1. Module name: Digital Library Evaluation, User Studies

2. Scope
   While a number of kinds of evaluation/research studies may be conducted during the
design and development of a digital library (e.g., usability testing), this module is
concerned with methods for evaluating the outcomes, impacts, or benefits of a digital
library, including cost/benefit analyses. It also includes methods that are useful for
general user studies (i.e., studies that intend to more fully understand people’s
interactions with digital libraries). While some methods covered here are useful for
usability testing, usability inspections and usability testing are explicitly covered in
module 6-d, Interaction Design, Information Summarization and Visualization, and
Usability Assessment.

3. Learning objectives
   Students will be able to:
   - Understand the importance of DL evaluation;
   - List and describe the strengths and weaknesses of multiple approaches to
evaluation; and
   - Apply an appropriate evaluation method to a particular DL.

4. 5S characteristics of the module
   Streams: N/A
   Structures: N/A
   Spaces: N/A
   Scenarios: Scenarios may form the basis of an evaluation plan, by describing
   particular situations of use that must be supported effectively by the DL.
   Societies: The concept of societies may be useful in planning an evaluation because it
   will support the evaluator in more systematically consider the potential stakeholders
   of the DL.

5. Level of effort required (in-class and out-of-class time required for students)
   - In-class time: 2-2½ hours
   - Out-of-class time: 1½ hours for assigned reading
   - Learning activities (optional): See notes on timing with each activity or
     assignment.
6. Relationships with other modules (flow between modules)
   It is expected that this module will follow other modules on digital libraries, and will
   be in the final portions of the module sequence.

7. Prerequisite knowledge required (completion optional)
   Students will not be expected to have had prior training in social science research
   methods.

8. Introductory remedial instruction: None

9. Body of knowledge

   Evaluation and user studies:

   Definition of evaluation: “An appraisal of the performance or functioning of a
   system, or part thereof, in relation to some objective(s)” Saracevic, 2000,
   p.359

   Evaluation incorporates the making of value judgments about whether
   performance is adequate
   Its purpose is to inform decision making (Reeves et al., 2003)

   Evaluation is critical to any project
   NSF recommended that at least 10% of the project budget be devoted to
   evaluation in their early DL initiatives

   User studies may be more general, in terms of the types of questions asked
   They do not necessarily incorporate the making of value judgments about
   performance quality
   User studies may be more specific, in that they involve users
   Evaluations may be conducted on the DL collection or other aspects of the
   DL without involving users

   This module will focus particularly on evaluations that involve users

   The object of the evaluation or user study: digital libraries and their
   processes/functions

   A particular aspect of a digital library
   Individual digital libraries
   Multiple digital libraries
DL processes that may be evaluated (based on Saracevic, 2005), and criteria for evaluation:

- Information representations, metadata and surrogates used in the DL
  - Task appropriateness
  - Usability
  - User satisfaction
- Particular tools available in the DL
  - Index, search, and output features
  - Navigation, browsing
  - Failures in functionality or usability
  - User satisfaction
- Particular services offered by the DL
  - Collection quality
  - Retrieval performance (recall, precision)
  - Reliability
  - Human-intermediated services (e.g., reference services)
  - User satisfaction with individual services or with collection of services
  - User behaviors when interacting with the DL (may or may not be evaluative)
    - Information seeking/searching behaviors
    - Use of information retrieved
    - Work patterns

“All efforts to design, implement, and evaluate digital libraries must be rooted in the information needs, characteristics, and contexts of the people who will or may use those libraries.” Marchionini, Plaisant, & Komlodi, 2003, p.1

Questions that may be asked during an evaluation/user study:

Frame the study questions based on the decisions that must be made about the DL’s functions/processes (Reeves et al., 2003)

- Focus on those questions that are most important for making the decisions that are most important
- Focus on impacts of DL functions/services (Marchionini, Plaisant, & Komlodi, 2003)
  - What types of impacts are there? On whom?
  - Who and what influence those impacts?

Formative versus summative evaluation

- Formative evaluation focused on decisions about how to modify/change the DL’s functions/services
- Summative evaluation focused decisions about the worth or value of the DL’s functions/services
Stages/steps in the evaluation/research process

1. Develop an evaluation/research plan (Chowdhury & Chowdhury, 2003; Reeves et al., 2003)
   - Clarify the decisions to be addressed and the questions they generate
   - Identify appropriate evaluation methods, including sampling procedures, data collection procedures and data analysis procedures
2. Carry out the evaluation/research plan
3. Report the results to appropriate stakeholders
   - Primarily the decision makers
   - Also other constituencies of the DL

Review of an example evaluation, in terms of these steps

Possible example evaluations:

Evaluation design strategies

Naturalistic studies
- For some evaluation studies, it is critical to conduct them in a natural or naturalistic setting/context
- The constraints of the setting usually imply that fewer experimental controls can be applied to the study design
- Usually, the evaluator will need to take into account aspects of the setting as part of the data collected for the evaluation study

Experiments
- Usually conducted in a lab setting, or a setting in which control over the conditions of the evaluation study can be exerted
- The researcher attempts to control all the potential effects on the results of the study, other than those effects being intentionally manipulated as the focus of the evaluation

Some important concepts in designing an experiment
- Randomization is a key tool for control: random sampling and/or random assignment to treatment and control groups
- Variables: the researcher will manipulate the independent variables (e.g., whether the DL has a particular feature or not) and will evaluate the outcomes based on the dependent variable
The design may be a within-subjects design (where each participant interacts with all the variations of the independent variables, and so comparisons on the dependent variable are made “within” each subject’s performance) or a between-subjects design (where each participant interacts with only one version of the system and comparisons are made “between” groups of subjects).

Avoiding the effects of researcher bias

It’s easy for a researcher’s biases to influence the design of a study and, thus, its outcomes.

- Identify your biases
- Ensure that your study design and procedures will allow you to avoid any influence on the study outcomes

Data collection and measurement methods

Collecting data from people requires ethical treatment of those people as study participants.

- Each institution will require review of the research proposal by an Institutional Review Board that verifies that study participants are being treated ethically

Observation of user behaviors, including transaction logs

- To see what the user is doing as he or she interacts with the system

Observation of work (e.g., via contextual inquiry)

- Special kind of interview
- Observe person while performing task to be supported
- Interrupt with questions about how and why, as needed

Think-aloud protocols

- During DL use, the participant is asked to verbalize their thought processes
- Allows you to observe “unobservable” cognitive behaviors
- Usually videotaped or audiotaped

Indirect observation of work

- Logging and metering techniques embedded in the software of the current system or intermediate versions
Diaries
For detailed descriptions of tasks
How much time they take
Sequential dependencies between tasks

Allows observation over longer periods of time than contextual inquiry interviews

Interviews and focus groups
Augmenting other data collection methods, or on their own
Uses during DL evaluation
For identifying problems in the DL design
For additional features needed in the DL
For other improvements in the DL which the user can suggest
Individual interviews or group interview (focus groups)
Focus groups require a skilled facilitator

Questionnaires
Surveys: typically one item/question per construct
Measures: intended to measure constructs that are not directly observable and not easily measured with a single item
The more subjective the construct, the more likely that you will need a multiple-item measure for it
Find a measure in the literature, rather than developing your own

Print vs. online administration
Print allows people to annotate (can be good or bad)
Online eliminates the need for a separate data entry step

**Study sample: Who should be participants in your evaluation study?**

Define the population of interest
Current users or a subset of them
Potential audiences (who are not current users)

Consider sample size
Usually a tradeoff between small sample (cheaper) and generalizability

Intensive versus extensive studies
Intensive studies: to thoroughly understand a phenomenon within its context

Extensive studies: to understand the extent of a phenomenon within a population

Develop a sampling plan

Random sampling
  Supports statistical inferences to the population
  Identify a population to which you want to generalize your findings
  Enumerate the population
  Draw a random sample
  Problem: enumerating the entire population
    Not necessarily problematic, but often is

Other methods of sampling
  Quota sampling, purposive sampling, accidental/convenience sampling
  Strive for representativeness
    In range, as well as central tendency

Develop a plan for recruiting the sample you want
  May need to offer incentives

Analysis and interpretation of data

Reporting the results and interpreting the results are two distinct steps

Interpretation should address the questions, “What do the results mean? How should they be understood?”

All results must be interpreted in the context of:

Prior empirical work and relevant theoretical frameworks
Situation
  What is happening in the particular situation in which the study was done?
Weaknesses in the research

Measurements: level of reliability; validity
Design: attrition, external events; internal and external threats to validity
Analysis method: assumptions violated

Recommend particular actions, based on the interpretation of the results

10. Resources

Assigned readings for students:


Chapter 1, Why evaluate? (p.1-6)
Chapter 2, Evaluating planning (p.7-21)

Recommended background reading for instructor:


Additional potential readings include:


11. Concept Map (created by students)

12. Exercises / Learning activities

a. Analyze a DL evaluation report

Exercise 13.a, “Analyze a DL evaluation report,” could be adapted to an in-class small-group discussion exercise. If so, the results of the each group’s analysis could be reported orally or could be posted to a class wiki or discussion forum.

If used as an in-class exercise, assign the groups to read a particular evaluation report before class, to prepare for their in-class discussion and report.

Time requirements: 2 hours of preparation outside of class; 25-30 minutes for discussion in class; 20-30 minutes for report presentation in class, depending on the number of groups.
b. **Develop an evaluation plan**

Based on a DL that is familiar to all the students in the class (e.g., flickr, MySpace, a music collection, the university’s OPAC or a special collection that is well-known), have students work in small teams (3-4 people each) to develop a draft evaluation plan. They can play the role of an evaluation consulting firm, designing an evaluation study for their client, the DL managers.

Each plan should include the following:

- The evaluation questions to be addressed
  - Stated briefly, in one sentence (preferably ending with ?)
- The sample to be included
  - How they will be selected
  - How they will be recruited
- The methods for data collection
  - The types of data to be collected, and how each pertains to the evaluation question
  - The procedures for collecting the needed data

Have each team of students present their plan to the class, as if it were an initial presentation to the client (the DL managers).

Time requirements: It is expected that the students will prepare their report after this module has been presented in class. Students should expect to spend 4-5 hours outside of class, preparing their reports. Each report should be presented in 7-10 minutes, during the next class session.

c. **Interview a digital librarian about evaluation**

Note: This exercise is only possible if there are a number of robust local digital library projects, and the students will have access to their directors/administrators.

For this exercise, students should work in pairs; each pair will be assigned to investigate a particular digital library. Prior to the interview, each pair should read the available documentation on the digital library on which they’re focused. Using the following interview guide, they should interview the director/administrator of the digital library.

- Interview guide:
  - When was the digital library first established?
  - What are the primary goals of the DL?
  - In what ways do you evaluate whether you’re achieving those goals?
  - Do you evaluate any other aspects of the DL’s operations? If so, how?
  - How and to whom are the evaluation results reported?
Each pair should write up a brief (1-3 page) summary of their interview findings. In addition, they should be prepared to orally report on the most interesting aspects of those findings at the next class session.

Time requirements, outside of class: 1-2 hours for preparatory reading; 1 hour for conducting the interview; 2-3 hours for writing up the interview report.

Time requirements, in class: 30-40 minutes for the class to discuss the findings from the interviews.

13. Evaluation of learning objective achievement

a. Analyze a digital library evaluation report

Using Saracevic’s (2005) meta-analysis of digital library (DL) evaluations as a framework, evaluate an additional DL evaluation report. The report can be selected from the following:


Analyze the evaluation report in terms of the following aspects:

- **Construct** for evaluation.
  - What was evaluated? What was actually meant by a “digital library”? What elements (components, parts, processes…) were involved in evaluation?

- **Context** of evaluation - selection of a goal, framework, viewpoint or level(s) of evaluation.
  - What was the basic approach or perspective? What was the level of evaluation? What was the objective(s)?

- **Criteria** reflecting performance as related to selected objectives.
  - What parameters of performance were concentrate[d] on? What dimension or characteristic [was] evaluated?

- **Methodology** for doing evaluation.
  - What measures and measuring instruments were used? What samples? What procedures were used for data collection? For data analysis?

- **Findings** from evaluation studies
  - Only a single generalization is provided.” (Saracevic, 2005, p.2-3)

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1 Additional reports can be added to this list or reports can be deleted, at the instructor’s discretion.
Prepare a report (2-5 pages, single-spaced) summarizing the findings of your analysis.

The report should be evaluated in terms of its demonstration that the authors understood the DL evaluation conducted, its coverage of the five aspects of evaluations posed by Saracevic, its identification of strengths and weaknesses in the DL evaluation, and its clarity (organization, grammar, etc.).

Time requirements: approximately 6-8 hours outside of class.

b. Develop an evaluation plan

Class exercise 10.b, “Develop an evaluation plan,” could be adapted as a graded assignment. Each team would be expected to develop their plan over the week after the class’s discussion of evaluation. If class time is available, the final plan can be presented orally; or, if preferred, the evaluation plans could be turned in as an evaluation proposal (2-4 pages).

The evaluation plans would be evaluated in terms of their completeness (were all the major components of an evaluation study addressed?), their feasibility (could the evaluation study actually be conducted, given reasonable resources?), and their clarity.

Time requirements: 6-8 hours outside of class, preparing and writing the evaluation plan.

14. Glossary

Between-subjects design: A research design in which “each research participant receives only one level of the independent variable” (Schmidt, 2000).

Dependent variable: “A variable that may, it is believed, be predicted by or caused by one or more other variables called independent variables.” (U.S. Dept. of Justice, n.d.)

Evaluation: “An appraisal of the performance or functioning of a system, or part thereof, in relation to some objective(s)” Saracevic, 2000, p.359

Formative evaluation: An evaluation that is intended to “strengthen or improve the object being evaluated. Formative evaluations are used to improve [information systems] while they are still under development.” (Trochim, 2001, p.347)

Independent variable: “A variable that may, it is believed, predict or cause fluctuation in an dependent variable.” (U.S. Dept. of Justice, n.d.)

Research design: “A plan of what data to gather, from whom, how and when to collect the data, and how to analyze the data obtained.” (U.S. Dept. of Justice, n.d.)

Sample: “The actual units you select to participate in your study.” (Trochim, 2001, p.351)

Stakeholders: “People who have a vested interest in the success of the project or are involved in the implementation of the project.” (California State University, Monterey Bay, n.d.)
Summative evaluation: An evaluation that “examine[s] the effects or outcomes of [an information system].” (Trochim, 2001, p.352)

Within-subjects design: A research design in which “each research participant provides data for all the levels of the independent variable” (Schmidt, 2000).

References for glossary:

15. Additional Useful links

None

16. Contributors

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