necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's schools.

... should encompass (a) basic research in various learning-related disciplines and on various educationally relevant technologies; (b) early-stage research aimed at developing new forms of educational software, content, and technology-enabled pedagogy; and (c) rigorous, well-controlled, peer-reviewed, large-scale empirical studies designed to determine which educational approaches are in fact most effective in practice. The Panel does not, however, recommend that the deployment of technology within America's schools be deferred pending the completion of such research.

...Section 8 focuses on the need for rigorous scientific research designed to evaluate the effectiveness and cost-effectiveness of alternative approaches to the use of technology in education, on the extent to which such research should be funded at the federal level, and on the manner in which it might best be organized and administered. (2)

So here are two national studies who conclude that technology might help, but call for substantial research to find out what will work efficiently. There are lots of anecdotal stories about successes, but not controlled well designed studies. We seem to be flying blind, as to what technology works long term to increase learning. So at this point we can't say definitively that technology will increase learning. We need to do more well designed research. We can't answer the question I started with.

We are, however, under a pressure to do something with this new technology. Areas such as multimedia and hypermedia and using the Web are popular with students and administrators. Funds are usually available. If nothing else the 'Hawthorne effect', using something new should increase learning and have the usual short term effect of increased learning. I'll go a little further and hope that combined with experience, an application of multimedia and hypermedia will have some longer term effect on learning. Perhaps tying the new methods to current learning theory would be beneficial. What do we mean by learning? The constructivist learning methods are close to what we do in some chemistry labs.

... (students) will thus need to be prepared not just with a larger set of facts or a larger repertoire of specific skills, but with the capacity to readily acquire new knowledge, to solve new problems, and to employ creativity and critical thinking in the design of new approaches to existing problems. In the words of Frank Withrow, the director of learning technologies at the Council of Chief State School Officers, "the US work force does not need knowers,' it needs learners.'"

... constructivists believe that learning occurs through a process in which the student plays an active role in constructing the set of conceptual structures that constitute his or her own knowledge base. (2)

Bibliography

1. Project 2061 Blueprints On-Line
   American Association for the Advancement of Science, Washington, DC 1997
   URL = http://project2061.aaas.org/products/bluepol/blpframe.html

2. Report to the President on the Use of Technology to Strengthen K-12 Education in the United States
   URL = www.whitehouse.gov/WH/EOP/OSTP/NSTC/PCAST/k-12ed.html

AN INTRODUCTION TO CASCADING STYLE SHEETS AND DYNAMIC HTML

Susanne M. Dana
Roanoke Valley Governor's School for Science and Technology
2104 Grandin Road, SW
Roanoke, Virginia 24015
sdana@rvgs.k12.va.us
and
Brian M. Tissue
Department of Chemistry
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0212
tissue@vt.edu

INTRODUCTION

Cascading style sheets (CSS) and dynamic hypertext markup language (DHTML) provide new methods to control page layout and provide interactivity on Web pages. The benefits of CSS and DHTML include the ability to control the formatting and layout of the page content, and the ability to add animation, interactivity, and multimedia effects. These techniques, and some of the newer development tools, can simplify the development of interactive tutorials and exercises for chemical education. DHTML pages do not require the loading of Java applets or ActiveX controls, the presence of browser plug-ins, or repetitive transfers from a Web server. Unfortunately, the current browsers that support DHTML, Netscape Navigator (ver. 4.0 and higher) and Microsoft Internet Explorer (ver. 3.0 and higher), implement many DHTML features differently. In the future, CSS and DHTML will be an integral part of HTML standards as part of the Document Object Model being developed by the World Wide Web Consortium (W3C) [Document Object Model (DOM): http://www.w3.org/DOM/].

Like other client-side programming methods such as JavaScript, DHTML is best suited for developing and delivering presentations, tutorials, or practice exercises [B. M. Tissue, "Overview of interactive programming methods for the World-Wide Web," Trends Anal. Chem. 16 (1997), 490-495; http://www.elsevier.nl:80/inca/homepage/saa/trac/progmeth.htm.] Applications that require an interface to a database for quiz generation, student tracking, or grading are still best programmed using server-based methods with the common-gateway interface (CGI) or server-side scripting. DHTML can animate graphics to replace animated GIF images, which lack user interactivity. Many multimedia development tools are more sophisticated and stable than DHTML to create presentations, but do require that users have the appropriate plug-in.

Our original intent in this article was to provide a simple tutorial of DHTML. Unfortunately, even defining DHTML is difficult since different authors and organizations use the term quite differently. DHTML might refer to any of a variety of Web-based programming methods or to a very specific set of HTML extensions or procedures supported by either Netscape Navigator or Internet Explorer. The best definition we have found for DHTML is from the W3C DOM Working Group [op. cit.: http://www.w3.org/DOM/]:

"Dynamic HTML" is a term used by some vendors to describe the combination of HTML, style sheets and scripts that allows documents to be animated.

To avoid adding to the confusion about DHTML, this article will concentrate on describing the underlying notion of cascading style sheets, and then qualitatively discuss some of the options for using and developing DHTML.

CASCADING STYLE SHEETS

Style sheets provide the means to control all attributes of a Web page [Web Style Sheets: http://www.w3.org/Style/]. They provide layout control to augment the document structure that HTML tags specify. Style sheets replace many HTML extensions such as <FONT>, <B>, and <I>, and layout work-arounds such as complicated tables or image spacers. For example, style sheets can specify the font type, color, line spacing, margins, and positioning of document components such as headings, <H1>, or paragraphs, <P>. Arbitrary styles can also be applied to any part of a document (see <SPAN> below). The following HTML code is an example of a cascading style sheet, which is placed in the header section of an HTML file or in a separate file.

```
<STYLE TYPE="text/css">
BODY {
 background: white;
 color: black;
 margin-left: 5%;
 margin-right: 5%;
}
H1 {
 margin-left: -5%;
 text-align: left;
 color: blue;
}
H2 {
 text-align: center;
 color: red;
}
#userdefined1 {
 font: italic bold 16pt Arial;
 color: green;
}
</STYLE>
```

In this example, the body text will be black on a white background. Any H1 headers will be flush to the left edge of the page, and everything else on the page will appear indented by 5% of the page width on both the left and right margins. The userdefined1 style can be applied to any text on the Web page by placing the <SPAN ID=userdefined1> and </SPAN> tags around the text to be highlighted. The ID attribute can also be used in <P> or <DIV> tags to format whole paragraphs or sections of a document. This simple example uses percentages for positioning. Style sheets allow absolute or relative positioning in percentage, pixels, points, and other units, for complete control of a Web page.

HTML files can be linked to external style sheets by placing a line of code such as the following in the header section:

```
<LINK REL=StyleSheet HREF="mystyle.css" TYPE="text/css">
```

The mystyle.css is a text file that contains the <STYLE>...</STYLE> content, such as shown above, but not <HTML>, <HEAD>, or any other HTML tags. An external style sheet can control the formatting of mul-

tiple documents, allowing an author to create and maintain a consistent interface throughout a set of Web pages by editing only one file. More tools and information about cascading style sheets are available on the following Web sites:
CSS draft specifications: http://www.w3.org/Style/css/
HTML Help by The Web Design Group: http://www.htmlhelp.com/

DYNAMIC HTML
The cascading style sheets provide the tools to control style and layout on a Web page. Combining style sheets and scripting languages allows delivery of dynamic and interactive elements on a Web page. A useful feature for interactive tutorials is the ability for a text block or image to change based on the position of the pointer or on a mouse click in a certain area. Other examples include drop down menu boxes, text boxes, and animated text or image overlays.

Unfortunately, these dynamic features are where Netscape Navigator and Microsoft Explorer diverge in their implementation of DHTML. DHTML pages on the Web currently, are either browser-specific, or they incorporate browser testing and two sets of DHTML code. The more sophisticated DHTML development tools have the capability to produce browser-independent code. The following development tools support CSS and DHTML to varying extents.

HomeSite 3.0, Allaire Corp., http://www.allaire.com/
HoTMetaL PRO 4.0, SoftQuad Inc., http://www.softquad.com/products/hotmetal/
Interactor 1.1, mBED Software, http://www.mbed.com/
NetObjects Fusion 3.0, NetObjects Inc., http://www.netobjects.com/
Dreamweaver 1.0, Macromedia Inc., http://www.macromedia.com/software/dreamweaver/

More tools and information on DHTML are available on the following Web sites.

WebReference.com (sm) - The Webmaster's Reference Library: http://www.webreference.com/
ZDNet InternetUser / Garage / Dynamic HTML: http://www.zdnet.com/products/garage/dhtml.html

Collaborative Intercollegiate Physical Chemistry Projects

David Whisnant
Wofford College
Spartanburg, SC 29303
whisnantdm@wofford.edu

Lisa Lever
University of South Carolina at Spartanburg
Spartanburg, SC 29303
llever@gw.uscs.edu

Jerry Howe
Converse College
Spartanburg, SC
jerry.howe@converse.edu

In Spartanburg, South Carolina, there are three relatively small colleges - Wofford College (1100 students), Converse College (1000 students), and the University of South Carolina - Spartanburg (3300 students). Our departments all are faced with the problem of small enrollments in our physical chemistry classes, which makes it difficult to justify the purchase of expensive equipment to update laboratories or to regularly use research-style collaborative projects. For the last four years, with support from two NSF ILI grants and Oxford Molecular Modeling (*1*) the three physical chemists from these colleges have cooperated by sharing equipment and collaborating on experiments in which all our students participate. The collaborative experiments have been particularly valuable because they have converted our sometimes small classes, in which there are only a limited number of students with whom to interact, into effectively larger classes.

Our first venture into collaborative experiments was during the 1996-97 academic year. Conversations with Theresa Zielinski of Niagara University had introduced one of us (Whisnant) to the potential of the Internet for promoting the interaction of students from different schools (*2*). For the two previous years we had struggled with problems involving a laser system designed to measure heat capacities by thermal lens calorimetry (*3*). Last year we decided to involve our students in a research-like project intended to narrow down the sources of error in the experiment. Groups from two of the colleges studied the effect of variable changes (e.g., cell positions, concentrations, or solvents) on the results of the experiment. They statistically analyzed their data and submitted the results to one of us who posted the results on the project Web page (*4*). When the students wrote their reports on the project, they were responsible not only for discussing