Evaluation of Virtual Asynchronous Resources for Teacher Education

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Over the past 20 years, educational research, as well as experimental efforts by teachers in instruction and curriculum development, have produced an encyclopedic base of knowledge which would assist educators of deaf students interested in enhancing science and mathematics education. National and state standards, multi-year federally-funded grant projects focusing on pre-service and in-service professional development for teachers, and the implications of research with hearing students, especially those who are English-as-a-Second-Language (ESL) learners, also provide valuable information to new and experienced teachers. Many educators are not aware of the wide array of resources that would save them time and enhance their teaching and curriculum development efforts.

The Clearinghouse On Mathematics, Engineering, Technology and Science (COMETS) is a comprehensive, web-based resource developed through a grant project funded by the National Science Foundation. The focus of the project is to provide information about "best practices" to a variety of target audiences, including K-12 and college educators, parents, support personnel, and those responsible for teacher education and professional development. One goal of this project is to evaluate whether the World Wide Web can be effective in providing useful information to support the needs in the field. Specifically, the evaluation addressed three questions that will be summarized in this paper:

- Can an asynchronous (any time, any place) website be effective in providing information to a variety of audiences with related interests in improving science/mathematics education for deaf students?

- What design considerations are important in terms of features and components in such an asynchronous website focusing on information dissemination?

- What factors are important in terms of managing such a website?

Introduction

There is an urgent need for well-grounded information about "best practices" in teaching and curriculum development for pre-service teacher preparation programs and for ongoing professional development in science and mathematics education for deaf and hard-of-hearing students. This need is exacerbated by the problem of teacher turnover and the assignment of science and mathematics instruction to teachers not appropriately trained in these disciplines. With increased attention being focused on improving the quality of teaching around the country, there also is a need for resources to support such efforts to be available any time and any place (i.e., on an "asynchronous" website).

On the postsecondary level, more than 26,000 deaf and hard-of-hearing students are enrolled. Educators in the college environment would welcome a central clearinghouse of information and resources. These informational needs of K-12 and postsecondary professionals are reflected in hundreds of queries received each year at the National Technical Institute for the Deaf (NTID) at Rochester Institute of Technology (RIT) from teachers, parents, interpreters, "informal educators" (museum staff, planetarium directors, etc), graduate and undergraduate students, and other professionals. Such queries led to establishment of the Clearinghouse On Mathematics, Engineering, Technology and Science (COMETS), a comprehensive resource for networking around

the country, which has much information quite appropriate for educators of students with other disabilities or, for that matter, <u>all</u> students.

<u>Systemic Reform</u>

Based at NTID, COMETS is funded by the National Science Foundation (Award No. HRD-0095948). One focus of COMETS is on "systemic reform" in science, technology, engineering, and mathematics (STEM) for deaf students. The "system" in "systemic reform" in this project is a complex mosaic of people with a variety of needs. As shown in Figure 1 below, systemic reform includes people and resources working to achieve a common goal – quality science and mathematics education for deaf students.
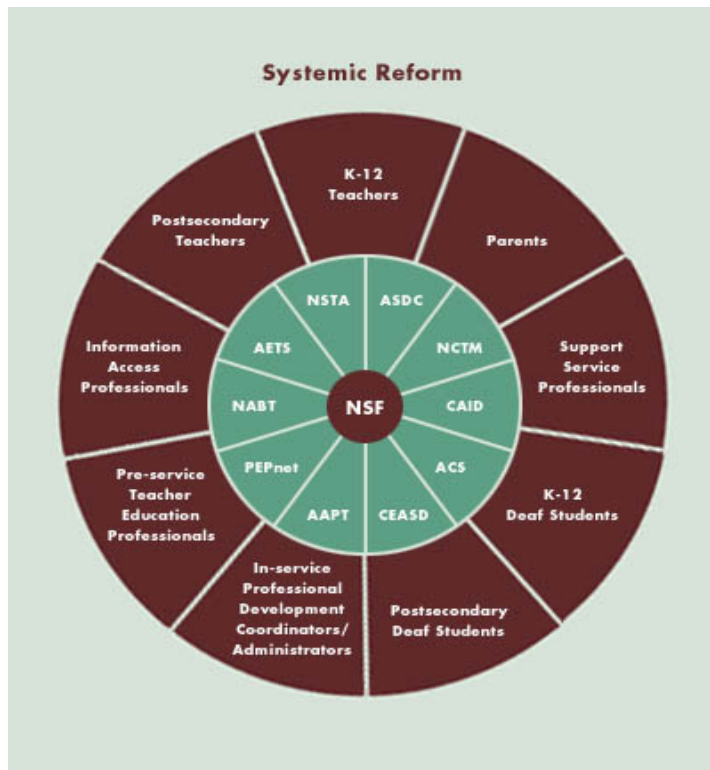

Figure 1: Systemic Reform with Professional Organizations

Science/Math-Related

ACS - American Chemical Society
NCTM - National Council of Teachers of Mathematics
NSTA - National Science Teachers Association
AETS - Association for the Education of Teachers in Science
NBTA - National Biology Teachers Association
AAPT - American Association of Physics Teachers
APS - American Physical Society

Deaf Education-Related

CAID - Convention of American Instructors of the Deaf
ASDC - American Society for Deaf Children
PEPNet - Postsecondary Education Programs Network
CEASD - Conference of Educational Administrators of Schools and Programs for the Deaf

Figure 1 shows the various organizations we are contacting on the national level. Other organizations at the state level are also being contacted. Some, such as the National Council of Teachers of Mathematics (NCTM), have found our website and initiated the reform efforts by inviting the COMETS staff to publish an article in their magazine *The Mathematics Teacher.* Others, such as the American Association of Physics Teachers, invited COMETS staff to provide workshops at conferences. As the information about the clearinghouse is disseminated, more and more teachers are learning the "best practices" for teaching and curriculum development.

Features of the COMETS website include discussion boards for each target audience which allow for individuals to establish their own networking efforts and share valuable information and experience. A comprehensive bibliography of more than 230 references allows parents, educators, and other scholars to follow up on their own with additional readings. An archive of several years of monthly newsletters is provided for newcomers who want to catch up on announcements about resources and activities in the national network.

Informational pages are provided about working with support personnel such as interpreters, tutors, and note takers, as well as about support technology like closed captioning and real-time captioning. COMETS also includes a growing lesson bank of math and science lessons designed specifically with many of the best practices that focus on the special needs of the deaf learner. Teachers will also find a description of how to write up a lesson plan with specific modifications for deaf learners. General teaching tips about working with deaf students as well as how to set up the classroom are also offered, in addition to current information on the national learning standards and information

about state and local level standards. Links to a variety of classroom projects being carried out by other schools are provided.

High school students will find information about pursuing options for college careers in math and science, and links to projects involving other deaf students. College students will find a tip sheet titled "Survival Skills" with suggestions on how deaf students can best navigate their experience in college to be most beneficial for them. College Faculty and Support Personnel will find information on the COMETS website related to interpreting, note taking, real-time captioning, and tutoring. Parents of deaf and hard of hearing children who are interested home schooling their children are presented with ideas for teaching science and mathematics. COMETS also provides parents with tips for how to support their children's education based on educational research.

To more easily navigate through the extensive information on the COMETS website, a site map, internal search engine, tables of content, and frequently asked questions (direct queries from other members of the network) guide readers to the information that is most related to their particular question.

Meeting the Needs of a Variety of People

Three of the most serious challenges in providing quality science and mathematics education to deaf students on the K-12 level relate to teacher content knowledge, training in the use of best practices with deaf learners, and the high turnover rate. The problem of under qualified teachers is a serious one in public schools across the country. The COMETS website particularly addresses best practices. The website meets the informational needs of nine audiences: Pre-service teacher education, In-service

teacher education, K – 12 teachers, High school students, College faculty, Deaf college students, Support personnel, Employers, and Administrators. The information on the COMETS web pages is organized based on the interests and needs of each audience as identified through hundreds of queries.

Workshops

Some of the information for the pre-service education, In-service teacher professional development, and K-12 teacher sections are presented in the form of a set of "workshops." These include such topics as Writing to Learn, Reading to Learn, Active Learning, Career Education in the Science/Math Classroom, Technology in the Classroom, and Teaching Problem Solving. Each workshop is designed as either a methods class session or as a professional development course. The workshops include pre-readings of pertinent information, background information about research in each area, and then a description of the various activities and how to incorporate them into the classroom. Thus, any university pre-service professor or any school program professional development coordinator, principal, or supervising teacher can use the COMETS website to update their students or colleagues with information derived from the most recent educational research and use these workshops at no cost. Schools do not need to search for a national expert to invite for a presentation. The workshops are developed so that individual teachers may read, "any time, any place" for their own benefit.

Access for Blind Persons.

Using the BETSIE system, people with partial vision can read informational pages developed by COMETS staff in large print format, and graphics are described in text-only format for blind readers.

<u>Evaluating the Networking Efforts.</u>

As with any NSF grant project, it is critical to evaluate whether the efforts to disseminate information are effective. COMETS is conducting an extensive on-line evaluation of both the quality of the information offered to the target audiences, and the accessibility of the information. People use different web browsers, different platforms, and low speed (e.g. modems) and high speed (e.g. Ethernet) connections to the World Wide Web. Graphics, sign language movies (technical signs for science and mathematics terms), and other offerings may be slow to download, or that may require software not available to some users. The COMETS project evaluated these technical issues, as well as the design and organization of the entire website in order to determine whether a comprehensive website may be an effective change agent in enhancing the science and mathematics education of students who are deaf or hard of hearing.

<u>Evaluation Results</u>

In order to evaluate the usefulness of this National Science Foundation project's website, we established three broad questions.

Research Question #1: Can an asynchronous (any time, any place) website be effective in providing information to a variety of audiences with related interests in improving science/mathematics education for deaf students?

The COMETS website resources were evaluated by samples of several target audiences through the use of on-line survey ratings, open-ended questions, and

unobtrusive observations. In particular, many of the website features and components
were evaluated by 52 professional educators. Table 1 summarizes the results of the
ratings. A Likert Scale with ratings 1 (low satisfaction) to 5 (high satisfaction) was used
to evaluate the quality, usefulness, and other factors. The data indicate very high
satisfaction with the information, design, and various features on this asynchronous
website.

Table 1: Website Evaluation Means/Standard Deviations

Evaluation of COMETS Website (Likert Scale Items/Ratings 1-5)		
	Mean	SD
Usefulness	4.27	.82
Quality	4.50	.61
Presentation/Organization	4.50	.85
Currency	4.48	.72
Scope	4.32	.61
User Friendliness	4.44	.11
Easy to Find Information	4.22	.92
Audience Buttons	4.45	.11
Newsletters	4.14	.86
Site Map	4.10	.82
Systemic Reform Page	3.96	.76
Bibliography	4.08	.90
Frequently Asked Questions	4.24	.86
Discussion Boards	4.10	.92
Books/Resources	4.26	.89

Open-Ended Comments by Professionals (Examples)

Hundreds of comments were obtained through the survey. Some representative
responses are summarized below:

"I think that some of my students feel that science is beyond their reach. This website
connects them to the world of deaf scientists and makes my classroom immediately
tangible to them."

"I thought that the FAQ page would be helpful for our mainstream teachers who have our deaf students in their classes. It also provided information that I could use in helping these teachers and students within their classes."

"This is wonderful to have professional science education for the deaf information provided in an interactive format and easily searchable. Science teachers for the deaf are often so isolated and these pages can help establish common understanding and common strategies for this community. I'd like to see more research summaries where possible."

"I am just now taking information found and sharing it with the mainstream and classroom teachers. I believe this will be a great tool since all of the teachers and students have access to the Internet. We will be able to better incorporate technology in the curriculum by utilizing the website."

"I find the information immediately pertinent to my job and (since I recently came from a public school as a teacher) immediately relevant to any science teacher curriculum. This is a great example of how public schools can incorporate a diverse focus into their curriculum planning."

"There is a lot of information available through this site. It is information that is not easy to come by through other teacher websites that I have visited and this is specifically for the area I want to teach."

"I find that most of the topics on your website are all things that have given me some difficulties at some point and now I have somewhere (one place) that I can go to address these problems as they occur."

Suggestions for New Efforts by COMETS (Examples)

In addition, we asked for suggestions to improve the asynchronous website

resource. Below are several responses, which indicate that the needs of the target

audiences are many and varied:

"Maybe more on using technology in the science classroom with deaf students. It'd be nice to have more students work up. I know you've solicited it. I have some I should send. Will try to get that to you. I still wish there was a way to promote more interaction between schools for the deaf..ie share what's happening, set up exchanges, etc. I know it has been hard to do. I have always wished there could be more coordination for schools for the deaf when they participate in large projects such as the JASON project, GLOBE, Voyage of the Mimi, etc."

"It would be nice to include some bilingual strategies, to be more specific -- teaching and learning strategies.

Include more information (sample lesson plans) about implementing the Writing to Learn and Active Learning strategies in the classroom."

"There are good quality information that any teacher including me can find. All links fit the information when I opened them up. Everything makes more sense to me. There is no need to improve these pages."

"In case I just missed it, include somewhere a list of captioned TV science programs and the age/grade levels for which the content might be appropriate (already-made resource for teachers to share with parents)."

"Can you please include more lesson plans so that I can look at them and have some ideas for my teaching?"

"Please add more information for teaching younger students math and science. I know there is a lot of information out there for typically developing students in the earlier grades but if you have lessons or tips for teachers who teach younger students it may help some us out! Thanks!"

"Material dealing with teaching math to deaf students at the secondary level (our state has K-12 certification in education of the deaf i.e. instructional guidelines beyond the obvious need for content knowledge. Is there a need for different strategies than those used with younger students? How about very low level readers at the secondary level?"

Unobtrusive Observations

Unobtrusive observation data included unsolicited comments sent to the project staff

through e-mail, letters, and comments in the website's guest book. Some examples are

provided below:

Guest book (Examples)

"Excellent effort to improve science education. Would like to share with Lamar University's teacher training program"

"My school is in the process of reform. We are researching topics for teaching mathematics to the deaf (K-8) and sharing them with the rest of the faculty. I believe I've come to the right place. I'm excited and will keep on surfing."

"Wow! I'm glad this is here. It's so hard to find information on teaching science to Deaf and hard-of-hearing students."

"Great resource for teachers as well as students."

"Great Site! I'm book marking this for the Deaf/Hard of Hearing elementary teachers in Fayette County, Lexington, KY."

"COMETS is an excellent resource for future teachers of deaf students like myself. I especially love the curriculum ideas, teaching strategies, sample lessons, and up-to-date

journals and philosophies on the education of deaf students. COMETS offers many invaluable resources at your fingertips. Thanks for a great website. I believe that COMETS should receive an award as an excellent resource for all those in the field of deaf education!"

"COMETS website just keeps getting better and better. And it is up to us to offer suggestions. I can see you are very eager for comments. And I have seen that the comments of users have had an impact. We have great math and science teachers of the deaf. Here is our chance to share our great ideas. Keep up the good work."

Correspondence (Examples)

"This is the entire class active learning method I wish I had thought of years ago. How simple and effective it is! Thanks for the inspiration and I have come up with some ideas of my own following this…So far, the students are paying more attention, actively participating at all times, and doing their work more too." [Teacher]

"We still use lots of your techniques in class. The write to learn and the active learning activities are great!!. A question has come up that we would like to throw out to you. We are currently writing IEP goal sheets. [Our principal] would like us to add an objective that "... will participate in write to learn activities". She would like parents to be aware of some of the "special" kinds of programs we use here. We have told her that we really do not see that as an objective but as way to assess student understanding in an informal way (so we can adjust our lesson and modify or reteach if necessary) and as a way to help students construct knowledge. There is a column on the IEP for evaluation procedures. What do you think? Should that be an objective, an evaluation procedure, or does it just not belong there? " [Teacher]

Additional Recognition

In addition, the website was recognized by the Eisenhower National

Clearinghouse (ENC), whose mission is to "identify effective curriculum materials," the

Fields of Knowledge "Infography Award of Excellence," as one of the outstanding

websites in education, and StudyWeb® as "one of the best educational resources on the

Web." StudyWeb® selects only the finest sites to be included in their resource guide.

The information provided on the website was also evaluated through field-testing

in in-service formal professional development workshops and with pre-service teacher

education. Workshops were presented at several universities and schools, as well as through a "Methods" course offered for two years to graduate students. Evaluations were very positive, indicating the information was beneficial to the participants.

The networking efforts were evaluated through the increase in the number of subscribers to the newsletter and the number of contacts with queries during the two-year grant funding period. In addition, the interaction among the network participants and the responses of organizations to the systemic reform efforts also provided evidence of the success of the network approach. During the grant period, 358 professionals subscribed to newsletter. More than 40 teachers offered to share best practices with the COMETS project. Others participated in the Discussion Boards and responded to the COMETS Newsletter announcements. Through the course of the two-year project, the concept of 'networking' became much more meaningful in terms of its form and function/impact.

Despite the "asynchronous" nature of the website (especially the FAQs), more than 100 requests for assistance were received. Of these, 44 percent of the requests related to Teaching and Curriculum; 18 percent were requests to connect their own projects or websites to COMETS; 11 percent related to organizations interested in sharing information from the COMETS website with other audiences; and 9 percent requests for additional information. Some examples of requests are provided below:

Hands-on activities and lesson plans that are standards based
Requested more information on cognitively guided instruction in workshop on Problem solving, balancing problem solving strategies with skill and other concepts, curricula that support thinking skills, and how to elicit information from young deaf students

Discuss plans to use COMETS as a resource for paraprofessionals, parents, deaf and h/h

students, educators, etc.

Seeking support for a dissertation

Seeking assistance for doctoral dissertation on attitudes of teachers toward mathematics.

Impressed with technical signs page, requested permission to disseminate COMETS

information in the Utah RID newsletter.

Seeking suggestions for teaching sound to deaf students

Requested information about the effectiveness of the Accelerated Math program which serves low-income, little-English speaking students in CA.

Seeking information on deaf chemist John Cornforth. October 14, 2000

Seeking photos and information on deaf scientists for a display for a children's museum

Searching for an email directory of deaf doctors and nurses.

Looking for resources for elementary science signs.

Student seeking help with technical signs for interpreters on the graduate level in neuroscience

Queries also poured in from all over the world, including Africa, England, Spain,

Greece Canada, Belgium, Australia, India, Russia, Austria, and Norway.

Systemic Reform on the Project Level

National Council of Teachers of Mathematics (NCTM). The National Council of Teachers of Mathematics invited COMETS to publish an article in *The Mathematics Teacher*. This article, titled 'Teaching Mathematics to Deaf Students: A Comprehensive Web-Based Resource' appeared in the April 2002 issue of *The Mathematics Teacher* (Volume 95, Number 4, p. 318). COMETS' plans include advertising COMETS in other mathematics teachers' magazines and newsletters.

American Chemical Society (ACS). The American Chemical Society invited the COMETS PI to participate in a working conference in 2001 to rewrite the book TEACHING CHEMISTRY TO STUDENTS WITH DISABILITIES. This book includes information about COMETS. In order to receive a copy, interested persons can call the American Chemical Society at 800-227-5558 ext. 4600. Single copies are sent free of charge.

Council of Educational Administrators of Schools and Programs for the Deaf (CEASD). The Council of Educational Administrators in Schools and Programs Serving the Deaf invited COMETS to present a paper at its national conference in Rochester, New York in July 2001.

American Association of Physics Teachers (AAPT). The COMETS PI co-presented three papers/panel sessions at the annual conference of the American Association of Physics Teachers.

Postsecondary Education Programs Network (PEPNet). COMETS has linked to the website of the Postsecondary Education Programs Network. In turn, PEPNet has linked to COMETS.

Convention of American Instructors of the Deaf (CAID). The Convention of American Instructors of the Deaf has a special interest group (SIG) for science and math teachers. Information about COMETS was shared through the newsletter of this group newsletter.

The CAID SIG is sharing information about COMETS at a special meeting during the NCTM's Eastern Regional Conference in Boston, Massachusetts, November 2002.

American Physical Society (APS). The COMETS website has been linked to APS to inform its membership of the resources we have developed.

Design Considerations

Research Question #2: What design considerations are important in terms of features and components in such an asynchronous website focusing on information dissemination?

Throughtout the two-year project we learned much about designing a website for information dissemination purposes. We include many suggestions in the appendix of this paper.

Technical Issues

Attempts to build a network were made difficult by various technical factors. For example, people frequently change email addresses to avoid spam. This resulted in the e-mail network being more difficult to maintain. Attempts to use movies and other graphics found obstacles related to the "browser war." Software which works on one browser may not work on another. Movies and multimedia clips may work on a newer version of a browser but not on an older version of the same browser. Staff help was needed at times to clean out unwanted materials left by hackers or other individuals within the COMETS discussion boards.

Downloading times for website pages containing graphics, movies, and other types of information varied depending on the browser, the browser version, the operating system used, the software, and the platform of the user. Educators using low-speed

systems, such as slower dialup modems, would be discouraged from accessing examples on pages that contained movies or multiple graphics.

Research Question #3: What factors are important in terms of managing such a website?

Based on our experience with this two-year NSF grant, we provide some recommendations to educators interested in information dissemination through an asynchronous website and networking approach. Our recommendations agree with those reported in the Stanford Persuasive Technology Labs Study and the Bloomberg Marketing Study for business websites.

1) Make sure there is adequate staff and technical support. There are great demands on time and energy needed to develop quality information with a quality design. Many technical issues require expertise with various platforms, browsers, operating systems and software.

2) Be sure to provide access to all users, including those with visual problems. We used the "BETSIE" system of large print for partially sighted people and, as much as possible, descriptors of all graphics, buttons, etc. This is not always easy, as in the case when there are lexicons with sign movies.

3) Determine the specific audiences you wish to address, define their needs clearly, and communicate from the start what limitations will be placed on the website development.

4) If your website is funded by a federal grant, there will be expectations to sustain the results or "institutionalize" them. In other words, after funding is over, the funding

agency expects that the information will remain available. Without funding, however, it is difficult to maintain a complex website without staff help and other resources. In our case, we will continue the website information for as long as possible, while simultaneously developing a textbook version of most of the information for use over a longer period of time.

5) There should be quick response to questions and queries. The more you advertise your information, the better prepared you should be in terms of having adequate staff to deal with queries. Even an "asynchronous" website with a voluminous amount of information will lead to a large number of queries for additional information, collaborations, assistance, etc. If you do not plan to help people beyond providing information on the web pages, avoid interactive features, such as Discussion Boards, email address contacts, requests for sharing information from other projects. These features can quickly overwhelm the project staff.

6) Be sure to provide credentials for the website author and/or director. People are attracted to websites that are developed by established experts in their field. The UCLA Internet Report in 2001 (AirTran *Arrivals*, December 2002/January 2003), 58 percent of users believed that most or all of the information on the Internet is reliable and accurate. This means that about ***four out of ten people do not believe the information on the Internet is accurate and reliable***. Make every effort to show that the information you are sharing is based on sound educational research, for example, rather than just opinions.

7) Be sure to have your website hosted by a well-respected organization, such as your school or university. This will increase the confidence in the accuracy of the information you are disseminating.

8) Indicate to the users when the website has been updated. This will allow them to determine if there may be new information since their last visit.

9) Make sure links work, and that the website never becomes unexpectedly unavailable.

10) Make sure that navigation is easy for all users. This becomes increasingly difficult as the bank of information expands, and as the needs of multiple target audiences are addressed. In our project, we used site maps, an internal search engine, tables of content on many main pages, Frequently Asked Questions, and a careful design of features and audiences displayed on every page. Still, it was a constant struggle to maintain easy navigation in order that people could find information they desire.

For educators to have a true impact on practice, we may also borrow some of the suggestions from the business world. The Bloomberg Marketing Study, in particular, suggests that efforts be made to gain visitor trust, foster visitor loyalty, stimulate return site visits and site bookmarks, stimulate longer, deeper site visits, and improve search engine connections (AirTran, 2003).

<u>Networking can make a difference in the Education of Deaf Students</u>

The acronym "COMETS" presents an appropriate metaphor. As with the so-named astronomical bodies, this project will leave a trail of material and energy that will be available for a long time to come. Readers interested in teaching students with disabilities in general are encouraged to browse around the COMETS website at http://www.rit.edu/~comets and try some of the best practices with their own students.

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Appendix

Design Tips for Web Accessibility

Alan B. Cutcliffe, COMETS Website Designer

1. Ensure that text and graphics are understandable when viewed without color; don't rely on color alone. To test, set monitor to b+w and review legibility.
2. Ensure high contrast between text and background.
3. Don't use text behind a patterned background.
4. Maintain consistent, predictable layout and navigation behavior
5. All visual cues should be noticeable if one is not looking directly at the screen.
6. Ideally, navigation buttons should have three visual states: change upon mouse rollover; change upon clicking and holding; change after mouse button is released and selection is complete.
7. Don't make the navigation of a site dependent on sound. Provide all auditory information in a visual form, e.g. captions, visual alerts, or instructions.
8. Provide a 'Show Sounds' switch. A ShowSounds feature allows a user to specify that all sound should be accompanied by a visual event including a caption for any spoken text on screen.
9. For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation.
10. For blind users, provide clearly worded, succinct alt tags that can be read by assistive braille readers.
11. Provide alternative content in case active features are inaccessible or unsupported for scripts, applets, and plug-ins. Provide captioning and transcripts of multimedia audio, descriptions of video, and accessible versions in case inaccessible formats are used.
12. Avoid using tables for column layout. Instead, if your target audience(s) have updated browser software, use CSS for layout and style where possible.
13. Use the "alt" (alternative) attribute for IMG, INPUT, APPLET elements.
14. Empty spacer type of image graphics can be described as alt="" so that screen readers won't read unnecessary information.
15. For image maps use the "alt" attribute with AREA, or use the MAP element with A elements (and other text) as content.
16. For tables, frames, graphs and charts, use a summary phrase (like an alt tag) at the top of each.
17. Each succeeding alt tag should not be redundant; make each its own individual text, information that gives a complete picture.
18. Alt tags should be not too wordy, nor too vague.
19. For blind users, alt tags can be read by assistive braille-reader software.
20. Provide a 'text only' homepage button. This text version of the site also makes the information accessible to blind people because the accessibility software and accompanying braille-writer keyboard can read this version.
21. Use 'label' tags for form elements. Forms are features such as a search box where the user types in a request for information. Label tags should also be given to such features as a submit button and a reset button.
22. Use plain speech. This suggestion is useful for all audiences.
23. Hypertext links. Use text that makes sense when read out of context. For instance, do not use "click here."
24. Give text feedback for errors, or for any responses.
25. Keyboard enable your site.
26. Tab enable your navigation buttons.
27. Have a homepage button that says something like 'accessibility features' to go to a separate page that lists the browser tips and the designer's own added accessibility features. For example, PC browsers are wired so that you can tab your way through the buttons of an interface in order to avoid using the mouse; it's not a feature that a designer or programmer has to add.

28. Have a 'text-only homepage' button for slower machines to access the site. Text-only pages with equivalent information or functionality need to be provided to make a website accessible when compliance can't be achieved any other way.
29. When pages utilize scripting language, that information should be accompanied with functional text that can be read by assistive software.
30. Provide keystrokes for major functions. For example, if a website consists of nine major sections, then the keyboard buttons 1-9 should be programmed to access the nine sections.31. Check your work. HTML should be 'valid'. Valid means, for example, that closing tags that may be unnecessary for browsers to read information properly, are still provided because they are needed by assistive screen readers to interpret the same information properly.
32. Use evaluation tools 'Bobby' and text-only browsers to verify accessibility.
33. Make sure that software support people are reachable via TTYs.
34. Generally speaking, avoid the use of tables to create multiple columns, if possible. Remember that screen readers read left to right, which means a three-column directory document will be misread by the reader. Use headings, paragraphs, lists, and definition elements creatively to present information in a more accessible manner. It is helpful to end items on the lists or sentences with appropriate punctuation marks, for the screen readers do recognize and translate them for the user. If you definitely want to use tables to create columns, you will have to experiment with modifications to table markup for the content in the columns to be rendered in the correct order by a text browser or screen reader. For example, placing a <BR> tag at the end of a row in a table will create a break in text that a browser or reader will recognize as a signal to move on to the next line of text. Screen reader developers are currently working on methods to have their software read within a table rather than across columns.
35. Using frames can create a page that is inaccessible to those using screen readers. If frames are necessary, an effective alternative to the frames page should be included. The <NOFRAME> tag should always be included when using framed pages. This tag allows entire documents to be displayed in browsers that are incapable of displaying frames.
36. Very often when quickly skimming Websites our eyes will be drawn to lists, for we know that lists offer a summation of the text and the bullets or numbers indicate what the author wants us to read. With screen readers, however, bullets may be interpreted as dots, asterisks, or periods. Instead of using text bullets in an HTML document, use the correct tagging: <UL> to start the bulleted list; <LI> before each bulleted item; and </UL> to end the list. Browsers will interpret these tags and insert correctly formatted bullets before each item. Always remember to add a period at the end of each item on the list. This will tell the screen reader that it is at the end of one item and will allow it to move on to the next item on the list.
   Similarly, numbered lists should not be created by inserting numbers in the HTML text document, but rather by using appropriate tagging: <OL> to start the numbered list, <LI> before each numbered item, and </OL> to end the list.
37. Forms are yet another roadblock for screen readers, although screen-reading developers are confident that they will find a solution to the problems. Readers do not know where the fill-in box is, how many lines must be filled out, or when they have reached the end of the form. Thus, if you wish visitors to your site to fill out electronic applications, offer an alternative method, such as a simple "mail to" link that could ask them to submit the same information in e-mail messages. Other options would be to offer the ability to download the form as a text or PDF file, or to put up an image that could be printed out. The user would then have a paper version of the form that could be filled out and submitted.
38. Work with Lynx (a text-based browser) because if Lynx can view a document Braille displays and screen browsers should be able to interpret it correctly as well.

Access-Related Websites
www.cast.org/bobby
www.cast.org
www.w3.org/WAI/
www.rit.edu/~easi
www.webaim.org
www.microsoft.com/enable
www.trace.wisc.edu
http://ncam.wgbh.org/cdrom/guideline/tips.html

http://murmur.arch.gatech.edu/crt/Techknow/Devices/Assistive.htm
http://bigsearch.mit.edu:8765/query.html?qt=web+accessibility
http://www.bbc.co.uk/education/betsie
http://www.ataccess.org
http://www.usability.gov
http://www.usablenet.com