Usability, Learning, and Subjective Experience: User Evaluation of K-MODDL in an Undergraduate Class

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http://www.hci.cornell.edu
Best Digital Libraries in the world?

Gateway to Cornell University Library

amazon.com

Google

Human-Computer Interaction Group
Introduction

- Investment on DLs is significant! (Fox & Urs, 2002)
- NSDL: knowledge transformation instead of information retrieval (Zia, 1999)
- Evaluating educational impact is difficult (Giersch et al., 2003)
  - Pedagogical goals included in evaluation (Borgman et al., 2000);
— Activity-Centered Design (Gay & Hembrooke, 2004)
— digital libraries are “part of an ‘assemblage’ of artifacts, knowledge, practice, and community that entails realistic, workplace-based compromises by library staff, system designers, and patrons.” (Bishop et al., 2003)
— Multi-facts data need to be collection (Marchionini, 2003).
History of KMODDL

Franz Reuleaux (1829-1905)
Professor of Mechanical Engineering

Reuleaux Kinematic Models

Andrew White (1832-1918)
First President of Cornell University
KMODDL: the Kinematic Model for Design Digital Library

- Supported by NSF NSDL program (2002 – 2004)
- Connecting historical kinematic artifacts with engineering education (connecting museums with libraries);
- Transform historical kinematic models into its classroom use;
- KMODDL team include Cornell University Library, Sibley School of Mechanic and Aerospace Engineering, and HCI group of Information Science Program in Cornell University.
Evaluation Goals

- How to integrate a digital library in undergraduate classes?
- What are usability problems, evaluate learning and subjective experience.
Four Types of Learning Modules

Physical Models

peaucellier.mov
QuickTime Virtual Reality Movies

Java Simulation

Textual Materials
Evaluation Methods

- MATH 451: Geometry on Plane and Sphere
- 13 students participated, including both undergraduate and graduate students
- CIAO! (Context, Interaction, Attitude, and Outcomes) (Jones et al., 1996)

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<th>Class activity</th>
<th>Research goals</th>
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<td>Document</td>
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<td>Familiarize with the format and context of the class</td>
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<td>Analysis</td>
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<td>Observations</td>
<td>Introduction of K-MODDL</td>
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<td>Videotaping</td>
<td>Demonstration of physical models</td>
<td>Understand the use of physical models in classrooms</td>
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<td>Software</td>
<td>Use of digital models on K-MODDL web site</td>
<td>Understand the usability problems and learning when using K-MODDL</td>
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<td>Survey</td>
<td>Discussions of homework on K-MODDL</td>
<td>Assess subjective evaluation on usability and learning</td>
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<td>Web logging</td>
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<td>Interview</td>
<td>End of the course</td>
<td>The professor's view on the usefulness of K-MODDL in classroom learning and usability problems occurred</td>
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Evaluating Context

- Moore Method of teaching (Henderson & Taimina, 2001)
- Socratic style of lecture
- Intuitive understanding and personal experience of geometry
- Imagination and active participation are the keys of this class
Assessing Usability Problems

Through survey feedbacks
- Running speed of Java simulations;
- Manipulation of Java simulations or QuickTime movies;
- Typos and grammatical errors in textual materials.

Though Critical Incident Analysis (Flanagan, 1964) on captured screen movies
- 81 critical incidents
- Mental model discrepancies (37 incidents);
- Speed (23 incidents);
- Bugs in the programs (crashes) (21 incidents).
Assessing Learning

Critical Incident Analysis on screen capturing movies
- 10 learning incidents in 7 movies
- “ah-ha” moments, connections being made between different pieces of knowledge

Survey responses
- Digital modules are more useful than physical ones
- Physical modules are more fun than educational

![Bar chart showing comparison of different learning styles across different factors such as Curiosity, Understanding, and Remember. The chart includes comparisons for Physical, Textual, QTVR, and Simulation methods.]
Assessing Subjective Experience

Video analysis on classroom activities
- Students were interested and stimulated
- Hands-on activities before web use session began

Survey responses
- 10 in 12 gave positive responses
Conclusion

- Uncovered usability problems and made improvements;
- Revealed learning and positive experience;
- Hedonic problem;
- Relationship between usability, learning, and subjective experience.
Conclusion

Good Usability

Learning

Positive Experience
Current Research

Comparison between undergraduate geometry class and robotics class:
  Different groups of users prefer different models;
  Different learning modules helped them learning in different ways;
  Dynamic and evolving digital library design (Bishop et al., 2003).
Thank you and Questions?