Enhancing Interdisciplinary Instruction in General and Special Education

Thematic Units and Technology

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ABSTRACT

This article discusses interdisciplinary thematic units in the context of special and general education curricula and focuses on ways technology can be used to enhance interdisciplinary thematic units. Examples of curriculum integration activities enhanced by technology are provided in the context of productivity tools, presentation and multimedia tools, contextual themed software, and Web-based activities.

INTEGRATED OR INTERDISCIPLINARY INSTRUCTION IS a teaching model that is gathering attention in general education and special education circles. Rather than thinking of instruction and curriculum as separate entities, Shoemaker (1989) defined an integrated curriculum as

> education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study. It views learning and teaching in a holistic way and reflects the real world, which is interactive. (p. 5)

In general, integrated instruction is defined as flexible schedules and student groupings, relationships between ideas, a blending of subjects, an emphasis on project-based learning, and use of thematic interdisciplinary units to organize instruction (Northwest Regional Educational Laboratory, 2001). Interdisciplinary instruction has many characteristics attractive to special education instruction. It focuses on meaningful learning and skills that occur across content/curriculum and should assist students in forming the associations needed for lifelong learning.

For students with high-incidence disabilities, some characteristics of interdisciplinary instruction may impose challenges that require additional support or accommodations. As students who often move between general and special education classrooms, their learning can become fragmented. Students with high-incidence disabilities do not always apply what they learn in one situation to other situations or subjects. How can special education teachers integrate the curriculum or develop interdisciplinary instruction more effectively? We believe one strategy is to develop thematic units that focus on specific topics and use technology to support instructional events within that unit. In this article, we provide a definition of thematic units and focus on ways technology can enhance thematic units for students with high-incidence disabilities.

Interdisciplinary Thematic Units

Burns, Roe, and Ross (1992) defined thematic units from a literacy standpoint, where effective teaching of language is organized around a central topic, idea, or theme that uses related activities and experiences to conduct a more in-depth

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study. Vardell (1995) talked of making learning more sensible and identifiable for elementary students through thematic teaching units, where integrated learning activities and subject areas are organized around familiar topics in children's literature. Finally, Reutzel (1997) described how young children become more engaged, familiar, and situated in the learning process when they learn reading and writing via themed units that use interdisciplinary content (e.g., reading, writing, math, social studies, art, music). Therefore, taking into consideration the aforementioned perspectives, the following definition captures the spirit of interdisciplinary thematic units and what they do from an instructional perspective:

> Thematic or integrated instruction is an interdisciplinary teaching approach that presents subject matter according to themes or topics. Each theme or topic is presented in extended units so that students have enough time to develop understanding and to find connections to what they know and value. This approach integrates knowledge from different disciplines and encourages students to explore topics deeply, reading many different sources and engaging in a variety of activities. The use of multiple sources encourages students to be involved in planning, locating materials, and thinking more actively and deeply than when learning is based on a single text. As a result of their in-depth study, students are more likely to understand and feel confident in their learning. (North Central Regional Educational Laboratory, 2001, ¶ 1)

The concept of interdisciplinary thematic units—instructional activities that are thematically meaningful, structured, and organized across curriculum areas—provides teachers an opportunity to guide the study of critical components in the curriculum. In addition, thematic units offer a way of combining student interests with core skills to motivate them to perform less liked academic activities. By virtue of being across the curriculum, thematic units provide a wider opportunity for students to work on individual skill-based objectives within the context of curriculum standards. For example, a thematic unit on whales can be designed to meet science-based objectives for one student and to enhance literacy skills, such as grammar or creative writing, for another student. Thematic units also provide an opportunity for collaboration between the special and general education teachers to examine, adapt, and incorporate basic skills with the theme. As the process takes place, an important element in the development of thematic units for special educators is choosing an implementation strategy that is appropriate for their classroom schedule and management style. Table 1 lists six strategies for the implementation of thematic units in self-contained classrooms or resource settings. In each strategy, the theme acts as a pattern for organizing ideas, materials, and actions for both teachers and students. Once teachers choose a theme and begin to develop lessons based on individual student needs, the next step is to select technologies to enhance learning.

Technology Integration Activities

Technology integration into thematic units involves much more than simply using technology in a unit. It requires a process of deliberate instructional planning to achieve specific outcomes related to the unit. In this context, the rationale behind integrating technology is not to make an entire unit technology driven but to critically examine a unit's instructional events and find those places where technology effectively supports student learning.

When planning technology-based activities for students with high-incidence disabilities, it is important to consider how the learning will be structured and how much direction and guidance should be given to a student (Gardner & Wissick, 2002). It is equally essential that these activities be authentic, meaningful, and interactive (Ferretti & Okolo, 1996; Gardner & Wissick, 2002). Depending on the needs of individual students, technology-enhanced activities can create learning environments that are dynamic and generative, employing problem solving and promoting active learning (Grabinger, 1996), or that are directed at learning very specific skills (Robyler & Edwards, 2000).

In this section, our discussion on technology-integration activities in thematic units will focus on illustrating activities and applications of technology that enhance unit content. Several technology components can be integrated into interdisciplinary thematic units. Examples and discussion will focus on four general technology areas that include productivity tools, presentation and multimedia, content/skill software, and Web-based activities. When considering the development of thematic units, there is no uniform rule of technology use. Activities can include those that provide in-depth practice with one type of technology or exposure to several different types. In other words, the unit reinforces the overall context and structure of the theme and the emphasis on technology, but activities in and of themselves are there to enhance content. Units that integrate multiple technology-related activities can also serve to meet several of the *National Educational Technology Standards for Students* (International Society for Technology in Education, 2000).

Using Productivity Tools to Enhance Thematic Content

From a student perspective, productivity tools typically include word processors, spreadsheets, databases, and other software that perform specific functions to enhance learning. All of these tools can create impressive products. However, when considering productivity tools in the context of thematic

TABLE 1. Strategies for Thematic Unit Implementation

Focus	Description	Example
Centers	A series of themed lessons and activities are organized in centers around the classroom. Individual or small cooperative learning groups of students work through the unit during scheduled periods over the course of a week or two. Teachers might need to have instructional aides or parent volunteers assist students at the computer centers.	Centers could include the technology area, music area, art area, blocks, skill building, cooking, and creative play. Each student rotates through all the activities.
Daily activities	Time each day is devoted to a unit, and students build on their knowledge and explore the topic in-depth. Students work on skills related to science, social studies, math, and language arts, but the activities are not separated. Each activity builds on the skills from the previous activity.	A unit on insects: Students work on an activity each day for a total of 2 weeks. The end of the unit results in a class presentation slide show or book.
Cross-curricula	Activities that rely on skills that some students might believe to be independent from one another are presented as related based on thematic relevance. One activity for each content area (e.g., math, language arts, science, social studies, art, music, health) is developed. The activities do not necessarily need to build on the skills presented in the previous lesson, and the presentation order of activities can be adjusted for the individual skills needed by the students.	A unit on the Oregon trail: Day 1: Write a journal. Day 2: Based on weight, calculate the number of items that can be taken on your wagon. Day 3: Discuss the role of seasons and weather as it pertained to traveling by wagon.
Basic skills	A unit is developed around the core skills for reading. A variety of topics from the reading textbook are subsequently related to social studies, science, and math curricula. The unit reinforces general classroom reading concepts and can also provide weekly technology time to learn specialized assistive software, such as word processing and word prediction programs.	A unit related to SRA Reading Mastery III, Textbook B (Engelmann & Hanner, 1995): Develop activities that reinforce the science and social studies concepts magnets, use of timelines, ancient worlds, and early explorers.
Semester w/weekly activity	A thematic unit is integrated throughout the year on a weekly basis to allow teachers time to present core functional skills. One class per week or month is devoted to the topic, with long-term activities for the students to complete before the next lesson.	A unit on healthy living: Students keep a food chart of their snacks and lunch habits for a month. Other topics could include money management and careers.
Technology skills	Students are introduced to technology competencies. A theme is selected to focus on the process of investigation and the learning of new skills.The theme then provides an anchor for learning specific technology skills.	A unit on endangered animals: Students use the topics to develop skills in Web searching, word processing, data collecting, and presenting.

units, it is important to think beyond *what* they do (e.g., create spreadsheets, databases, produce papers/reports) and look at them in terms of *how* they function to improve the learning process by making it more efficient, meaningful, and enriching for the student. Thus, our focus is on examining the activities associated with a thematic unit and how productivity tools enhance those activities.

Writing Productivity Tools. Most teachers can easily envision activities that incorporate word processing. Individual students, especially students with disabilities, often need guidance in a variety of different writing activities. They are frequently assigned journal writing, reaction papers, or topical reports. The integration of word processing into a thematic unit can be more expansive and provide both the necessary prompts and opportunities to apply higher order literacy skills.

Writing is a process that is well supported by technology (Graham & MacArthur, 1988; MacArthur, 1996). The key to thinking of writing and technology for students, especially those with high-incidence disabilities, is understanding that word processing and writing productivity tools can be exam-

ined in terms of both how they support the overall process of writing and how they support language tasks and specific skills that are affiliated with writing. For example, MacArthur (1996) focused on how technology enhances the writing process and writing instruction. Okolo (2000) described features of word processing programs and software writing tools that enhance student motivation to write and the writing experience. These two studies provide comprehensive overviews regarding how technology can be used to support written language activities.

In the context of thematic units, depending on the individual skills and needs of the student, word processing should be considered a scaffold rather than an end in and of itself. In other words, simply providing students access to word processing as part of their thematic unit activities is a relatively weak strategy. The benefits of spell checking, grammar checking, editing and correcting errors, and printing a legible product should be taken for granted. A more robust approach is to use the context of the thematic unit to reinforce specific language skills and focus on ways these features can support the final written product. Table 2 describes a variety of language skill activities affiliated with a thematic unit and gives examples of how technology could be used to accommodate them.

Two fundamental tools that should be provided for students with high-incidence disabilities are word processing with word prediction and text-to-speech options. For some students, typing is extremely arduous. Other students, when faced with writing and typing, expend such an inordinate amount of mental energy retrieving words from memory that they are unable to concentrate on more functional aspects of writing, such as grammar, text structure, organization, and ideas. Word prediction programs, such as Co:Writer 4000 (Don Johnston, 2001a), apply rules of grammar and interpret content and vocabulary to predict and generate lists of words most likely to come next as the words of a sentence are being typed (see MacArthur, 1998, for illustrated examples). Word prediction can reduce students' anxiety and increase the flow of writing, although teachers have to consider the cognitive abilities of each student, as word prediction requires that students have the ability to review the list of words predicted and select the word they are anticipating, or continue typing to create a new list of word options.

Text-to-speech options are programs (such as IntelliTalk II [Intellitools, 2001]) or features of programs that allow students to hear their letters, words, sentences, and paragraphs spoken aloud as they write. For some students, hearing what they have written spoken enables them to evaluate and revise

TABLE 2. Writing/Word Processing Activities for a Thematic Unit on the Rain Forest

Writing activity	Method/description
The student will write a 2-sentence statement about a rain forest animal that contains 4 facts about the animal.	Prompted writing and sentence combination: The student opens a word processing file that contains 2 incomplete sentences serving as writing prompts. The student then performs a sentence-combination task, using the editing features of the word processor: The name of your animal is: *The Coatimundi*. The animal is found in the rain forest location: *Central America*. The habitat of this animal is: *on the ground and in the trees*. The animal eats: *fruits, insects, and small animals*. Write your two-sentence statement below: *Answer: The Coatimundi is an animal found in the rain forests of central America. The habitat of the Coatimundi is on the ground and in the trees, where it eats fruits, insects, and small animals.*
The student will practice using synonyms by editing a story about the rain forest.	Editing synonyms: The student opens a file and is instructed to edit italicized or boldfaced words by replacing them with a synonym of the word: "Poison Arrow frogs, also known as Dart frogs, *inhabit* rain forests of Central and South America. There are over 160 *different* species and they are found in as *many* colors and patterns as you can *imagine*. Their bright colors *'tell'* predators to stay away." (Kalasinskas, 2001)
The student will write a letter to the United Nations on the following topic: "What are some things that will help save the rain forests?"	The student will use a word processor and apply tools to maximize her ability to communicate ideas, information, and personal thoughts to a member of another audience. The student will develop a positive attitude about writing—writing can fulfill an important function in society and be an effective way to communicate personal values, beliefs, and opinions to others.

their grammar, word cohesion, and consistency. Finally, although speech-to-text (i.e., voice recognition) might logically be considered a third writing option, this technology is currently less stable. For some students, dictating their thoughts directly into a word processor can be a significant support, particularly at the drafting stage of writing. However, issues regarding the accuracy of the programs to decode students' speech into text and the required amount of student time and effort to train voice recognition programs still need to be resolved before they can be considered a practical option for most students (De La Paz, 1999; McNaughton, 1998; Wetzel, 1996).

In addition to special features of word processing programs, software programs that provide students with scaffolds to think about and organize their writing are available. Draft Builder (Don Johnston, 2001b) allows students to outline their topics and then move sequentially into their drafts. Inspiration 7 (Inspiration, 2002) allows students to create a web or map of thoughts providing a visual model for the links in their writing. For younger students or students with disabilities, Kidspiration (Inspiration, 2000b) provides the same mapping features but also includes a text-to-speech auditory feedback option.

There are many programs that provide students with the ability to publish their writing as books or animated products. Programs such as KidPix Studio Deluxe (Learning Co., 1998) and KidWorks Deluxe (Davidson & Associates, 1996) allow students to illustrate their writing and create a book or presentation as a final product. Programs such as Imagination Express (Edmark, 1995) or Storybook Weaver (Learning Co., 1995) allow students to write a story and create a scene by selecting background items and objects. Final scenes can be printed or animated in a presentation. The Imagination Express series have several thematic topics (e.g., rain forest, oceans, castles). Each software package also includes story starters and a research section for students to read or listen to background information on the topic.

Spreadsheets and Charts. Most spreadsheet programs have integrated charting and graphing features and can be used to demonstrate mathematical concepts, sort and analyze data, make predictions, and support problem solving (Robyler & Edwards, 2000). The most obvious way to incorporate spreadsheet programs into a lesson is to construct math activities related to the unit's theme that call for students to collect data, enter them into a spreadsheet, create a chart or graph, and make judgments based on interpreting the results. Table 3 provides examples of how spreadsheets can be used to support a thematic unit on oceans.

One positive aspect of spreadsheets is that they relieve students of the computational burden of math. Given that students with high-incidence disabilities often have difficulty performing numerical applications and making predictions, using spreadsheets and graphing software provides an important support for higher order math activities. In each of the examples in Table 3, students are placed in the role of problem solvers who must rely on information they have authentically gathered. They are free to concentrate on higher level thinking skills related to math, such as analysis, synthesis, and decision making using numerical information, rather

TABLE 3. Spreadsheet Activities for a Thematic Unit on the Ocean

Unit objective	Method/description
To learn about use of water and water conservation	The teacher and students can develop a spreadsheet detailing all the uses of water in the household and research the amount of water used with each appliance (e.g., dishwasher, washing machine) or activity (e.g., brushing teeth, taking a bath). Students count how often appliances are used and activities occur during the week. Students can make a graph of the appliances and/or activities that use the most water and illustrate how their family could reduce water consumption.
To compare the oceans of the world	Students can research the size of the world's oceans in terms of distance between countries, depth, volume, and numbers of species. Using a spreadsheet, they can create graphs comparing differences between oceans.
To learn about the animals in the ocean and develop an understanding of the food chain	Students can research various types of animals in the oceans and create a chart listing their sizes, weights, and types of food preferred. Graphs will help students visualize the food chain in the ocean. Students can also adopt a whale and create a spreadsheet to keep track of the cost of supporting the whale. The class can create a spreadsheet to calculate the costs of constructing a seawater aquarium.
To calculate costs related to ocean and environment	Students complete the activities for solving the problems in The Great Ocean Rescue (Tom Snyder, 1998). For each activity they use a spreadsheet to keep track of the costs of their mission. The class can create a chart to compare how much money each student spent on saving the oceans.

than on calculations. Converting a column of numbers into a visual bar or pie chart may be the difference that allows them to understand and/or apply mathematical concepts (e.g., more, less, rank order, percentages) to make decisions. In addition, the ease of changing values in a spreadsheet to create new graphs provides students with a tool to make predictions and then test those predictions. Moreover, given the amount of visual information we are presented with in newspapers and magazines, reading and interpreting charts has become a necessary life skill.

Database Applications. Electronic databases typically contain information in an organized format and, more important, provide ways to manipulate the information to answer questions. When students are placed into active roles that require the manipulation of information, Jonassen and Reeves (1996) suggested that databases should be thought of as *knowledge* databases, functioning as cognitive tools. They proposed that many of the tasks associated with using databases, such as organizing outwardly independent information into meaningful categories or making decisions through investigation and manipulation of content, promote higher order thinking skills. They also offered that the very process of compiling a database may enhance recall and retention of information. Using a database to enhance learning of content related to a thematic unit has many possibilities.

In a technology-enhanced environment, traditional written papers (e.g., word-processed documents) should not be the sole product used to judge learning of students with high-incidence disabilities. Some students may not be able to compose a grammatically correct paper on a topic but may be capable of finding, entering, and/or manipulating information in a database in structured and creative ways. For example, to teach a unit on the Civil War, where key topics for data collection are people, places, events, and other facts, the teacher could present the class with a blank record template that contains preestablished fields for each topic. For the "important people" category, the template fields might include a person's name, birth date, hometown, profession, and most notable quote; three facts about the person; and a larger text field for writing a short paragraph on the person's role in relationship to the Civil War. With these established parameters, the students are then free to gather their information from a variety of sources, such as books, CD-ROM encyclopedias, and the Internet. To evaluate their learning and effort, evidence of their compilation of information, such as a printout of the database's records, could serve as their major assignment in lieu of a paper. Other options are that students could give oral reports or create electronic presentations using the content of a database, or access preexisting databases, select records, and summarize the information into complete sentences that state facts.

A number of activities using thematic units and databases function very well in illustrating the instructional principle of problem-based learning. One example is to give a student a set of questions that require him or her to search/sort data and report conclusions orally or on a worksheet. A more comprehensive activity would be to provide a group of students with a database template and have them research and gather facts, enter the information into a database, search and sort information to answer questions, and subsequently produce a written report. Finally, using a database to enhance a thematic unit need not be limited to activities and outcomes that focus on the compilation of a database. Table 4 provides examples of database activities with learning goals represented in the context of Gagné's (1985) varieties of learning. In these examples, instructional activities center on learning goals that are not directly tied to any particular content database but to types of learning outcomes that may be important to particular students.

Presentation and Multimedia Tools

There is little argument that communicating information and knowledge to other individuals is an important skill. In their most straightforward form, presentation programs such as Microsoft PowerPoint and HyperStudio 6 (Knowledge Adventure, 2000) provide students who do not communicate well in written form the opportunity to integrate textual and pictorial information to support classroom presentations. In this situation, teachers place less importance on the formal writing of traditional papers or reports and more importance on the organization of knowledge that communicates information in a way that makes sense. Having students give oral reports using presentation software is one way to accomplish this.

Allowing creativity or adding novelty to instructional activities often boosts intrinsic motivation (Stipek, 1998). Another activity is to have students prepare an "eBookReport" using Microsoft PowerPoint to create a slide show as part of their book report. This activity would begin with a title slide that includes a picture of the book's cover, followed by a group of slides identifying interesting facts/features from the book. The eBookReport would end with a summary and conclusion slide stating how the book affected the reader's emotions. One afternoon, self-repeating slide shows of all the eBookReports, with the original print versions of the books alongside the computer, could be running in the computer lab or library media center. Students could move around the room to view each other's slide shows and glance through the actual book to decide if they were genuinely interested in reading it.

Multimedia programs can also be used in a variety of ways to support unit activities. For example, within the context of a thematic unit on the rain forest, Blair, Gardner, Fisher, Ryker, and Toperzer (2001) illustrated how multimedia programs were used to deliver instruction and assist project-based learning. Hyperstudio 6 was used to present vocabulary words. Each card of the program included the word, its phonetic spelling, a definition, a sentence using the

TABLE 4. Database Activities for a Thematic Unit on the Rain Forest in the Context of Gagné's (1985) Varieties of Learning

Gagné's variety of learning	Goal	Method/description
Attitudes	The learner will develop an appreciation of biodiversity (living creatures).	Students will be given questions that require them to use the database to sort categories of rain forest creatures (mammals, birds, reptiles, and insects). Using the answers to gain learners' attention and appreciation of the topic, the teacher will lead a group discussion regarding the biodiversity of living creatures in the rain forest.
Motor skills	The learner will improve her or his keyboarding skills.	Students will be given a database template. Information about rainforest mammals will be typed into the database. Students will focus their attention on typing words with 100% accuracy and/or avoiding use of the backspace key or mouse to delete typing errors.
Cognitive strategy	When asked a question that requires sorting of a database, the learner will apply a cognitive strategy.	Students, particularly those who are impulsive, will practice the RUSTY strategy: **R**ead the entire question. **U**nderstand what field(s) should be sorted. **S**ort the fields. **T**alk to **Y**ourself to make sure you have the information that answers the question.
Verbal information	The learner will state 3 facts about a rain forest creature.	Students will sort a completed database to identify 3 facts each about a rain forest mammal, insect, bird, and reptile. They will write these facts onto a worksheet provided by the teacher.
Intellectual skill: Concrete concept	The learner will identify common characteristics of rain forest creatures.	Using an existing database, students will sort and print a set of records in which all but one rain forest creature have a common characteristic. They will create an answer card that lists the common characteristic and the single animal that does not fit that characteristic. Students will trade their creature sets with each other and try to identify what the common characteristic is and the animal that does not fit.
Intellectual skill: Defined concept	The learner will describe rain forest creatures based on defined characteristics.	Students will research and create a database that includes rain forest mammals, birds, insects, and reptiles. The database must include fields that will allow creatures to be sorted based on 4 or more defined concepts of the students' choice (e.g., the layer of the forest they live in, which animals are generally nocturnal, which animals are meat eaters, which animals can fly)
Intellectual skill: Problem solving	The learner will identify rain forest creatures based on applying a rule.	Using an existing database of rain forest creatures, students will sort and print a record based on questions that contain a rule. For example, if the instruction was to "identify a creature in the rain forest database that eats mammals and lays eggs," possible answers would be the turkey vulture or boa constrictor.

word, and a recording of the word spoken and pronounced. In a second activity, students gathered facts on rain forest animals and used a Microsoft PowerPoint template to create interactive quizzes on rain forest creatures.

Teachers can also use multimedia presentation programs to create a sequence or scaffold for students to introduce and later review concepts related to the unit. Wissick, Schweder, Vesh, Coughenour, and Smithey (2001) demonstrated how multimedia programs were created to illustrate functional concepts and life skills. For a unit on healthy living and cooking, students viewed a presentation on making a grilled cheese sandwich. Presentations for a similar unit on cooking demonstrated the steps in locating items in a grocery store but also focused on the position of an item (e.g., on the shelf or off the shelf; inside the freezer or outside the freezer; in front of the counter or behind the counter). In another functional unit on job training, one student was filmed demonstrating the sequence for preparing for her job in a school cafeteria. In another example, general education students created presentations that were used by students in their special education classrooms.

Multimedia presentation programs offer many options for teachers to enhance unit activities. They can be used throughout the unit by both the teacher and the students to

gather and present information to support learning. The flexibility of the software and its ease of use provide opportunities for communication and interaction between general and special education classrooms. Furthermore, presentations created by students in either special or general education classrooms can be shared among students and classrooms.

Using Contextual-Themed Software

When planning thematic unit activities, there may be software available that provides some degree of enhancement or support for thematic activities. When selecting software, however, individual students' needs should always drive the software selection process. A fundamental goal of technology integration is the principle of curriculum correspondence, where instructional objectives and instructional software are aligned with one another (Edyburn, 1989; Gardner & Edyburn, 2000). A key strategy is to select software that matches a unit's contextual theme and functions in a way that supports the unit's goals and students' needs. Thus, for example, if upper elementary students were studying Egypt, their teacher would identify software that has an Egyptian theme, such as The Cluefinders 4th Grade Adventures: The Puzzle of the Pyramid (Learning Co., 1999a). However, the decision to use this software would be justified only if a valued goal is to have students work on problem-solving/thinking skills, or if the class is learning about the symbols and history of Egypt. This software provides activities that support both these goals and would, therefore, be acceptable to use.

Sometimes it is relatively easy to identify software that supports both a unit's theme and learning goals. For example, writing is a central skill that every student in school has to develop. Writing also requires a set of skills that many special needs learners have difficulty mastering. It would make perfect sense to incorporate a themed program designed to stimulate and support the writing process into a certain thematic unit, such as incorporating Imagination Express Destination: Ocean into a unit on oceans. In other situations, you may find a software program that does not focus on the topic completely but still has areas that fit the spirit of the thematic unit's theme. For example, Learning Center 4th Grade Word Problems and Logical Thinking Skills (Davidson & Associates, 1998) is not about the ocean, but it includes language arts and math skills activities that are ocean-themed. These technology-based activities might represent valid conditions where students can apply language arts and math skills learned during the unit or in previous lessons, in peer-mediated, guided, or independent practice situations. Table 5 provides examples of how various programs could enhance activities in the areas of reading, writing, math, and critical thinking for a unit on the solar system.

In many of the previous examples, we selected software that featured the theme of the unit. However, teachers need to

TABLE 5. Technology Activities in the Areas of Reading, Writing, Math, and Critical Thinking for a Thematic Unit on the Solar System

Content/ skill area	Software title (publisher)	Technology-based activity
Reading	Starry Night: Backyard (Space.com, 2002)	Students select a section/story from an approved list. When they are finished, they complete a teacher-made questionnaire that assesses comprehension and vocabulary.
Writing	Storybook Weaver Deluxe (Learning Co., 1995)	Students create science fiction stories that must include 5 solar system vocabulary words and 5 planetary facts.
Reading, math, problem solving	The Great Solar System Rescue (Tom Snyder, 1997)	Students work in groups to discover the planet location of a missing space probe. Students are given clues about the planet but must read and work together to select the correct planet. Incorrect choices cost the group money, so students need to calculate the amount spent. Spreadsheets can be used to create a graph of group expenses.
Critical thinking	Space Academy GX-1 (Edmark, 2000)	Students experiment through virtual manipulation of the position of the earth, moon, sun, and planets to understand the concepts of eclipses and planetary years.
Math	Learning Center Fourth-Grade Word Problems and Logical Thinking Skills (Davidson & Associates, 1998)	Students work on areas, perimeters, computations, estimation, and fractions in a space context.

go beyond the activities in the software in order to relate software activities to functional skills. We might be quick to use Where in the World Is Carmen Sandiego? (Learning Co., 1999b) as part of a thematic unit on geography simply because it fits the theme of geography and is a well-known and entertaining program. Once the program is selected, however, we need to use interdisciplinary instruction to relate the software to the objectives of the unit and the learning needs of the students. There are numerous ways this program might be extended in creative and effective ways to enhance different content areas. Students could complete journals summarizing their travels (writing). Other activities include keeping a travel log summarizing arrival and departure times and calculating time spent at particular locations or circling cities visited on a map and measuring the distance between cities (math). Another activity would be to have students access books and periodicals to complete fact sheets on the countries visited (reading).

When using software to enhance a thematic unit, the key component is to assist students in forming relationships between concepts. Skills practiced with software should be related to other classroom work. Information gathered from software should be combined with other information on the unit theme. Students may need assistance in creating those links between the content focus of software and real-life experiences.

Web-Based Activities

One of the most recent and significant changes to the way we use technology to support instruction in classrooms may exist in the use of the World Wide Web. In the early 1990s teachers were limited to floppy disk–based software applications. Today, many classrooms and labs are connected to the Internet, which serves as a significant resource for special education (e.g., Edyburn, 1999; Male & Gotthoffer, 1999; Wissick & Gardner, 1998).

According to Gardner and Wissick (2002), using the Web to enhance thematic unit content and instructional activities for special needs learners can take many different forms and functions. There are numerous education-related Web sites that teachers can access to support curriculum integration activities and to search for thematic unit topics and specific lesson plans (see http://www.ed.sc.edu/caw/toolboxsource.html for suggested education sites). Many sites have created interactive skill practice within a theme. For example, Numberwork (http://www.bbc.co.uk/education/schools/holding/index_numberwork.shtml) is a site that allows students to practice basic number skills within the story context of the ancient Aztecs. In addition, teachers can create their own activities for students by providing a list of links. Wissick (2002) compiled Web toolboxes for teachers, consisting of links to teacher sites that feature theme-based lesson plans and activities (http://www.ed.sc.edu/caw/toolboxtheme.html and http://www.ed.sc.edu/caw/toolboxthematicunits.html). Table 6 provides a set of Web sites that could be used to support a thematic unit on Japan.

At another level of Web-based instruction, students can participate in interactive or inquiry-oriented activity by being directed to specific Web sites to complete assignments. Students can participate in virtual field trips, where they browse museums, archaeological sites, or historical societies to acquire information and resources for assignments and reports. There are also a number of online tools that assist teachers in designing inquiry and problem-based activities (http://www.ed.sc.edu/caw/toolboxcreateyourown.html). Teachers can develop specific assignments for students to gather and manipulate Web-based information to perform higher order thinking. Gathering information for short-term single assignments or conducting research on a topic for a major assignment is a fundamental part of school learning. Unfortunately, for students who are traditionally challenged in the areas of reading and written language, finding information on the Web can be both frustrating and overwhelming. For example, depending on the idiosyncrasies of particular Web directories or search engines and which keywords are used, students may encounter problems with their results. These problems may include a vast number of hits (e.g., 200 to 2,000 or more); erroneous information (i.e., the keyword used by the student yields information unrelated to the original topic, such as searching for "Civil War" and getting the Web site of an antique dealer who specializes in Civil War relics); content that is at too high of a reading level; or sources that do not contain accurate and valid information (i.e., no identified authorship or cited sources of information—anyone can publish on the Web). One solution to this problem is to promote the use of student-friendly search engines and online encyclopedias, such as AskJeeves for Kids (http://www.ajkids.com), Yahooligans (http://www.yahooligans.com), L1kids (http://dknet.lineone.net/encyclopedia), and Fact Monster (http://www.factmonster.com/encyclopedia.html).

Thematic units often have students participating in inquiry-oriented activities for which they have to gather information and complete theme-related assignments. Using search engines or online encyclopedias is not always the most efficient way for students to gather this information. When students are learning about a predefined topic, there are a variety of occasions in which providing access to preexisting Web resources gives them the structure they need to complete inquiry-based learning activities. For example, if an assignment requires students to gather facts and answer questions about specific dinosaurs, book-marking dinosaur sites ahead of time is one simple way to foster efficient access. Another effective strategy is to create what March (1997) referred to as "hotlists" and "scrapbooks" (http://www.filamentality.com/wired/fil/formats.html). Hotlists and scrapbooks consist of collections of hyperlinks that are information-oriented (e.g., a list of hyperlinks to dinosaur Web sites) or collection-related (e.g., a list hyperlinks that are collections of photos, videos,

TABLE 6. Web Toolboxes for Educators: Activities for a Thematic Unit on Japan

Title	Web page & URL	Notation
Japanese food	Kids Window Restaurant—http://www.jwindow.net/OLD/KIDS/REST/ A Japanese Cookbook for Kids—http://jin.jcic.or.jp/kidsweb/cook.html	Visit the sites on food and restaurants. Activity: Find a recipe for a traditional Japanese dish. Copy it on a card. Prepare it and serve to your classmates.
Origami	Kids Web Virtual Origami:—http://jin.jcic.or.jp/kidsweb/ virtual/origami/origami.html	Shows pictures and movies on how to make an origami crane, helmet, and airplane. Activity: Create an origami animal or object.
Legends	Folk Legends of Japan—http://jin.jcic.or.jp/kidsweb/folk.html	Legends are important in Japan. Read some famous legends. Activity: Write a legend about an animal that lives in a small Japanese town.
Ikebana: Flower arranging	Kids Web Virtual Ikebana—http://jin.jcic.or.jp/kidsweb/virtual/ikebana/ikebana.html	Pictures of Japanese flower arranging. Activity: Study Japanese flower arranging and create a small display for the class using flowers or leaves from your yard.
Puppets	How to Make a Bunraku Puppet—http://www.mahoroba.or.jp/~bunraku/seisa-e.htm	Banraku Puppet shows. Activity: Write a puppet show or create a puppet out of household items. No woodcarving allowed.
Haiku	How Do You Write a Haiku?—http://jin.jcic.or.jp/kidsweb/japan/d/q2.html	The poetry form called *haiku* was developed in Japan. Read how to compose a haiku. Activity: Write a haiku about spring.
Mt. Fuji & volcanoes	Tectonics and Volcanoes of Japan—http://volcano.und.nodak.edu/vwdocs/volc_images/north_asia/japan_tec.html	Japan is a series of islands formed by volcanoes. Activity: Create a volcano.
Japanese kites	Japanese Kite Collection—http://www.asahi-net.or.jp/~et3m-tkkw/index.html	View photos of many Japanese kites or read directions on how to make a kite. Activity: Paint or draw a picture of a design for a kite or follow the directions to build a kite to fly.

or drawings of dinosaurs). Hotlists and scrapbooks can take the form of either a Web page or a document from a word processing program, such as Microsoft Word, that allows active hyperlinks (see http://www.ed.sc.edu/caw/toolboxhowto.html). Using any of these methods, the students can spend time locating specific information instead of wasting time wading through unrelated Web sites.

From an instructional delivery perspective, using the Web to enhance thematic units for students with high-incidence disabilities also requires consideration of a number of key elements: structure, scaffolding, and connecting specific learning goals with Web-based activities (Gardner & Wissick, 2002). TrackStar (http://trackstar.hprtec.org) and Xcursion Central (http://www.xcursioncentral.com) are free online tools that allow different, unconnected Web sites to be linked together in ways that depict a logical sequence of instruction. More important, TrackStar and Xcursion Central also provide teachers with a mechanism for scaffolding instruction by providing them the opportunity to imbed learning prompts and instructions that help students perform specific assignments/activities when visiting specific Web sites. In addition, TrackStar and Xcursion Central include searchable databases of Web-based instructional activities and/or hotlists that enhance many thematic unit topics.

WebQuests (http://edweb.sdsu.edu/webquest/webquest.html) are probably the most all-inclusive form of Web-enhanced thematic unit activities. A WebQuest consists of a highly structured, inquiry-oriented activity that centers on Web-based learning. In many respects, a WebQuest can function as a Web-based unit. Some WebQuests are designed for students to take several weeks to complete, whereas others can be completed in one class period. Most WebQuests challenge students to work cooperatively in groups, take different perspectives and roles, and analyze and synthesize Web-

based information to arrive at conclusions through problem solving (Dodge, 1997; March, 1997).

Discussion

Thematic units enhanced with technology can be an important way for students with special needs to navigate between the worlds of general and special education. Students practice lifelong learning by using tools that can assist them throughout their school career. They also have access to alternative methods for learning content. In addition, technology may allow students to see the bigger picture and relate individual skills to other contexts. Using technology to enhance interdisciplinary instruction for all students is not intended to be *the* solution for inclusion or other issues that separate general and special education. Rather, it is best viewed as one of many instructional strategies available to special educators.

If we take a step back and examine the features of thematic units—project- and inquiry-based learning, curriculum content and activities that are interdisciplinary and authentic, cooperative learning, and multiple instructional strategies to deliver thematic unit content—we observe fundamental characteristics of effective instruction that work for *all* students. Coupled with the use of technology to enhance, but not dominate, instructional delivery or content, technology-enhanced thematic units, we believe, bring together curriculum areas traditionally viewed by special education students as unconnected and unrelated. The content associated with the general education curriculum may set the theme, but the teaching methods and materials, enhanced by the features of thematic units and technology, are dictated by special education instruction.

Students who work on activities within the context of a thematic unit should be able to generalize information learned in general and special education classrooms to other settings. Special education teachers may use direct instruction to assist their students in learning critical skills related to the unit. They can also use inquiry-based learning principles to study one aspect of the theme in great detail. They may be exposed to technology that will assist them with their written products, research on a topic, mathematical computations, ability to interpret information and make predictions, or skills practice. By developing technology-enhanced interdisciplinary thematic units that align with the general education curriculum and incorporate multiple instructional strategies, teachers can equip their students with powerful tools for lifelong learning. ■

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REFERENCES

Blair, R., Gardner, J., Fisher, G., Ryker, P., & Toperzer, J. (2001, April). *Enhancing thematic units by integrating technology.* Paper presented at the annual conference of the Council for Exceptional Children, Kansas City, MO.

Burns, P. C., Roe, B. D., & Ross, E. P. (1992). *Teaching reading in today's elementary schools*. Princeton, NJ: Houghton Mifflin.

Davidson & Associates. (1996). KidWorks Deluxe [Computer software]. Torrance, CA: Author.

Davidson & Associates. (1998). Learning Center 4th Grade Word Problems and Logical Thinking Skills [Computer software]. Torrance, CA: Author.

De La Paz, S. (1999). Composing via dictation and speech recognition systems: Compensatory technology for students with learning disabilities. *Learning Disability Quarterly, 22*(3), 173–182.

Dodge, B. (1997). *Some thoughts about WebQuests*. Retrieved May 1, 2001, from http://edweb.sdsu.edu/courses/edtec596/about_webquests.html

Don Johnston. (2001a). Co:Writer 4000 [Computer software]. Volo, IL: Author.

Don Johnston. (2001b). Draft Builder [Computer software]. Volo, IL: Author.

Edmark. (1995). Imagination Express [Computer software]. Redmond, WA: Author.

Edmark. (2000). Space Academy GX-1 [Computer software]. Redmond, WA: Author.

Edyburn, D. L. (1989). Using microcomputers in special education teacher training programs. *Capturing the Potential, 2*(2), 1–3.

Edyburn, D. L. (1999). 99 essential web sites for special educators. *Special Education Technology Practice, 1*(3), 12–16.

Englemann, S., & Hanner, S. (1985). *SRA reading mastery III (Textbook B)*. DeSoto, TX: SRA/McGraw-Hill.

Ferretti, R. P., & Okolo, C. M. (1996). Authenticity in learning: Multimedia design projects in the social studies for students with disabilities. *Journal of Learning Disabilities, 29,* 450–460.

Gagné, R. M. (1985). *The conditions of learning* (4th ed.). New York: Holt, Rinehart & Winston.

Gardner, J. E., & Edyburn, D. L. (2000). Integrating technology to support effective instruction. In J. D. Lindsey (Ed.), *Technology and exceptional individuals* (pp. 191–240). Austin: PRO-ED.

Gardner, J. E., & Wissick, C. A. (2002). Enhancing thematic units using the world wide web: Tools and strategies that integrate technology for students with mild disabilities. *Journal of Special Education Technology, 17,* 27–38.

Grabinger, R. S. (1996). Rich environments for active learning. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 665–692). New York: Macmillan.

Graham, S., & MacArthur, C. A. (1988). Improving learning disabled students' skills at revising essays produced on a word processor: Self instruction strategy training. *The Journal of Special Education, 22,* 133–152.

Inspiration Software. (2000). Inspiration 7.0 [Computer software]. Portland, OR: Author.
Inspiration Software. (2000b). Kidspiration [Computer software]. Portland, OR: Author.
Intellitools. (2000). IntelliTalk II [Computer software]. Novato, CA: Author.
International Society for Technology in Education. *National Educational Technology Standards for Students*. (2000). Eugene, OR: Author.
Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693–719). New York: Macmillan.
Kalasinskas, R. (2001). *Animals of the rainforest*. Retrieved June 1, 2001, from http://www.animalsoftherainforest.org/poisonarrowfrog1.htm
Knowledge Adventure. (2000). HyperStudio 6 [Computer software]. Torrence, CA: Author.
Learning Co. (1995). Storybook Weaver Deluxe [Computer software]. Cambridge, MA: Author.
Learning Co. (1998). KidPix Studio [Computer software]. Cambridge, MA: Author.
Learning Co. (1999a). The Cluefinders 4th Grade Adventures [Computer software]. Cambridge, MA: Author.
Learning Co. (1999b). Where in the World Is Carmen Sandiego? [Computer software]. Cambridge, MA: Author.
MacArthur, C. A. (1996). Using technology to enhance the writing process of students with learning disabilities. *Journal of Learning Disabilities, 29,* 344–354.
MacArthur, C. A. (1998). From illegible to understandable: How word prediction and speech synthesis can help. *Teaching Exceptional Children, 30*(6), 66–71.
Male, M., & Gotthoffer, D. (1999). *Quick guide to the internet for special education*. Needham Heights, MA: Allyn & Bacon.
March, T. (1997). *WebQuests*. Retrieved May 1, 2001, from http://www.filamentality.com/wired/fil/formats.html#WebQuest
McNaughton, D. (1998). Tech talk: "You talk, it types?" Not quite: Speech recognition technology for postsecondary students with disabilities. *Journal of Postsecondary Education and Disability, 13*(2), 78–81.
Northwest Regional Educational Laboratory. (2001). *Thematic or integrated instruction*. Retrieved May 1, 2001, from http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at7lk12.htm
Okolo, C. (2000). Technology for individuals with mild disabilities. In J. Lindsey (Eds.), *Technology and exceptional individuals* (3rd ed., pp. 243–301). Austin: PRO-ED.
Reutzel, D. R. (1997). Integrating literacy learning for young children. In C. H. Hart, D. C. Burts, & R. Charlesworth (Eds.), *Integrated curriculum and developmentally appropriate practice* (pp. 225–254). Albany: State University of New York Press.
Robyler, M. D., & Edwards, J. (2000). *Integrating educational technology into teaching*. Columbus, OH: Merrill.
Shoemaker, B. (1989). Integrative education: A curriculum for the twenty-first century. *Oregon School Study Council, 33*(2).
Space.com (2002). *Starry night* [Computer software]. Toronto, Canada: Author.
Stipek, D. J. (1998). *Motivation to learn: From theory to practice* (2nd ed.). Boston: Allyn & Bacon.
Tom Snyder. (1997a). Great Ocean Rescue [Computer software]. Cambridge, MA: Author.
Tom Snyder. (1997b). Great Solar System Rescue [Computer software]. Cambridge, MA: Author.
Vardell, S. M. (1995). Thematic units: Integrating the curriculum. In M. R. Sorensen & B. H. Lehman, (Eds.), *Teaching with children's books: Paths to literature-based instruction* (pp. 129–136). Urbana, IL: The National Council of Teachers of English.
Wetzel, K. (1996). Speech-recognizing computers: A written-communication tool for students with learning disabilities? *Journal of Learning Disabilities, 29,* 371–380.
Wissick, C. A., & Gardner, J. E. (1998). A special educator's learner's permit to the world wide web. *Teaching Exceptional Children, 30*(5), 8–15.
Wissick, C. A., Schweder, W., Vesh, C., Coughenour, K., & Smithey, F. (2001, April). *Technology integration: Mentors, models and making grilled cheese*. Paper presented at the annual conference of the Council for Exceptional Children, Kansas City, MO.