

Visible Human Browsers: Formative Evaluation Based on Student Feedback

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Introduction

The University of Michigan Visible Human Project (UM-VHP) includes a team of faculty and student's whose main purpose is to evaluate and assist in developing the user interface of the Visible Human dataset. The purpose of this investigation, part of the formative evaluation for the Visible Human (VH) instructional system, was to evaluate students' use of the current browser software. The goal was to gain insight into how students interact with the software interface, and also how students perceive the usability of the different types of browsers. The research questions addressed by this project were:

1. What is the most effective way for student users to interact with VH browser interfaces?
2. What are students' perceptions of the usefulness of the VH software for learning anatomy?

Background Information/Literature Review

Formative evaluation emphasizes collecting information in the early design stages in order to improve the design, achieve greater effectiveness and efficiency, and test usability and acceptance. Recognizing the drawback of summative evaluation, which is focused on the end product, research in the past three decades increasingly focused on formatively evaluating instructional materials and generating products which significantly improve students' performance. Having the potential users experience and evaluate the product can provide information that may not be found by expert review. At early stages of the instructional design process, before the system is ready for larger scale field testing, small group evaluation generates information to support design decisions.

This study employed focus groups to test software usability. The usability testing allowed the researchers to observe users' immediate responses to the software. The focus group method afforded the opportunity to observe participants' interactions with each other and to discuss design issues directly with the participants.

Methods

Research participants were 2nd year medical students who had just completed a year of gross anatomy study. IRB approval was obtained before data collection occurred from the University of Michigan. Three, semi-structured group interviews (focus groups) were videotaped for subsequent analysis.

After informed consent was obtained, a member of the research team demonstrated features and controls of each software program followed by the students having the opportunity to 'take the controls'. Then one student volunteer operated the software controls with the other three students coaching the operator while the students carried out an anatomy 'assignment' to find a particular anatomical structure. The students were encouraged to converse and think out loud as they explored the database using the browser software. After this exercise was completed, a member of the research team led a discussion with the participants regarding their thoughts about

how they felt the software could best be used in learning anatomy and elicited their opinions about the software's user interface.

Software used in study included the Edgewarp program and the PSC VH volume browsers, a web interface to an anatomy content database as well as a simulation of an Edgewarp fly-through (movie) that was well populated with pop-up labels.

Data Analysis

Qualitative methods were used to analyze the data. Two investigators together studied videos of group interview sessions. The investigators took meticulous notes on their observations and recorded quotes and event descriptions. Investigators worked through the videotapes in sections, repeatedly viewing and discussing each section in order to reach a consensus understanding of that section. From their notes and observations, the investigators extracted salient utterances, behaviors, and events, and looked for themes or patterns.

Results

Inferences and themes were drawn from the data which are important to the future development of the VH based tools for anatomy instruction. In total 12 students participated in the research project: 3 groups of students with 4 students in each group. The data were organized according to the following framework:

1. Interactions with VH software
 - 1.1 Inquiry into: functions, controls and display
 - 1.2 Interpretation of orientation and anatomic information
 - 1.3 Strategies for recognizing structures, finding structures and recognizing relationships
2. Vision for learning anatomy with the VH software
 - 2.1 Student requirements: Integration with other materials from the class. Links among anatomy information sources.
 - 2.2 Use of the software: learning curve, learning styles
3. Suggestions for: control devices, new functions and anatomy topics

Major themes included: students preference for a familiar interface, consensus that the browsers would be most useful for study of the head-and-neck and pelvis regions, thoughts that the VH browsers would be a supplementary learning tool in first-year anatomy, and not replace the resources they already use and that labels of anatomical features in the browser window were important. All students agreed that the VH browser views would become increasingly valuable as they advance in their studies and become more dependent on images from radiology (CT, MRI, Ultrasound). Student research participants experienced several difficulties while working with the volume browsers. For example, slow performance resulted in the image breaking up (become coarsely pixilated) until new data were downloaded. This loss of resolution made it impossible for students to tell how far they had moved the cut plane. They consistently undershot or overshot their intended endpoint and often became lost or disoriented. Students also got disoriented while translating or rotating the cut-plane view, even when the displacements were small.

Conclusions

These data point out the importance of integrating the VH browsers into a comprehensive set of anatomy learning resources. Students are already accustomed to approaching anatomy study in a particular way, using texts and dissection as primary resources. This orientation may change as other resources are polished and made available. The 3D models seem to be very important as local frames of reference for the students. There is a general consensus that their should be student or instructor programmable with preferences to select levels of complexity and power in the user interface (controls): beginner, intermediate, advanced.

Medical Students are strongly accustomed to canonical, orthogonal cutting planes, and seemed uncomfortable when viewing arbitrary, oblique sections for very long. The ability to jump back to a preset view (sort of a home button) should be a standard feature of any VH browser. Students also requested that labels of anatomic structures be provided in some form. Observation of browser image break-up implies that high data throughput is essential for the volume browsers to be of any use in an instructional setting. It is also essential to provide student users of VH browsers with an orientation support system. The expressed sentiment that students would not use the current browsers may be related to the complexity of the user interfaces of the demonstrated versions, which required too high a time and effort investment in learning to use the software before they could be fluent enough to begin thinking about anatomy. A simple, intuitive user interface may be the key to student acceptance and use of a VH browser in learning anatomy.