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Contents

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Teaching Cyber Ethics to Students: "What Do You Mean COPYRIGHT Does Not Mean I Have the Right to Copy?"

by Diane Demott Painter

Editor's Note: In the Fall/Winter VSTE Journal, we republished a series of articles by Dr. Painter concerning action, or classroom-based, research. We are pleased to follow in this issue with a recent example of Dr. Painter's research. We believe it is a very good example of how research can be tied to useful educational technology implementation.

A few years ago a sixth grade student came up to me and asked, "I really like that CD, *Explorers of the New World.* Can I take it home this weekend and make a copy? I will bring it back on Monday." The following conversation ensued:

Teacher: "No, you can't do that."

Student: "Oh sure I can. I have a CD burner!"

Teacher: "No, that's not what I meant. You MAY NOT copy the CD. It is copyrighted."

Student: "I know."

Teacher: "What do you think I mean when I say, "copyrighted?"

Student (confidently): "I have the right to copy it."

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What a surprise to hear directly from one of my students that he blatantly copies copyrighted CD's; and does this thinking he has the "right" to do so. He was totally unaware that he was engaging in software piracy. Financial losses from worldwide piracy amounted to $13 billion in 2002 and many of the pirates are teens who trade software, movies and music online. They find that engaging in pirating activities is fast, cheap and in most cases, it can be done anonymously. The legal consequences can be devastating.

Three American industry organizations: the Motion Picture Association of America (MPAA), the Software and Information Industry Association (SIIA) and the Recording Industry of American (RIAA) now employ large numbers of people to track down Web sites that trade pirated materials (Hatcher, 2002). Not only are those running illegal Web sites taken to justice, now we are beginning to see individual users of such Web sites taken to court. For example, in New York a 12 year-old girl was sued by the recording industry for illegally downloading software from an unauthorized Web site (CBS News, 2003).

I felt that if my student did not understand the legal and economic issues involved in his actions, then probably many of my elementary school students were unaware of these issues, too. I decided that I should discuss this problem with our school's technology committee and make a recommendation that we add copyright and fair use topics to the cyber awareness lessons we share with our students each October in celebration of Computer Learning Month. We began cyber safety lessons in the year 2000 after I attended a Cyber Safety and Ethics conference at Marymount University, but the lessons primarily addressed how to be safe while using the Internet, not copyright laws and fair use policies.

I began to search for instructional materials that would help me present copyright and fair use issues in a manner that would engage elementary age students and that would be meaningful. A member of our technology committee saw such materials geared for elementary students advertised in Weekly Reader. The Business Software Alliance (BSA) created the *Play It Safe in Cyber Space* materials for elementary and middle school-age students. The curriculum, posted online (link at end of article), is available for download and is widely used by parents and teachers to assist in conversations about responsible cyber behavior. Co-produced by children's publisher *Weekly Reader*, the curriculum was first distributed last year to schools nationwide and is anticipated to reach more than seven million kids, parents and teachers by the end of 2004.

I used these materials for the first time during the 2002-2003 school year with my students in grades three through six. I found that the students who made the best connections to the copyright and fair use concepts presented in those lessons were fifth

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and sixth grade students because those students were the ones telling me that they were actively involved in file sharing activities. This school year, I restructured my Computer Learning Month activities to focus primarily on Cyber Safety issues in grades three and four, and in grades five and six we focused on the Copyright and Fair Use lessons.

Purpose of the Study

This paper will address the cyber ethics initiatives that involved our fifth and sixth grade students and what I learned about their understandings and perceptions related to copyright and fair use. The initiatives were evaluated as a part of a teacher research project that I began in September 2003. This project was designed to systematically collect and analyze data related to what students know, understand and consider most important related to cyber ethics. The data also helped to determine planning ideas for future Computer Learning Month activities.

To structure the project, I discussed with colleagues on our school's teacher research team what I was hoping to determine. They helped me develop the following research questions:

1) What do elementary-aged children know about copyright and fair use laws?
2) What do elementary-aged children want to know and need to know about these issues?
3) What do the parents of elementary-aged children consider important enough to address with their children at home related to cyber ethics issues?

Methodology

I began the cyber ethics and fair use project at the end of September by giving a survey with 246 fifth and sixth grade students to determine what they understand about copyright and fair use laws (Appendix A).

The survey asked them to choose the best response that defines what is meant by ethical behavior, copyright, intellectual property, software piracy, and manufacturer's licensing agreement. In addition, we wanted to know how students would respond to the question, "When is it okay to share your computer games and software programs with your friends?" Student responses are shown in Table 1.

The majority of students responded, "I don't know" to question 1 (defining ethical behavior), question 3 (defining intellectual property) and question 6 (defining licensing agreement). Nearly 60% of the students gave a correct response to defining copyright. However, the 41.3% of the students who answered incorrectly tended to respond that copyright means something has been copied correctly, or people have the right to copy

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something. This confirmed my initial suspicion that there are students that really do not have an understanding of what it means when we refer to something being copyrighted. As noted in Table 1, the majority of students knew that the best way to share programs with friends is inviting their friends over to use the software on their own computers, and that software piracy refers to illegal copying, distributing or downloading of software.

Table 1

Correct Responses for Student CyberEthics Survey.

Question & Choice	Grade 5	Grade 6	Total
When you hear that someone is demonstrating "ethical behavior", what do you think it means? (B)	32/122 (26.2%)	41/124 (33%)	73/246 (29.6%)
When you hear the word "copyright", what do you think it means? (C)	66/122 (54%)	81/124 (65.3%)	147/246 (59.7%)
When you hear the words "intellectual property," what do you think it means? (B)	20/122 (16.4%)	19/124 (15.3%)	39/246 (15.8%)
When is it okay to share your computer games and software programs with your friends? (A)	106/122 (86.8%)	96/124 (77.4%)	202/246 (82%)
When you hear the words "software piracy," what do you think it means? (B)	90/122 (73.8%)	99/124 (79.8%)	189/246 (76.8%)
What does "manufacturer's licensing agreement" mean? (A)	74/122 (60.7%)	67/124 (54%)	141/246 (57.3%)

Cyber Ethics, continued

Introductory Lesson

Following the survey, I gave an introductory lesson to each fifth and sixth grade homeroom class that addressed what happens when people buy legal CD's but copy them to make and distribute illegal copies for others. I wanted the students to be exposed to the concepts and terms that would be presented in the *Play It Safe in CyberSpace* lessons, as well as terms they would hear during an assembly we scheduled for the end of October presented by the Business Software Alliance. The terms and concepts were:

1) The people who are involved in creating new software such as the creator, programmer, manufacturer, retailer, and the people who buy the software known as consumers.
2) What is meant by a licensing agreement and copyright documentation found in software packages.
3) What is meant by intellectual property and software piracy.
4) What is meant by ethical behavior.

As a follow-up to this introductory lesson, I asked each student to write on an index card a question that they would like to ask the assembly speaker, Mr. Bob Kruger, Vice-President of Enforcement for BSA. He is a lawyer and also a parent of a fifth grade child. I used these cards to determine what interested the students most about this topic, and to also help identify specific questions that we could use to generate audience interaction with the speaker.

The vast majority of the questions were from the first two themes: burning CD's and using file-sharing sites. Students in both grades wanted to know how they can use CD burners without getting into trouble and they also wanted to know what would happen if they were caught pirating software. Would they really put "kids" in jail many asked? Sixth grade students were more interested than fifth grade students in how "pirates" are detected by law enforcement authorities. A few students wanted to know more about the terms they had heard from the introductory lesson. *Intellectual property*, *fair use* and *copyright* were mentioned most often (see Appendix B).

The questions students wrote were varied and fascinating. It appeared that most of the students' questions fell into the following themes and categories:

1. Burning CD's:
   - Combining songs from CD's into one CD
   - Making back-up CD's
   - Creating CD's for friends
   - Using CD burners

Cyber Ethics, continued

2. Using File-Sharing Sites:
   - Which sites are legal to use for downloading music?
   - Which Web sites are illegal to use for downloading music and games?

3. Legal Consequences:
   - What happens when you get caught doing something that is illegal to do?

4. Clarification of Terms:
   - Intellectual property
   - Copyright

When planning the assembly with representatives from BSA, we thought it would also be interesting to see what parents of sixth grade students think about our cyber safety and cyber ethics initiatives at our school. We surveyed these parents because their children would have received cyber safety awareness lessons each October for the past three years. We wanted to find out what parents talk about with their children at home related to those issues, as well as determine what they feel we should be addressing at school. The survey was sent home with the 124 sixth grade students following the introductory lesson (Appendix C). Seventy-five of the 124 students (60%) returned the survey with their parents' responses. The results for questions 1-3 are shown below in Table 2.

Table 2

Responses for Parental Survey (Questions 1-3)

Question	Percentage
Have you discussed downloading or copying music or software with your child?	77%
Do you feel you have adequate information about copyright protection to teach your child about appropriate practices regarding Internet downloading of music and software?	68%
What information resources have you used to help you better understand copyright, fair use and digital piracy issues?	59% (Newspaper) 24% (Parent web sites) 41% (School information) 33% (Work policies)

Cyber Ethics, continued

When parents were asked how they feel about our school's efforts to address cyber safety and copyright and fair use laws, parents were very positive about the initiatives (Question 4). The responses were coded and broken into three themes and subcategories as noted in Appendix D.

Specific Parent Comments

Listed below are some of the comments made by parents on the survey. These comments indicate a high degree of pleasure that we are addressing cyber safety and cyber ethics issues and tell why they think this is important:

"We are pleased that DPES is tackling the issue. The Internet is very enticing and the rules and ethics are not always clear. The safety issues are especially important for children of this age. I have learned a few things about Cyber Safety from my child that had not occurred to me!"

"We think the school has taken the right step with this kind of survey. Internet security is very important as a proper guidance- teach students early in their lives-will save them from crimes. Music and video downloading is equally dangerous as it is a crime to steal. Good efforts from the school- we are happy."

"I think DPES has an active and progressive program with regard to Cyber Safety and copyright and fair use laws. This survey is a testament to that statement. Additionally, I feel DPES is taking the correct measures to ensure my child knows the risks associated with the copyright laws propagated by the advent of the Internet."

"The lessons on Cyber Safety and Copyright and fair use laws seem quite thorough although I have not attended parent information meetings. I have read information sent home from school. Additionally, my husband is in federal law enforcement and we discuss obeying the law with regard to downloading."

"I believe there should be more information give to all our children concerning Cyber Safety, Internet copyright and fair use laws, and security at home and school. It is important that children learn that viruses, computer worms and Trojan horses are often hidden in pictures on the Internet. When children or adults download pictures, they could be downloading a virus (worms). Children need to learn that the computer hacking laws (passed by our Congress lately) have gotten tougher on persons who intentionally damage personal, state, federal or private industries' computers. Computer security and Cyber Safety is very important to our National Security. What we would like to know, are your school's computers protected by a firewall?"

Cyber Ethics, continued

Making the Connection

Activity Two, "Making the Connection" from the *Play It Safe in CyberSpace* materials geared for grades 6-8 was then given to fifth and sixth grade students before the BSA assembly. This "Game Show" lesson actively involved the students in a role-play situation that addressed the following points:

- Illegal downloading, copying or buying counterfeit software
- When software is purchased from authorized dealers, purchasers accept the licensing agreement that comes with the software telling how the software can be used.
- Generally the purchaser is permitted to install the software only on one computer, unless otherwise stated in the licensing agreement.

After Activity Two's lesson, students asked me several questions, particularly regarding the use of home CD burners. One common question asked in almost every class that I visited was, "If using CD burners to copy programs for your friends is illegal, why do they make CD burners and put them in computers?" I was fortunate to have the opportunity to talk about the appropriate use of CD burners to back up files that we create such as stories, images that we take with our own digital cameras, home movies we make with video cameras and so forth. However, a number of students mentioned that they have or know of family members and friends who have used CD burners to make copies of games or music from commercially produced CD's.

The Assembly

Bob Kruger used a PowerPoint presentation along with the student questions we had chosen from the index cards to guide his presentation. He began with the concept of copyright by answering a sixth grade student's question on how copyright works. "Did you know that whatever you create can be protected under the copyright laws without your having to fill out a lot of paperwork and going through a lot of legal steps?" Kruger said. "Once your ideas are tangible, they are copyrighted." He addressed another student's question, "How long does a copyright last?" Kruger responded that it does not last forever, but expires 75 years after the death of the creator.

"What is intellectual property?" another sixth grade student wanted to know. Kruger responded by saying that intellectual property comes out of a creative idea. Examples of intellectual property may be a book, movie, poem, song, painting, photograph or a software program. Then he asked the students, "Why do we want to protect intellectual property?" The discussion centered on the fact that creators want to protect their creative ideas so that they can get rewards for their hard work. Once a creator's ideas become tangible as in a book, a movie, or a song, the creator decides how it can be distributed. This led to an explanation of licensing agreement. This "permission" document that is included in software packages tells how the creation can be

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specifically used. Some licensing agreements, for example, state that you can make a back-up copy of software. In some cases a creator may say that the creation is 'freeware' which means it can be distributed without charge. Other creations that can be used without charge are "fair use" products. These may be parts of book or an article that a teacher may want to use in the classroom.

Another student asked, "What happens when people break copyright laws?" Kruger answered by telling the students that someone can get arrested if caught pirating software or making available for download games and music from file-sharing sites that are unauthorized by the creators. Kruger then told the story of the 12 year-old girl who was sued by the recording industry for engaging in such activities. Kruger explained that BSA employs four fulltime people whose full time occupation is to search the Internet daily for unauthorized file-sharing sites throughout the world. These sites are reported to the authorities and now many people, including high school and college students, are being taken to court and may face heavy fines.

Several students then wanted to know how to find "legitimate" file-sharing sites. Kruger mentioned Apple Corporation's Apple Music Store as one such site. This site gives people downloading rights by charging 99 cents per song. Kruger ended his talk by talking about fair use laws. Specifically he talked briefly about using intellectual property in the classroom and directed students and their teachers to the Web site *Copyright Kids* [link at end of article] to learn more.

Following his presentation to the students and teachers, Kruger introduced BSA's Code of Cyber-Ethics designed to help students understand cyber ethics at an early age so they may make the right choices about appropriate Internet and computer behavior. He urged students to look for the copyright symbol on software programs and be able to explain to others why illegally copying software is not appropriate behavior.

When teachers and students returned to their classrooms, they discussed the Cyber Ethics Champion Code. A special Certificate of Recognition was then awarded to students who voluntarily agreed to be "Cyber Ethics Champions" by following the code.

Overall Findings

What Did Students Learn? What Do They Value?

To determine what the fifth and sixth grade students learned about copyright and fair use laws and what points were most of value to them during Computer Learning Month, students were asked to complete Activity 4, "You're In Charge" from the *Play It Safe in CyberSpace* materials geared for grades 3-5. This activity asked the students

Cyber Ethics, continued

to share their knowledge of software theft by writing a letter to the principal, the editor-in-chief of a newspaper or a software company. We also gave them the option to write the letter to anyone else who they may care about. They were asked to include the legal, ethical and practical reasons why people should use legal software and games.

Of the 246 fifth and sixth grade students, 221 completed this activity and made their letters available for analysis. The first sort we did was to determine to whom the students wanted to write. Just about 38% of the fifth and sixth grade students chose to write to their best friends. However, 30% chose to write to their parents. Some students wrote to the president of the United States and three students even wrote the letter to themselves as if they were "reminding" themselves about what they had learned. The rest of the students wrote to software companies, newspaper editors, and our school principal. The letters were divided into fifth and sixth grade levels and coded according to the points students made in the letters. These categories that emerged from the data analysis were then sorted into nine themes. Tables 3, 4 and 5 show the number of times students referred to points relating to those nine themes.

Seventy-nine letters written by fifth graders and 36 sixth graders referred to downloading from unauthorized Web sites as illegal. That means that slightly more than half the 221 students (52%) felt this was an issue important enough to discuss in their letters. Eighty-two of the fifth and sixth grade students (37.1%) felt mentioning using CD burners to duplicate commercially produced CD's was also important to discuss. Only 11 students (5%) talked about installing more than the licensed number of software copies on to computers. So it appears that illegally downloading and duplicating CD's were the two top "warnings" students gave in their letters. Listed below are a few examples of what they wrote:

> Dear Sam:
> If you download games or programs that have been illegally copied, this can give your computer a virus that could seriously mess up your hard drive. If you buy illegally copied software, you can hurt people's jobs. Also, if you buy illegally copied software, it's like stealing from the company. *From Taylor*

> Dear Frankie:
> Today in computer lab I learned never to burn, copy, or do anything illegal on the computer like listen to shared music files from Kazaa or Napster. All of that is illegal, and you could be charged for doing any of this. When you burn, copy or listen to music from Kazaa or Napster, you're stealing money from all the people who were involved in making the CD's. So, now I know that I should never burn, copy or illegally do anything with a CD because it is all against the law. *From Kim*

Cyber Ethics, continued

Table 3

Students Showing an Understanding of Cyber Ethics Terms

Grade Level & Number of Letters	Licensing	Copyright	IAP*
5th Graders (123)	18 (14.6%)	34 (27.6%)	10 (8%)
6th Graders (98)	33 (33.6%)	40 (40.8%)	14 (14.3%)
Total (221)	51 (23%)	74 (33%)	24 (10.8%)

** IAP is "Intellectual Property Agreement"*

Table 4

Students Showing an Understanding of How Piracy Occurs

Grade Level & Number of Letters	Illegal Downloading of Material from Web	CD-RW to Make Illegal copies	Installing Software to Violate Use Policy
5th Graders (123)	79 (64.2%)	35 (28.5%)	3 (2.4%)
6th Graders (98)	36 (36.7%)	47 (47.9%)	8 (8.1%)
Total (221)	115 (52%)	82 (37.1%)	11 (5%)

Table 5

Students Showing an Understanding of Piracy Consequences

Grade Level & Number of Letters	Legal Issues	Economic Issues	Obtaining Viruses
5th Graders (123)	20 (16.3%)	78 (63.4%)	19 (15.4%)
6th Graders (98)	55 (56.1%)	60 (61.2%)	30 (30.6%)
Total (221)	75 (34%)	138 (62.4%)	49 (22.1%)

Cyber Ethics, continued

> Dear Betsy:
> You need to stop using Kazaa because it is illegal. When you download songs you are stealing from the producer. People are getting fined and going to jail because they are doing the same thing you are. You are causing people to lose their jobs because no one is buying their CD's. They're just downloading them for free off the Internet. I hope that you will think twice before you do this. *From Your Brother, Eric*

As noted in these letters, students addressed both economic and legal ramifications for engaging in software piracy. One hundred and thirty-eight (64.2%) of the students referred to the economic problems that occur such as loss of jobs. Seventy-five students (34%) mentioned the legal issues that can occur. Most of the comments were in the form of warnings that people can go to jail or be fined. Forty-nine (22.1%) of the students also mentioned the danger of obtaining a virus from downloads or illegally copied software. This finding is critically important because as Mike Heffron (2003), Online Center System Operations, Facilities and Security Manger for GE states:

> Kids download their favorite games, music, and movies using file-sharing applications, but it through these programs viruses, worms, and Trojan horses thrive. File-sharing applications have no type of filtering to check for invading components like viruses. Many of those viruses, worms and Trojan horses were named to fool their victims. Beyond this, some of them have seemingly friendly names like StarWarsFullDownload.exe and GreatGames.exe. (p.2)

Did students understand the terms ethical behavior, copyright, intellectual property, software piracy, and manufacturer's licensing agreement by the time we completed the Computer Learning Month initiatives? It is difficult to determine because only the terms license agreement (23%), copyright (33%) and intellectual property (10.8%) were mentioned in correct and meaningful ways in the student letters. In a few instances we noticed that students confused the word "copyright" with the word "download." They would write something like "copyrighting it" when referring to installing or downloading programs. However, as a whole, it appeared that the vast majority of students understood the legal and economic consequences of software piracy and for the most part chose people who they care about (family members and friends) to inform about the dangers of such illegal practices.

Thoughts for the Future

Since our students are at impressionable ages, our technology committee members believe that the time we spend addressing cyber ethical issues is critically important. My only hope is that our students will heed their own words and never engage in piracy practices- not because they might get caught, go to jail, be fined or get viruses- but because they want to do the right thing because doing so is the right thing to do.

Cyber Ethics, continued

Article Resource Links

Playitcybersafe Web Site - http://www.playitcybersafe.com

Copyright Kids - http://www.copyrightkids.org

CyberSmart! School program - http://www.cybersmartcurriculum.org/home/

Disney's Surf Swell Island Adventures - http://disney.go.com/surfswell/index.html

E-Man Creations - http://www.e-mancreations.com

iSafe America - http://www.isafe.org/

Safety Clicks! - http://www.safetyclicks.com/

Virginia Community Policing Institute's "Mousetrap" - http://www.vcpionline.org/mousetrap/

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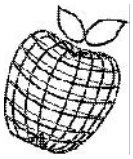

Cyber Ethics, continued

Appendix A

Survey Questions about Ethical Uses of Software

Name _____Homeroom teacher _____

1. When you hear that someone is demonstrating "ethical behavior", what do you think it means?
   a. It means that person is doing questionable behavior.
   b. It means that person is doing the right thing.
   c. It means that person is doing something wicked.
   d. I really don't know.

2. When you hear the word "copyright", what do you think it means?
   a. Something has been copied the right way.
   b. It means people have the right to copy something.
   c. It means that the person who created something gets to decide how it is used.
   d. I really don't know.

3. When you hear the words "intellectual property," what do you think it means?
   a. Something that is like a smart chip in a computer- it is very intelligent.
   b. Something that someone creates out of an idea.
   c. The licensing agreement found in software packages.
   d. I really don't know.

4. When is it okay to share your computer games and software programs with your friends?
   a. I can invite my friends over and we can use the programs on my computer.
   b. My friends can borrow my software and load it only on their computer because I gave them permission to do that.
   c. Since I bought the software, I own it. I can decide what to do with it- like letting my friends load it on their computers.
   d. I really don't know.

5. When you hear the words "software piracy," what do you think it means?
   a. Shoplifting software from a store.
   b. Illegal copying, distributing or downloading of software.
   c. Stores that charge too much for a software program.
   d. I really don't know.

6. What does "manufacturer's licensing agreement" mean?
   a. It explains how you can use the software.
   b. It tells you how many copies of the software you can buy.
   c. It tells how old you have to be to use the software.
   d. I really don't know.

Cyber Ethics, continued

Appendix B

Examples of Student Questions

Examples of Questions from Fifth Grade Students

1. If you take songs from different CD's and burn one CD for yourself, is that illegal?
2. If I make a CD of songs from Kazaa, is that illegal?
3. How do people get caught downloading things illegally from the Internet?
4. Can you burn a software CD as a backup, just in case you lose your first copy?
5. How can you tell if you are downloading from a legitimate Web site?
6. Why is it illegal to make a copy of a CD that you own?
7. Is it illegal if someone burns his own game on to CD's and sells them to his friends and then makes them available for download on the Internet? Would it be bad to download software on your computer but then go and buy the CD and keep the CD for yourself and not sell it to anyone else?
8. What percentage of the CD's that are sold are illegal copies?
9. What are the consequences if someone copies a commercially produced CD? Also, what exactly does copyright and fair use mean?

Examples of Questions from Sixth Grade Students

1. Is it OK to download music from different CD's and put them together for only you and not sell them?
2. Can I burn a copy of a CD and GIVE it to my friend- as long as I don't make money from it?
3. If burning games on CD's is so bad, then why create CD burners?
4. Is there such a thing as a legal way to burn a CD?
5. If you get permission from the creators, can you copy their disks?
6. Is it legal to make back-up copies of your CD's in case your computer crashes?
7. How do Federal Law Enforcement Agents crack down on copyright infringements? How many people do they catch each year that copy and sell illegal software?
8. What are the actual consequences of burning CD's and making money from it?
9. What does intellectual property mean?
10. What do patent workers really do? How does a copyright work?

Cyber Ethics, continued

Appendix C

Parent Survey of Copyright and Fair Use Awareness

As part of an assembly program being presented on October 14 for fifth and sixth grade students on copyright and fair use, we ask that you respond to the following questions on parents' copyright awareness. Your participation in this survey is voluntary, but we would appreciate your responses. Thank you.

1. Have you discussed downloading or copying music or software with your child?

   Yes ____ No ____

2. Do you feel you have adequate information about copyright protection to teach your child about appropriate practices regarding Internet downloading of music and software?

   Yes ____ No ____

3. What information resources have you used to help you better understand copyright, fair use and digital piracy issues?

   ____ Newspaper articles
   ____ Parent Web sites
   ____ Child's school information
   ____ Work policies
   ____ Other (please list)

4. What do you think of Deer Park School's efforts to address the following:
   a. Cyber Safety
   b. Copyright and fair use laws

Response:

_____
_____
_____
_____
_____
_____
_____
_____

Please return this survey to your child's teacher. Thank you.

Cyber Ethics, continued

Appendix D

Themes from Parent Surveys

Theme One: Pleased with school's efforts

Category 1: Lack of Knowledge
Two parents admitted that they do not know what is and what is not legal to do in terms of downloading and copying software. No one mentioned not knowing anything about cyber safety. However, six parents indicated that they had not heard anything about any of the school's efforts to address cyber safety or cyber ethics before the survey came home alerting them to such a program.

Category 2: Desire for more information
Twenty parents said they applaud the school's efforts and they want to learn more from the school about the cyber safety and cyber ethics issues.

Theme Two: Connections between home and school

Category 1: Parents learning from their children
Two parents indicated that they learned about cyber safety and cyber ethics directly from their children

Category 2: Open communication at home
Three parents indicated that they discuss these issues openly at home with their children. Two parents stated that they limit and/or restrict their children's Internet use.

Theme Three: Economic and social ramifications

Category 1: Acknowledgement of the legal impacts of cyber crimes
Eighteen parents mentioned the importance of teaching children about the legal ramifications of software piracy. Nineteen parents specifically mentioned that children should be made aware of Internet dangers and what to do to avoid such dangers.

Category 2: Acknowledgement of the economic impacts of cyber crimes
Three parents mentioned the importance of teaching children about the impact on the economy from software piracy.

Technology in Education
Virginia Society for
VSTE
www.vste.org

Redesign of a CADD Facility to Nurture Interactivity

by Robert Cobb, Jr., Arjun Kapur, Craig Rhodes, & Elinor Blackwell

Introduction

Teaching is the implementation of strategies to deliver and present information to stimulate behavior. Learning is an observable and measurable change in behaviors. Instruction is the creation of an environment allowing the application of skills, knowledge, and attitudes promoting positive behavioral changes. Opportunities in the classroom should simulate a mental and/or physical place in which the desired behaviors exist.

The design of effective instruction requires constant and consistent analysis, design, development, implementation, and evaluation of materials, activities, equipment, and environment. Room design influences the social context of the classes, student-instructor and student-student relations, instructional design options, and overall effectiveness of instructional technologies (Chism, 2002).

The learning environment plays an important role in enhancing the desired changes in behaviors that impact the learning process. Weinstein (1981) argues that learning is optimized only when the physical environment is treated with the same care as curricular materials and teacher preparation. Chism (2000) said room design influences the social context of the class, student-instructor and student-student relations, instructional design options, and overall effectiveness of instructional technology.

Drs. Robert Cobb, Jr., Arjun Kapur, Craig Rhodes and Ms. Elinor Blackwell felt the existing physical arrangement of the computer aided design and drafting (CADD) lab at North Carolina Agricultural and Technical State University (NC A&T SU; Greensboro, NC) was in need of a change to promote a more optimal learning environment. The layout of the facility impacts content, student, and instructor interactions; it was the authors' intent to eliminate problems related to visibility and network connectivity. It was the contention that redesigning the lab would have positive repercussions on the acquisition of skills, knowledge, and attitudes pertaining to solving problems relevant to design and drafting.

CADD Facility Redesign, continued

The Initial Lab Arrangement

One of the CADD laboratories in the School of Technology at NC A&T SU has been used to provide instruction to learners in several capacities. This facility has been utilized to conduct training workshops for professionals in the field of graphic design and graphic communications.

Figure 1: Initial arrangement of instructional equipment in CADD lab

It is used to provide problem-solving experiences using CADD software applications. Students who utilize this facility major in Graphic Communication Systems and Technological Studies, Electronics and Computer Technology, Construction Management, Manufacturing, Computer Science, Engineering, and the Arts and Sciences.

Figure 2: Demonstration monitor located at the front of the CADD lab

The initial arrangement of the lab appears in Figure 1. The monitors for the computer systems are on tables arranged in rows in the middle of the classroom. In many instances, there are two monitors on each table. The towers for the computers are located on the floor under the tables. There are also computer systems aligned along two adjacent walls to the left and in the back of the laboratory facility. The computer systems are allocated to the students for completion of design and drafting documentations.

Demonstrations are used to illustrate concepts, the application of concepts, and the use of psychomotor skills. This strategy is highly utilized because of its flexibility in a variety of contexts and accommodates a variety of learning styles. The instructors use demonstrations to present conceptual and theoretical information as well as demonstrate procedures used to manipulate the CADD software because it is the most appropriate at the higher levels of the cognitive domain (Weston & Cranton, 1986). The students are able to actively engage in synchronous demonstrations and interact as the information is being presented.

CADD Facility Redesign, continued

This allows the students to execute commands and manipulate the software to solve simulated design problems. To project the demonstrations, the lab is equipped with three 21 inch monitors connected to a single computer system by way of a video signal splitter. The demonstration monitors are located at the center of two rows of tables (see Figure 1) and a cart at the front of the lab (see Figure 2).

The Problem

Skill and Young (2002) expressed careful observation and analysis of environmental factors that encourage or inhibit learning are essential tools for identifying meaningful patterns that will inform design for learning spaces. The students' ability to interact with the equipment used to demonstrate concepts, apply concepts, or use psychomotor skills applicable to using CADD software was one tier of student-content interaction that created concern among the instructors who utilize the facility. It was observed that the demonstration monitors were not easily visible for all students.

There were instances when a student would inadvertently hinder another student's visibility of a demonstration monitor and they were forced to view a monitor that was further away. Students positioned with their backs turned to a demonstration monitor had to turn toward a nearby monitor, see what was being demonstrated, turn back to their assigned computer and execute the procedures. Students' body movement, frequency of questions during demonstrations, and number of times procedures were asked to be repeated were indications of a problem between the positions of the students relative to the demonstration monitors.

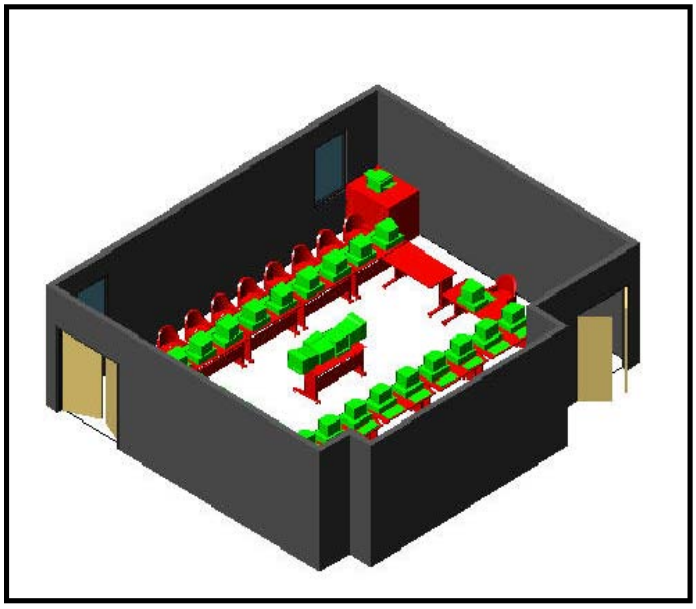

Figure 3: Three-dimensional computer generated model of proposed CADD lab layout

Promoting Interaction

Student-Content Interaction. Using Autodesk Architectural Desktop, Dr. Cobb developed a computer-generated model for one of several proposed solutions to address the visibility problem (see Figure 3). The number of demonstration monitors increased from three [in the initial set up] to four arranged on an "island" in the middle of the laboratory. The monitors are arranged facing the north, east, south, and west of the facility. The tables are in

CADD Facility Redesign, continued

a U-shape orientation enclosing the island of demonstration monitors. The students are facing towards the demonstration monitors. The line of sight distances from the student's seat to the demonstration monitors ranges between seven and 11 feet. This distance would be reduced approximately four to six feet in comparison to the previous layout where the distance from a demonstration monitor to a student was in excess of 15 feet.

Demonstrations provide real-time, synchronous interaction with instructional content and instructional materials. Of the CADD lab's 24 computer systems, nineteen systems are located on tables in the center of the lab. The other five computers are along the west and north walls of the facility (see Figure 1).

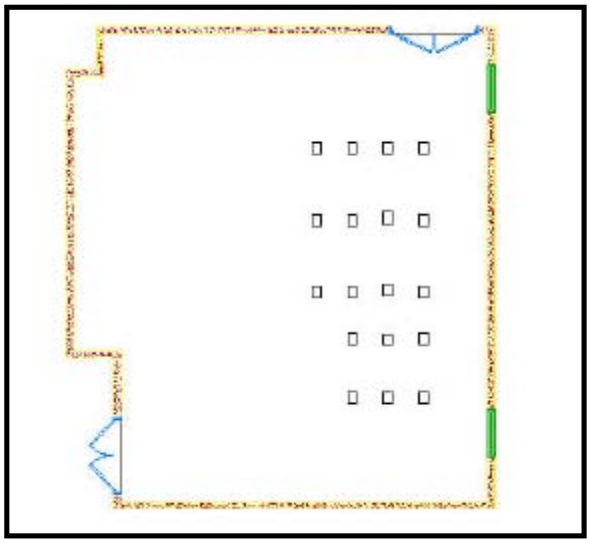

Figure 4: Location of power outlets and network connections in the floor of the CADD lab

In the floor of the CADD lab, there are 20 covered openings. Each opening provides access to four electrical power outlets and two network connections (see Figure 4). Students using one of the nineteen computers in the center of the classroom have Internet accessibility. The network connections are positioned from the east (right) wall in rows and columns to the center of the room. The five computers on the west (left) and north (back) of the lab do not have Intranet/Internet access (see Figure 1). Students assigned to these computers have to attain instructional materials stored within the Blackboard course portal prior to entering the facility to engage in the day's instructional experience.

Full classroom technological capabilities and connectivity allow teachers and students greater opportunities for a wider range of teaching and learning tools which appear to support academic programs (Salomon & Almog, 1998). In the CADD courses offered in the School of Technology at NC A&T SU, students access Blackboard to download prefabricated demonstration files, view presentations, engage in threaded discussions, chat, and assess their mastery of skills and knowledge related to computer aided design and drafting concepts and principles.

However, students assigned to the five computers (see Figure 1) to the left and back of the facility do not have immediate access to web-based instructional materials because the computers are not connected to the Internet. This creates a "virtual disconnect" between those students and the instructor. The students cannot interact [in real-time] with all instructional materials available in the web-based, virtual environment. The proposed

CADD Facility Redesign, continued

redesign efforts include the once isolated five computers [and students] among the learning community physically and virtually by putting them in proximity to the network connections located in the floor of the laboratory.

Student-Instructor Interaction. Student-instructor interaction is also essential in the creation of a positive learning environment. Interaction between the student and instructor is created during classroom discussions as concepts and theories are covered in the classes. Much of the interaction occurs in the aisles between the rows of tables as the instructor assists students in applying the skills and knowledge discussed to solve practical design issues. There are approximately five aisles in the lab allowing movement throughout the facility. Figure 5 illustrates one of the aisles existing in the CADD lab. Some observers of today's college-age learners contend that they are most eager to learn when they can become deeply immersed in a learning environment (Tapscott, 1998). When the instructor or a student moves through the aisle, the students seated are required to move to allow the student or instructor to pass. This interrupts their time on task causing a disruption in their learning experience and the learning environment.

Figure 5: An aisle in the initial arrangement of the CADD lab

Student-Student Interaction. In the redesign of a learning environment, consideration should be given toward building student-controlled spaces where faculty can comfortably engage in conversation with students (Skill & Young, 2002). The U-shape orientation creates better movement about the classroom. The instructors would be able to place themselves among a greater number of students at one time increasing the likelihood of interaction with a larger group of students. The new arrangement would reduce disruptions during the delivery of and engagement with instruction. Sufficient space has been allocated between the students' chairs and the walls for the instructor [or other students] to move about the facility and interact with each other.

Consequently, this arrangement promotes active student engagement as well as improves student-student interaction. The students are facing each other. They are able to discuss and exchange ideas more freely without being forced to move about the laboratory. If movement is necessary, the new arrangement allows for ease of movement with minimal disturbance or disruption added to the learning environment.

CADD Facility Redesign, continued

Student Reactions to Interactions

During the fall 2003 semester, several arrangements were proposed to Dr. Kapur, associate professor in the Graphic Communications System and Technological Studies (GCSTS) department. Through consultation and discussion among other faculties in the department, an arrangement was agreed upon (see Figure 3). At the completion of the fall 2003 semester, Drs. Cobb, Kapur, Rhodes, and Ms. Blackwell rearranged the equipment in the CADD lab in room 3009 in Smith Hall (see Figure 6). The "renovated" CADD lab was unveiled to the students in the spring 2004 semester.

The rearrangement of the equipment in the CADD lab was done so to promote interactivity among instructional content, instructor, and students. To assess the accomplishment of this goal, students participated in an online survey through the Blackboard course delivery system. The survey provided a forum for students to express their attitudes and opinions concerning the impact the new layout had on their interaction with the instructional content, the instructor, and other students. Ninety percent of the students who participated in the survey had taken courses in the CADD lab prior to the spring 2004 semester.

Figure 6. New arrangement in CADD lab

The participants were asked to comment on the positive and negative attributes of the lab regarding the location of the demonstration monitors. Tashyka Ledbetter, a double major in Graphic Communications and Fashion Design said, ". . . I can see the demonstration monitors much better. Before, I had to do a lot of adjusting to be able to see. This made it very uncomfortable and hard to dictate notes." Janelle Jackson agreed, "The old setup had computers positioned where the demonstration monitors were behind the students. The new arrangement allows all of the students to see the monitors regardless of where you are seated."

When asked about the interaction between the students and instructor, Nakiya McAdams, a senior Graphic Communications major, commented, "The new arrangement allows the instructor to move about the room to assure students are on task and completing the assignment." Jasper Brown added, ". . . it is easier for the instructor to walk around and lecture, while keeping our attention. We get more personal attention from the professor."

CADD Facility Redesign, continued

Consequently, the common responses from students regarding collegial interactions reported the new arrangement allowed eye contact to be established among the majority of their colleagues. The arrangement increased the likelihood of peers within the learning environment to "get to know" each other. All of the students who participated in the survey reported the new arrangement had a positive impact on the learning environment and their learning experience in the CADD lab.

Conclusion

The implementation of technology to enhance instructional design efforts is becoming more of the norm in classroom and laboratory facilities. Due to this fact, its impact should not be overlooked in the learning environment. Designed physical environments within which formal instruction occurs plays an important role in student learning when physical properties are considered and individual factors are controlled under particular circumstances (McGuffey, 1982).

Evidence from many environmental psychology studies note physical environments may have positive or adverse effects upon users when their responses are measured in a limited or controlled way (Heft, 1997). The redesign of a CADD laboratory at NC A&T SU was initiated due to an identified concern with students' ability to interact effectively with instructional equipment. In the development of a resolution, interactions (i. e., student-content, student-student, and student-instructor) were identified as a focal point to creating an optimal learning environment.

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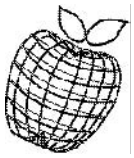

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Planning for Successful Implementation of Assistive Technologies

by Glenna Gustafson

"...for all individuals, technology can provide important tools for making the performance of tasks quicker and easier, but for some individuals with disabilities, assistive technology is a necessity that enables them to engage in or perform many tasks." (OSERS, 1989)

Today over 95% of students with disabilities are working in general education classrooms and the majority of these students utilize assistive technologies to be more successful and independent. This fact, along with the 1997 reauthorization of the Individuals with Disabilities Education Act, has left many school systems struggling with how to best provide assistive technology devices and services to students with disabilities. IDEA '97 requires that assistive technology devices and services be considered for all students with disabilities and that these considerations are noted in the student's Individual Education Plan (IEP).

The assumption being made is that IEP teams and school divisions are composed of personnel who have been trained in the selection and use of assistive technologies. Unfortunately, the majority of educational professionals, both special and general education, have had no or limited training in the selection and use of assistive technology. So how does a school division develop a plan to make the selection and delivery of assistive technology services successful for all students?

In 1998 members of the National Assistive Technology Research Institute created a group of professionals known as the QIAT Consortium (Quality Indicators for Assistive Technologies; pronounced, "quiet"). This group consisted of assistive technology (AT) practitioners representing local schools, state and regional education agencies, vendors,

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researchers, consumers, and families from across the United States (Lahm, et al., 2001). Since that time the QIAT Consortium has worked to compile specific guidelines to assist educators in making effective AT decisions and meeting mandates as set forth by IDEA '97. Educators, service providers, and consumers can utilize *The Quality Indicators for Assistive Technology Services*, in the selection, delivery, support, and evaluation of assistive technology tools and services. Additionally the indicators support the alignment with local, state and federal mandates (QIAT Consortium, 2002).

QIAT guidelines are based on the following assumptions:

- It is essential that all AT services developed and delivered are legally correct and are aligned to district policies.
- Families, caregivers, school personnel, and other necessary individuals and service agencies should be involved in the AT process.
- Multidisciplinary team members involved in AT processes should abide by the code of ethics for their specific profession.

Based on these three assumptions, quality indicators were developed for eight areas. These areas include quality indicators for administrators; assessment of assistive technology needs; documentation within the IEP; implementation of assistive technology selections; evaluation of the effectiveness of the AT selection; AT and transition; and professional development and training in AT (2002).

Definitions of AT devices and AT services

Before the need for AT can be determined and selections of AT devices made, it is essential to understand the legal definition of assistive technology. The term "assistive technology" is a legal term and as defined by IDEA includes assistive technology devices and services. An *assistive technology device* refers to "any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is to increase, maintain, or improve the functionally capabilities of students (or individuals) with disabilities" (IDEA: 20 U.S.C. Part A, Section 602, 1997) Assistive technology devices cover a spectrum from no tech to high tech; from highlighters to portable word processors to voice activated computing systems.

An *assistive technology service* as defined by IDEA refers to

> any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes —the evaluation of the needs of such child, including a functional evaluation of the child in the child's customary environment; purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by such child; selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of

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assistive technology devices; coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs; training or technical assistance for such child, or, where appropriate, the family of such child; and training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of such child. (1997)

The QIAT takes into consideration these definitions as mandated in IDEA '97.

Quality Indicators for Administrative Support

The importance of administrative support is essential in the implementation and use of AT devices and services. The indicators in this area define the critical areas of administrative support and leadership for developing and delivering assistive technology services. Administrative support indicators focus on the development of policies, procedures, and other supports necessary to sustain effective assistive technology programs. Administrators and staff should work together in the creation of a clear, systematic procedural plan developed to delineate the procedures for assessing, selecting, and evaluating the AT needs of students. These plans should be coordinated with other local, state, and federal procedural guidelines. All personnel should be familiar with these procedures and have the necessary skills and knowledge to work with a variety of AT tools. Continuous learning opportunities, training, and technical assistance focusing on AT issues should be provided for educational professionals, the family, and the student and be addressed within this plan. The importance of budgeting both time and monies for AT needs is another essential indicator of administrative support.

Quality Indicators for Assessment of Assistive Technology Needs

The "Assessment of Assistive Technology Needs" indicators delineate a process conducted by a team, used to identify tools and strategies to address a student's specific need(s). The assistive technology decision and selection making process should be a student-centered, team process. It is essential to have input from multiple individuals that work with the student including parents, teachers, therapist, and assistants. Each of these team members brings with them a different knowledge basis, skills, and ideas. Perhaps one of the most overlooked areas in the AT decision making process is the failure to consider the student's input regarding a potential technology solution. The omission of student input can be an instant formula for disaster (Richardson, 2001). All AT decisions made by the IEP team should provide the student with greater access to the goals and objectives found on the IEP and be well

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documented within the IEP. AT occurs along a continuum from 'no tech' to 'high tech.' The AT device/service that is the least complex and results in the greatest success for the students should be the first consideration.

Quality Indicators for Documentation in the IEP

Assistive technologies should focus on the use and need of a tool(s) to assist an individual with educational, recreational, and daily functional activities. These activities can include reading, writing, mathematics, positioning, hearing, self care or organization. In order to accomplish these tasks an individual may require a variety of tools to be used in a variety of situations. No one assistive technology device may be applicable for all situations nor will the same device be useful for individuals with the same disability. The "Documentation in the IEP" indicators assist the IEP team in describing the role of assistive technology within the student's educational setting and program. The need for a variety of assistive technology devices and services should be included throughout a student's IEP if deemed necessary for the student to receive a free, appropriate public education in the least restrictive environment. The AT can be designated as either special education, a related service, or as supplementary aids and services.

Quality Indicators for Assistive Technology Implementation

"Assistive Technology Implementation" indicators pertain to the ways that AT devices and services, as included in the IEP (including goals/objectives, related services, supplementary aids and services and accommodations or modifications) are delivered and integrated into the student's educational program. AT should be integrated throughout a student's daily schedule; all team members share responsibility for this. Many students will often need extended practice time on using their AT before becoming efficient. Ongoing training and preparation of the student, educational and support professionals, and parents is essential. Individuals working with the student should be able to model the use of the technology for the student as well as perform basic troubleshooting tasks for the device.

Quality Indicators for Evaluation of Effectiveness

Assessment and intervention form a continuous and dynamic process. The indicators for "Evaluation of Effectiveness" are designed to assist educators in the evaluation of the effectiveness of the AT devices and services being provided. An evaluation should include data collection and documentation to monitor changes in student performance resulting from the implementation. As students grow and change so will the tools that they need to experience independence and success. This means that the AT tools that the student is using will need to be changed as their needs

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change—requiring that data collection be ongoing and consistent. IEP goals and objectives should be utilized in evaluating the effectiveness of AT tools.

Quality Indicators for Assistive Technology Transition

To be truly successful, students need to be able to utilize their AT across a variety of settings in order to avoid the loss of independence or function. A transition plan should be developed that provides for support for the student using AT in a variety of environments. This plan should be based on the complexity of the student's needs; address possible additional technical assistance and training needs of support personnel and the student; and consider possible funding needs that might arise from providing AT in various settings. Again, a team approach is needed with responsibilities outlined for all members. While IDEA mandates that transition planning must begin for students with disabilities at age 14, for students utilizing complex AT tools, transition planning may need to begin earlier.

Quality Indicators for Professional Development and Training in Assistive Technology

In order for students with disabilities to receive a free appropriate public education and meet IEP goals and objectives all educators need to be prepared to provide these students with the appropriate tools. The use of AT tools enables many students with disabilities these opportunities. The "Professional Development and Training" indicators view the goal of AT training and development as "increasing educator's knowledge and skills in a variety of areas including, but not limited to: collaborative processes; a continuum of tools, strategies, and services; resources; legal issues; action planning; and data collection and analysis" (QIAT Consortium, 2003, p. 17). Based on these indicators this ongoing training should be provided to educators, service providers, support staff, parents, students, and technology specialists.

Conclusion

To assist school systems and others in guaranteeing consistency and quality in the development of guidelines to provide students with disabiltites the required AT devices and services, the QIAT Consortium created the *QIAT Self-Evaluation Matrices* (QIAT Consortium, 2001). These matrices are designed to assist school systems and other users of QIAT indicators in the promotion of sustained change based on an evaluation of their perceived existing strengths and weaknesses using the *QIAT Indicators*. Users can then build upon their strengths and develop plans to address their identified areas needing improvement.

While QIAT is not the only tool that is available for use by school systems, it is a tool that can be used to improve the development and delivery of assistive technology services in a way that assures quality of services while increasing consistency of

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services. QIAT is not a list of competencies for service providers. Instead, by using quality indicators educators are provide an "external, objective measurement to use in assessing their own performance" (Zabala, et. al, 2000). By utilizing *QIAT Indicators* in Assistive Technology planning, school systems are utilizing best practices in the provision of federally mandated AT services for students with disabilities.

Article Resource Links

QIAT - http://sweb.uky.edu/~jszaba0/QIAT.html

Quality Indicators of Assistive Technology Services
http://www.wati.org/qualityindicators.htm

QIAT Conversations - http://www.connsensebulletin.com/qiat1.html

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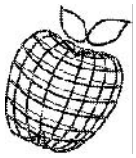

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Usability and Accessibility in Virginia School Division Websites*

By John Hendron

Introduction

Today, since the Internet boom of 1995, the majority of Virginia schools are online. How do the websites that represent Virginia school divisions rate with regards to usability and accessibility? When developing new technology plans, Virginia school divisions should focus attention and resources to the maintenance of their websites. School divisions need to maximize the usability and accessibility of sites for Virginia's families, who use the Internet to access education-related documents and multimedia. While this is a trend in professional web development currently, it will be of concern to educators when considering technology initiatives and planning in their schools for the near future.

Usability is a scientific approach used to understand how something, such as a website, can be better designed to facilitate the goals of interaction. Usability assists in the production of a website that is easy to navigate and focuses on user interaction, helping visitors reach what they expect to discover. Since usability is not a mainstream concept, but rather a specialty area (Pearrow, 2000, p. 3), it is not surprising to find many school divisions that lack the resources to have professionally-designed, usable sites. Usability expert Jeff Johnson (2003) blames finances for some usability shortcomings: "Developing and maintaining a website can be expensive. Individuals and small organizations don't have much money to spend on Web development, so it isn't surprising when their sites contain bloopers" (p. 8).

Accessibility, in terms of the Web, is a measure of how much access different users have to the same document. One way a site can be less accessible is through the requirement of plugins, such as Adobe PDF and Macromedia Flash. Accessibility concerns, however, extend also to users

** The views expressed in this article are solely those of the author and not necessarily those of the editors of the VSTE Journal or VSTE members.*

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of non-traditional browsers, blind and visually-impaired users, and users who have other disabilities such as motor impairment. Nielsen adds:

> The concept of disabilities needs to be defined relatively broadly when it comes to the Web. It is not a matter of whether a person uses a wheelchair; in fact, many wheel-chair users need no special considerations at all when browsing the Web. Rather, the question is whether the user has some condition that makes it difficult to use traditional computer input and output devices in the way they were intended. In the U.S. alone, there are more than 30 million people who have some such problem. (Nielsen, 2000, p. 298)

The results of research on Virginia school division websites revealed that a majority of sites fail to follow the advice of usability experts and are inaccessible to users with disabilities and those using non-traditional browsers (and not simply because they use Flash or PDF). The experience of visitors to school division sites should improve if usability and accessibility concerns are included in the goals of schools that have gone "online."

Procedure

A random-sample consisting of thirty-four website homepages was examined. All homepages belong to Virginia school divisions, selected from a list provided by the Virginia Department of Education on their website. Among those sites examined, several common faults were identified, with regards to usability and accessibility. The individual analysis or "deconstruction" of each website examined is available on the author's website.

Common faults among the sites examined include:

1. the use of Javascript-enabled pull-down menu navigation systems (DHTML menus),
2. a lack of content on the front page,
3. a failure to meet accessibility guidelines, due to the use of non-standard HTML or dependence on graphics,
4. a failure to use or misuse of an "alt" attribute for inline images, and
5. methods used to link to people and e-mail addresses (not tabulated since every homepage did not include e-mail links).

Analysis of Common Faults

Menu Systems

Twenty-six percent of sites used a form of the original Macintosh graphical user

School Division Websites, continued

interface (GUI) menu bar, today found in modern operating systems. While the concept of the menu is familiar to users of GUI computers, it is not well-suited for use in websites, despite its popularity. The menu bar fails for several reasons:

1. it many times requires the use of Javascript,
2. it covers up page content when activated,
3. it fails to mimic the click-states of a real GUI menu,
4. in some cases, it requires quick dexterity with a mouse,
5. it hides the visitor's current location within the hierarchy of the site's organization.

Among the experts, Nielsen (2000) frowns upon non-text versions of navigation: "Pull-down menus and graphics should be used for navigation only with great care because they don't behave in the standard manner of underlined text" (Nielsen, 2000, p. 195).

While forms of Javascript are standardized, differences in Javascript "flavors" introduce behavioral differences in different browsers, depending on the standardization and quality of the code. For example, text-based, PCS (webphone)-based, and PDA (Palm, PocketPC)-based browsers cannot access these menus because their browsers simply do not support Javascript. This includes the class of browsers upon which some users with disabilities rely.

When used, DHTML menus many times cover the content on the page. Beyond cluttering the appearance of the page, it hinders a user's ability to view the page while navigating the site. Many users scan a page and begin navigation simultaneously. The menu that covers content prevents users from scanning a page. Pearrow (2000) adds, "Instead of diving into chunks of text and trying to understand it all, Web site users look quickly for keywords, hyperlinks, and other important eye-catching features in order to progress to the next important page" (p. 184). This is impossible in sites that maintain a menu-metaphor navigation bar.

One problem with menu navigation is the unexpected behavior of some systems. In one site examined, each of their categories across the top is not a link but acts as a link header. Only the choices below each menu take us to a webpage, thus following menu bar GUI conventions. The last option, "Search," breaks the model by itself being an active link. In a true menu bar, the menu titles are not links. They are organizers of options. For menus with submenus, the menu item that expands is not itself a "link" or option. Many of the sites ignore these menu guidelines and introduce new behavior to the metaphor, thus confusing visitors to the site with an unnatural mapping of a user interface construct (Pearrow, 2000, p.171).

Nielsen (2000) states that "many users have difficulty with detailed mouse

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movements, and they may also have problems holding down multiple keyboard keys simultaneously" (p. 309). Some menus from this study required quick dexterity of the mouse. Some users do not have dexterity with a mouse, therefore they will find navigating a site with menu metaphor systems difficult, if not impossible.

Some sites use menu systems that require a significant amount of Javascript code. The amount of scripting required for the links inconveniences users with longer download times. Examination of code-length revealed that many sites would load significantly more quickly if DHTML-menus, requiring Javascript, were eliminated.

One site used slide-over menus that were difficult to execute until after several tries. As Nielsen (2000) states, "Websites should make the main things users want to do very simple.... People are extremely goal-driven on the Web. They have something specific they want to do, and they don't tolerate anything standing between them and their goal" (p. 380). One site offered menu links, and as one slides right, submenu options. Many of the submenu links are the same as the header links. Some sites linked twice to the same page with different link text, and in the same menu. "Duplicate links inflate the perceived size and complexity of a website or Web application." (Johnson, 2003, p. 100) Johnson (2003) also states, "At best, duplicate links force users to think about which of the duplicate links to click, distracting them from their task and taking time" (p. 98). An additional problem introduced with one website menu is mouse focus. While the menu options take up a generously-wide button shape, only clicking on the text (a much smaller area) engages the link. This is another dexterity issue that shuts-out users with reduced motor ability.

The ultimate problem with the menu bar metaphor as a navigational tool is that the navigation menus routinely do not indicate your current location within the hierarchy of the site's pages. In fact, the site as a whole is blocked out, until one navigates through each menu. At one site, some links take users to pages that do not use the menu bar. The concept behind the menu bar metaphor is that it is omnipresent. It is unnecessary to introduce a new navigation scheme on each section of your site. As Johnson (2003) states, "Unless your goal is for visitors to your site to wander aimlessly, which is the goal for some sites, you should minimize the number of navigation schemes the site presents...each scheme should have a clear, unique purpose" (p. 91).

Navigation is also confusing when pages link to themselves. There is no need to direct users back to a homepage when the same navigation system is in place on the current page. This problem—forcing users to re-choose the same page they are already browsing, or losing track of their place in the site—slows down the experience on a website. "An extremely common navigation blooper is for a Web page to include an active link to itself. Clicking on such a link merely reloads the page. At best, this wastes people's time as the page reloads. At worst, it can be very disorienting,

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because users may not recognize the redisplayed page as the same one they were on" (Johnson, 2003, p. 112).

Menu bar metaphors should be avoided as the main navigational block in websites of any kind. Nielsen (2000) recommends that "navigation interfaces need to help users answer the three fundamental questions of navigation: Where am I, Where have I been, and Where can I go?" (p. 188). Menu bars do not work, ultimately, because they serve a different function in GUI-based software.

No Content

Another common problem among Virginia websites was a lack of content on the front, or home page. Several categories of "content" were examined, and are color-coded on the author's website. Among them were: identification information (name, title, copyright information) in green, links to other areas of the site in blue, and text-based content (orange). It was this ultimate form of content that was missing on many sites. Johnson (2003) considers, among the essential ingredients of a home page, that the "organization name is placed prominently, [the] organization name is fairly self-explanatory, [a] brief textual summary of the organization's purpose is presented, picture(s) illustrate the organization's product or service, [and] labels of links to other pages provide good overview of site contents" (p. 17).

Despite the fact that a site's homepage is the most frequently accessed page, thus making it the most valuable of all a site's pages, many do not include real content in the form of a summary, news, or current events. Only fifty-six percent of sites examined contained front-page content (text providing information beyond the school division's address and copyright information).

Too many sites that did offer content provided visitors with static information. Without fresh content on a homepage, visitors will not find a compelling reason to return, thus negating the need for the homepage altogether. When late-breaking news is offered, it ought to be placed on the site's front page. One site in particular was littered with graphic-based, download-intensive links, but saved itself with a section of news called "e-Facts." The confusing nomenclature of "e-Fact" may cause some visitors to glance over the section. Pearrow (2000) warns, "Stick with names that the user knows and uses regularly; save the clever ideas for greeting cards" (p. 142).

Two sites examined offered visitors current events, but these events required a click away from the homepage. Johnson (2003) suggests that "[a] home page may need to highlight or explain certain site content, even though the site's ever-present navigation bar provides links to it" (p. 101). The front page of a website ought to contain content beyond links to other areas of the site.

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Designers are cautioned regarding control of font size. "What's wrong with tiny text? People who have impaired vision can't read it. That is a significant portion of the population" (Johnson, 2003, p. 246). While not widespread, some sites contained content or links that were difficult to see due to font size. At least one website contained small-text in their graphics, which is impossible for many users to see or change. As Johnson (2003) states, "Even knowing how to adjust the browser's font settings may not help, because many websites render browser controls impotent by embedding text in images" (p. 249). In this case, a JPEG file was used for text in a banner graphic. The compression artifacts around each letter make the text more difficult to read than necessary. When text must be presented graphically, GIF and PNG files are the preferred formats.

One site examined offered a DHTML menu plus small text. Adjusting text-zoom in the Mozilla browser made reading the text easier, but made the menu system impossible to use, a precarious result for visitors with less-than-ideal vision. Content that cannot be read might as well not be there at all.

Accessibility

There should be no argument that sites should cater to as wide a population as possible. Watchfire Corporation's *Bobby* allows web developers to test their sites for both WAI content accessibility and U.S. Section 508 guidelines. The analysis it provides requires careful reading, for it is not as lucid as the errors found for pages testing against HTML standards.

Section 508 of the Rehabilitation Act requires federal agencies to adhere to accessibility standards for electronic, computerized documents. While some states have adopted these standards for state websites, Virginia currently has not. One tenet of these standards requires access to information, regardless of medium or format. This includes transcribing, in text, the content of video presentations, and including alterative descriptions of photographs with text. In HTML parlance, these alternative text descriptions are called "ALT" attributes, which appear in the tags for displaying images in hypertext. Many Virginia school division websites have significant accessibility problems. None of the sites examined passed the Watchfire Bobby test. One method used to improve accessibility is detailed in the next section, which is to use alternate text for images and image maps. In addition, sites should use standard HTML organized structurally, and use text-based links when possible, avoiding image maps, frames, and graphical representations of text. To some of these, Zeldman (2003) writes: "Frames, Applets: Just say no." And to flashing and blinking elements: "Just say no. Not just no, he** no" (p. 352).

Many sites used presentational HTML tags, such as <FONT>. Others used the preferred method of Cascading Style Sheets (CSS), but also used <FONT> or

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<CENTER> tags, which are unnecessary with the use of CSS. The latest recommendations from the World Wide Web Consortium recommend the separation of presentation from structure with the use of Cascading Style Sheets. Other sites misused <B> (bold) and <I> (italic) tags, with no structural function. Pearrow (2000) suggests reserving the use of emphasis for truly important items (p. 149).

Many sites examined declared they would use web standards through the use of a <!DOCTYPE> tag in their code. Among the sites examined, only one (Arlington County) passed validation. While many browsers are forgiving of errors, the display results across different browsers are not consistent—another accessibility issue. Badly-coded HTML produced different results for one site, depending on which browser was used. The HTML and XHTML used in websites can be verified for free by using the World Wide Web Consortium's validator.

One last accessibility issue addresses the presentation of information in graphical form. One website provides a logo and address at the top of their page using a JPEG image. On their homepage, it is the only location for the address and phone number. Users of text-based browsers will not see this information. The dependence upon graphics also increased download times for the site's front page. The redesign makes no strides in better accessibility. Nielsen (2000) sums-up the accessibility issue that plagued many sites in Virginia: "Any time you use any format other than plain text and standard HTML, you risk depriving users with disabilities from being able to use your site. This is one more reason to restrain the use of multimedia to cases where it adds substantial value to a site" (p. 155).

Alternate Text Untapped

Within the standards for HTML 4 and XHTML is an attribute that one can add to the tag for an image, called "alt." This attribute holds a text-string that describes what a picture illustrates. For visitors who cannot see graphics, this alternative can be read as text or read to them using a voice synthesizer. Some browsers will display this string of words before an image loads, on slow connections.

If an image is purely decorative, and has no value, assigning a null value to "alt" results in the image being ignored by some browsers. "If an image is purely decorative and has no meaning other than to make the page look better, then there is no reason to slow down blind readers with having to hear an explanation" (Nielsen, 2000, pp. 305-6).

Seventy-nine percent of pages examined had issues with "alt" attributes, resulting in alarmingly inaccessible site scenarios, while using the text-based browser Lynx. Accessibility for users of text-based browsers would increase if images included "alt" attributes. One county's school division website, with no real title on the page, does not

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allow users with non-traditional browsers to see anything except a "state.gif" as the second item on the page (after being told they cannot use the menu system). Any site should have functionality, despite its generous use of graphics. The federal government's website on Section 508 provides more information on other ways websites can be made more accessible for users with disabilities, including avoiding the use of color alone to distinguish elements on the page.

Linking People

"the personal page should list all those contact mechanisms that the person is willing to make publicly available" (Nielsen, 2000, p. 66).

Sometimes, a website visitor's goal is to find out how to contact someone—perhaps a principal, teacher, or board member within a school division. A number of sites examined made finding personnel difficult, specifically with the way they have linked names to spawn e-mail programs. The usability error is creating a link to a name that includes a "mailto:" in the link's code. This causes the visitor's browser to defocus and the mail application to spawn for sending the e-mail. Nielsen (2000) takes issue with what text is linked to the e-mail address. "I recommend against making a person's name into a link to email that person. Doing so violates expectations on the Web because a link normally takes you to information about the thing you clicked to rather than making you communicate with the thing" (p. 66).

Albemarle County Public Schools' website solves the linking problem by listing the webmaster's e-mail address separate from the word "webmaster." By making the e-mail address the link itself, users are more likely to guess the result from following the link. One website included e-mail links, sprinkled among links to pages, in a drop-down menu-metaphor navigation system. Such a navigation system is confusing to visitors who do not know what to expect when trying to find their way around the site.

Conclusion

By citing five common faults of websites belonging to school divisions within Virginia, this article has attempted to reveal the usability and accessibility concerns raised by experts in web development. While school divisions lack the resources, and sometimes expertise to create truly first-class web experiences, a shift in the way websites are developed could attain usability and accessibility while keeping costs low. One possible solution is through the use of templates with a content management system.

None of the sites examined adhered stringently to web standards established by the World Wide Web Consortium. "Accessibility and standards have much in common.

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They are both about ensuring that our work will be useable and available to the largest possible number of readers, visitors, and customers" (Zeldman, 2003, p. 327). A number of popular websites do conform to standards, eliminating a roadblock for users with disabilities, including ESPN, Macromedia, Fox-Searchlight Pictures, and the homepage of the Virginia Department of Education.

Regardless of how it is done, school divisions need to improve their electronic publishing, with attention on catering to all users, despite disabilities or choices in operating systems or web browsers.

Resource Links

VA Department of Education School Division Website List - http://www.pen.k12.va.us/Div/#Schl

Author's website - http://hendron.is-a-geek.net/operation_deconstruction.html

Watchfire Bobby website - http://bobby.watchfire.com/

W3c Validator - http://validator.w3.org/

World Wide Web Consortium - http://w3.org/

U. S. Section 508 website - http://www.section508.gov/

ESPN - http://msn.espn.go.com/

Macromedia - http://www.macromedia.com/

Fox-Searchlight Pictures - http://www.foxsearchlight.com/

Virginia Department of Education - http://www.pen.k12.va.us/

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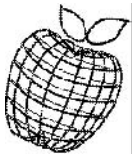

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What Makes Educational Software Educational?*

by Keith E. Polonoli

To understand what features make a piece of educational software effective, it is first necessary to recognize that the underpining premise for using software in the classroom lies in having students learn something (Pillay, Brownlee, &Wilss, 1999). Of course, some software is more successful at helping children achieve learning goals than others. With this in mind, we must ask ourselves what features account for this difference in learning.

Crozier (1999) reports that educational software can be thought of as falling into one of four loosely defined categories:

1. drill and practice, which offers repetition or practice of a particular skill;
2. problem solving, which presents a scenario where a child needs to provide a solution to solve a problem;
3. simulation, which presents events in a number of virtual environments; and
4. tutorial, which presents a lock-step approach to teaching a concept.

It must be noted that much of the software produced today is actually a combination of two or more of the four previously discussed categories; therefore, many of the features will overlap, affecting hybridization.

Thankfully, much research has focused on identifying features that makes software educationally successful. From this body of research, I have identified the following properties: learning theory, gaming features, cultural sensitivity, and eliciting a learner response. Each factor will be discussed in the proceeding paragraphs with the hope that the reader will apply this information when selecting software for classroom use.

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Educational Software, continued

Features of Quality Educational Software

Learning Theory

It stands to reason that if software is to be used by a teacher in the classroom to teach content, the software features should have their foundations in some accepted learning theory; otherwise, why bother to discriminate between recreational and educational software. Gray (1990) states learning theory can be viewed as falling into two general categories: behavioral and cognitive. Being professional educators, classroom teachers should possess some knowledge of the major tenets that define both categories. In addition, educators should be able to identify what strategies purported by these two genres will aid in reaching established learning outcomes.

Behavioral Theory

Behavioral theorists advocate that learning is a result of the association of a stimulus and a response. For example, B. F. Skinner's theory of operant conditioning is based on the idea that learning is a function of a change in behavior (Skinner, 1954). Skinner states that changes in behavior are the result of an individual's response to an event (stimuli) that occurs in the environment: A response will produce a consequence. When a particular Stimulus-Response (S-R) pattern is reinforced (rewarded), the individual is conditioned to respond.

Many drill and practice programs successfully use this theory. Software grounded in behaviorist theory is quite effective when continued practice is needed to perfect a specific skill. AlgeBlaster, the popular algebra tutorial, is a software program grounded in behaviorist theory and is popular with math teachers to reinforce basic algebra skills.

Cognitive Theory

Cognitive theory differs from behaviorist theory because it regards learners as sources of plans, goals, and emotions rather than products of incoming environmental stimuli (Woolfolk, 1993). There are many cognitive theorists, but the common theme that runs through all of their work is that learning is an active process in which learners develop new ideas and concepts from interaction with the environment.

Learners will use past knowledge to bridge the gap from what is known to what is to be learned. When viewing educational software in this context, simulation software, which models real-life events, is definitely rooted in cognitive theory. Simulation software requires students to think critically and make decisions based on limited knowledge. MECC's *Oregon Trail* is an excellent example of software grounded in cognitive theory.

Educational Software, continued

One aspect of cognitive theory that should be visible in good educational software is the acknowledgment of learner differences. In general, learning style theory takes into account the way that an individual concentrates on, processes, internalizes, and remembers new academic information and skills (Shaughnessy 1998, p. 141).

Educational software should not only allow the instructor to adjust the software's content to individual student ability levels, but it should also have the capacity to present content based upon the student's learning style.

After applying learning style theory, classroom practitioners have reported statistically significant increases in student test scores and grade point averages (Shaughnessy 1998).

Hence, quality educational software will take into account that student learning will vary with age, gender, and processing preference. Exceptional educational software will not only allow the student to operate within their preferred learning style, but it should also expose children to situations where they are exposed to content delivered in a manner that is outside of their chosen style. This will aid them in flexing their style and develop the ability to use processing strategies that may otherwise never be employed.

This paper is not to tout the particulars of one learning theory over the other. Both schools of thought offer a sound framework in which to deliver instruction. A problem arises, however, when an instructor cannot identify the paradigm from which the software was developed. Consequently, it probably was not developed from an educational perspective; therefore, it would be best to avoid it.

Gaming Features

Discussing gaming features in a paper hoping to define the principle factors that define good educational software may seem a little strange, but according to a study done by Pillay Brownlee, & Wilss (1999), gaming offers positive learning benefits. The Pillay, et al. study concentrated on investigating the cognitive process as children played *Pilot Wings,* a helicopter flight simulation game. Each child was paired with an expert analyst who was familiar with the game and was trained in qualitative data gathering techniques.The results of this study indicate that children engaged in recreational game play exhibit the same cognitive processes that are found in other problem solving systems using technology. It was found that with the limited instructions given to the participants, inductive reasoning was the primary method of decision making while playing the same. Hence, many strategies that are employed in recreational gaming software have strong positive cosnitive effects.

Educational Software, continued

Roblyer, Edwards, & Havrilik (1997) make the statement that a classroom without games and fun would be a very boring classroom. In a review of the effectiveness of games for instructional purposes, it was found that games are more interesting than traditional instruction (Randel, Morris, Wetzel & Whitehill, 1992). With this in mind, it is reasonable to assume that educational software that use gaming strategies will foster more fervent pupil interaction. More intense involvement and longer contact periods with a learning activity is something that good classroom instructors are constantly trying to accomplish, and gaming is one way of achieving this goal.

Cultural Sensitivity

Many of today's software packages lack accuracy and sensitivity to non-mainstream cultures (Miller-Lachmann, 1994). Because of the power of multimedia software to convey sounds, pictures, movies, and animation, it is imperative that educators pay particular attention to the manner in which cultures are presented to students (see the chart with 10 questions Miller-Lachmann suggest educators ask when assessing the cultural sensitivity of software).

Mei-Yen, Walker, & Huang (1999) examined several educational software packages that were produced for the global market. American and Taiwanese educators were recruited to evaluate software packages produced both in the United States and Taiwan that were marked for global distribution. Both groups were given an identical 21-item scale to assess the software packages; the instrument also had a series of open-ended questions for personal responses. The results of the study purported that only the Asian products were truly developed fora global audience. In comparison, the American products were developed for a Euro-American market.

One particular piece of evidence reported by the authors that substantiate

Questions that Miller-Lachmann (1994) suggest educators ask when assessing the cultural sensitivity of software:

- What is the purpose of presenting other cultures?
- Do people of color and their cultures receive as much attention as people of European descent?
- How accurate is the presentation?
- Are the language and terms used in the package appropriate?
- Do the illustrations or sounds distort or ridicule members of other cultures?
- Does the program present a culture's diversity and complexity?
- Who are the characters, and what roles do they play?
- From whose perspective is the story presented?
- Does the documentation allow instructors to go beyond the program itself?
- Should some simulations not be played because of the lack of cultural sensitivity?

Educational Software, continued

this was the fact that all of the Asian software had the option of the user choosing Chinese, English, or French; the software produced in the United States had no such feature, English was the only language choice. In addition, very little evidence was seen regarding the referencing of non-Euro-American characters in the software produced in American.

Good software should only propagate truth — truth in content and truth in the portrayal of the culture and characters represented in the software. Using the suggestions previously mentioned will aid the educator in selecting software that is culturally sensitive. Choosing culturally sensitive software will aid in halting the perpetuation of pejorative stereotypes that currently exist regarding non-mainstream cultures.

Eliciting maximum usability from a piece of educational software*:

- Be certain that the software is designed for the appropriate grade level.
- Look for software that has a high level of interactivity and learner feedback.
- Look for game-like features in the software.
- The software should represent the child's world, not the adult's world.
- Be sure that the software portrays characters in a respectful truthful manner; that is, be certain that the software is free of racial or gender prejudices and stereotypes.
- Look for software that has a friendly interface; uses simple, easy-to-understand dialogue; exhibits consistency in navigation buttons, program exits, provides shortcuts and ready access to help; and allows learner customization.

* Amended from Robertson's suggestion (p. 261)

Emotional Response

Weinstein (1997) tells us that frustration—such as having our hard drives freeze or our software crash—is to be expected when using the computer. Nevertheless, great joys such as solving complex statistical problems with a mouse click or connecting to the Internet to access boundless sources of information are also to be expected. From an emotional standpoint, educators should look for software that has the capacity to frustrate the conventional problem-solving mind-set of students.

The software should cause a mild level of frustration in the learner, not so much as to turn the learner off, but just enough to cause a mild state of cognitive dissonance that will make the content challenging. When using a computer, Weinstein states, the joy lays not so much in accomplishing a task, but in transcending to the point of achieving a new level of understanding. Whether the instruction is computer-based or delivered in a traditional didactic mode, transcending beyond simple task completion to an intimate level of understanding should be the central tenet of education.

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Instructor Responsibility

Instructional software may include all of the previously discussed features, but if it is not integrated into the curriculum in a purposeful manner, it is worthless. With so much pressure being put on classroom educators to use technology in their teaching, it is important for them not to succumb to using computers/computer software in the classroom just for the sake of using technology—it loses purpose.

Usability is the term used to describe the quality of user-interface (Robertson, 1994 of a system. It is a measure of how well a technology is used for some purpose by humans. Although the term comes from the field of industrial engineering, Eason(1988) extends the meaning to define how well planners (teachers) institute the technology for the users (students) to gain the most learning without undue strain on their capacities. See sidebar list of six suggestions for eliciting maximum usability from a piece of educational software.

Conclusion

Effective educational software packages all share four elements:

1. their conception is grounded in accepted learning theory,
2. they employ gaming features;
3. they are culturally sensitive, and
4. they possess the ability to elicit an emotional response from the learner. The instructor should carefully review the package to be sure these details are present before adopting software for classroom use.

However, even if the software contains all of the previously mentioned features that define it as educationally sound, the idea of usability must be addressed; the human element cannot be ignored. As educators, we must acknowledge the fact that usins an effective educational software package will not compensate for poor instructional planning. Quality planning will, however, allow a savvy teacher to rise above the sea of mediocrity and become a better instructor when pedagogically sound software is used in an appropriate manner in the classroom.

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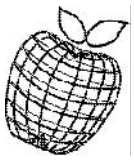

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