Technology Assessment has concluded that technology

> *can be a key vehicle for stimulating learning, primarily because it creates environments and presents content in ways that are more engaging and involve students more directly than do textbooks and more traditional teaching tools.* (U.S. Congress, 1995)

Units within *Classworks* contain activities ranging from fun-filled basic skill and practice programs (e.g., *Math Blaster* and the *JumpStart* series) to open-ended tool products (e.g., *The Cruncher* and *HyperStudio*). This variety keeps students motivated, since each activity is different. One superintendent noted, "It can be tough to get students' attention these days—we have to compete with the media—but *Classworks* does a great job of engaging them."[14]

Self-Pacing. One of the advantages of instructional software for students is the ability it provides for them to work at their own pace. The variety of quality software included in the *Classworks* library permits students to spend more time in the areas where they feel they need more work, or with activities they find more engaging or that connect best to their own learning style. Students can also repeat sequences. Because the system reports the time that each student spends on an activity, teachers can use this information to see if and when they need to intervene. Teachers can monitor how students are pacing themselves through a sequence so they are continuously challenged at a level that maintains their interest and motivation.

According to the findings of a two-year study conducted by Lani M. Van Dusen et al.,[15]

> *Of all the areas in which change could occur, the time students concentrate on a learning activity heads the list. Because they love working with a computer, because they can progress at their own pace, and because they receive immediate feedback on what they are doing, "the students remain engaged."* (reported in Grégoire et al., 1996)

Variety of Stimulating Software Titles. The variety of software within *Classworks* captures the attention and supports the varied learning styles of nearly every student. For example, in the area of early learning software, titles such as *JumpStart Kindergarten*®, *JumpStart 1st Grade*®, *Kid Phonics*™, and *Knock Knock*™ provide students with a wide assortment of age-appropriate experiences in reading, language arts, mathematics, music appreciation, and artistic expression.

For elementary school students, *Classworks* features a broad array of tutorial, skill, and practice software, including such titles as *Reading Maze*™, which introduces essential reading skills through fascinating mazes; *Grammar Games*, in which students learn the rules of grammar in a rain forest setting; and the *Math Blaster* series, which provides practice with a range of math skills in the context of outer space adventure scenarios.

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[14] Comment by Dr. Donald Tylinski, Superintendent, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

[15] Van Dusen and Worthen (1995)

Engaging logic-based exploration activities and games include programs such as Mindplay's *Ace Explorer™* series, in which students take the role of a reporter or detective to find clues to solve a problem, and *Math for the Real World™*, in which they learn how mastering real-world math problems leads to real-life success. These programs not only promote knowledge in specific skill or content areas, but also help develop students' reasoning and information-processing skills.

Classworks also provides ample opportunities for reading and writing experience. For example, *Story Club™* presents literature in an interactive, multi-sensory context and provides the tools for students to draw, write, or record their ideas and feelings about what they've read. For guidance throughout the writing process, there is *Media Weaver*, which offers a text and multimedia word processing environment that enables students not only to write and revise their work, but also to illustrate and publish it.

Other open-ended software tools for students include *The Cruncher*, which integrates a full-powered spreadsheet with interactive, multimedia tutorials that teach students how to use spreadsheets and graphs in everyday life; and multimedia presentation titles such as *The Multimedia Workshop* and *HyperStudio*. Information resources, such as the multimedia U.S. history database included in *Vital Links,* are also available for independent and directed student exploration.

These software programs promote effective learning and stimulate interest through a combination of captivating multimedia presentation of content, a variety of interactive formats, and extensive help and support systems. Additionally, *Classworks* can be expanded to include network versions of almost any third-party program. Taken together, the library of *Classworks* programs and the additional third-party resources teachers can add to the system help to make learning both challenging and enjoyable.

Support for Special Needs Students. Because *Classworks* gives teachers the flexibility to tailor instruction, they can adapt the predefined instructional units to create units that meet a variety of individual needs. The number and range of software titles in the *Classworks* library provides teachers with resources that appeal to students with many different learning styles. As one superintendent noted, this flexibility is an important benefit in working with special needs students:

> *Classworks accommodates students with all ability levels and varying learning styles. Classroom teachers are able to control the degree of difficult and mastery level to meet the individual needs of gifted as well as special needs students.*[16]

By offering a structured sequence of units and activities, *Classworks* can provide needed support for students who are behind academically, under-challenged, or under-motivated, or who may have other special needs.

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[16] Comment by Dr. Donald Tylinski, Superintendent, Freeport Area School District, Freeport, Pennsylvania, in a *Classworks* user survey

CLASSWORKS AND BEST PRACTICES IN COMPUTER INTEGRATION

"Best practices" are defined as those instructional methods

> *that help students communicate, provide highly visual learning environments, make it safe for students to ask questions and make mistakes, and help students develop thinking skills by solving real-world problems.* (Loeterman and Harkins, 1996)

Instructional approach and *systemic approach* have been identified as two key elements of best educational practices. With respect to instructional approach, best practice programs

> *promote and implement a "hands-on/minds-on" approach that includes investigation, discovery, and application.* (Ruskus and Luczak, 1995)

From a systemic perspective, best practices means that

> *program content and activities align with curriculum, instruction, assessment; with national and state standards; with district . . . frameworks; with school/district strategic plans; and with other change efforts.* (Ruskus and Luczak, 1995)

How does *Classworks* satisfy these criteria? Activities in each unit include a wealth of hands-on interactive approaches, each of which stimulates student thinking in a different way. Learning environments in the *Classworks* products are intensively visual, utilizing to its fullest the computer's graphic potential, while a broad array of help features provides consistent support and makes the computer a safe place for student learning. Projects in each unit include a variety of "hands-on/minds-on" dynamic activities that provide opportunities for students to integrate their understanding and apply knowledge to real-world problems.

Such projects also provide natural environments and opportunities for communication, particularly when they incorporate the use of communication tools such

as word processors and multimedia presentation programs. For example, in a *Classworks* project entitled "It's a Zoo Out There!" third grade students work in groups of five to plan for a new zoo. Based on data about populations of animals they plan to acquire for the zoo, students use *The Cruncher* to prepare an illustrated spreadsheet complete with formulas. When they have completed their analysis, they create and can share a graphic display of various habitat designs for selected animals.

Not only does *Classworks* meet the criteria for best practices in instructional methods and approaches, it also performs admirably when judged according to Ruskus and Luczak's systemic criterion. *Classworks* instructional sequences—units and activities—have been designed to align closely with the standard elementary curriculum.

Correlation to specific local, state, and/or national standards is easily accomplished, since each unit and the activities within it are matched to an objective. Additionally, teachers can easily create their own activities in *Classworks*, incorporating documents and files from third-party products to fill any gaps there may be in the coverage of specific standards used by the school or district. As one district administrator reported,

> *We were looking for a package that matched the New York State standards and was a good instructional match with our curriculum, and we felt that Classworks fit the bill. . . . We don't allow anything to dictate the curriculum to us, and you don't have to be lock step in a pre-designed curriculum with this system. The teachers can choose what they want—they have a lot of flexibility.*[17]

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[17] Comment by Cathy House, Language Arts/Reading District Coordinator, Wilson Central School District, Wilson, New York, in a *Classworks* user survey

CONCLUSION

This paper has focused on how and why *Classworks* can meet a school district's need to manage the integration of computers into instruction. By combining the range and quality of stand-alone software with the effectiveness of integrated learning systems, *Classworks* provides the best of both worlds in instructional technology.

For teachers new to technology, it provides an easy way to get started. *Classworks* places students into a sequence of well-defined instructional units consisting of activities drawn from its vast library of more than 150 titles. The versatility of the software used to create the activities—including many well-respected, award-winning product titles—provides a wide variety of different interactive environments. Linking the same objective to multiple activities in a unit increases the chances that a student will master the objective.

Classworks' sophisticated management system makes it easy for teachers to keep records and manage student assignments. Teachers can access reports on each student's progress and performance. They can use the reports to make decisions about how and when to intervene. And because each unit in *Classworks* is linked to an objective, the units and the activities within them can easily be correlated to textbooks and to local, state, and/or national standards.

Additionally, there is the capability of adding third-party software to *Classworks* and creating customized sequences of units and activities. Adding software is easy using the Curriculum Editor, and *Classworks* makes it possible for teachers to access and evaluate the work files students have created. Using the *Classworks* instructional management capabilities, teachers and students can meet and exceed the content and performance requirements specified in national standards documents.

To fulfill the promise of effective integration of technology into instruction, teachers must have access to the very best educational software and the means to organize and connect it to their instructional goals. The educational titles within *Classworks* give teachers access to software that educators and parents have consistently chosen as among the best in instructional technology. The design of the curriculum sequences provides a coherent, instructionally integrated scope and sequence, with the flexibility teachers need to tailor and customize that curriculum to meet the needs of their students. Additionally, the management system provides the freedom for teachers to supplement the *Classworks* curriculum sequences by adding other third-party software products to meet their instructional goals. In all these ways, *Classworks* supports school districts in fulfilling the promise of technology as an effective tool to promote and enhance student learning.

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