USABILITY EVALUATIONS OF Health Information Technology

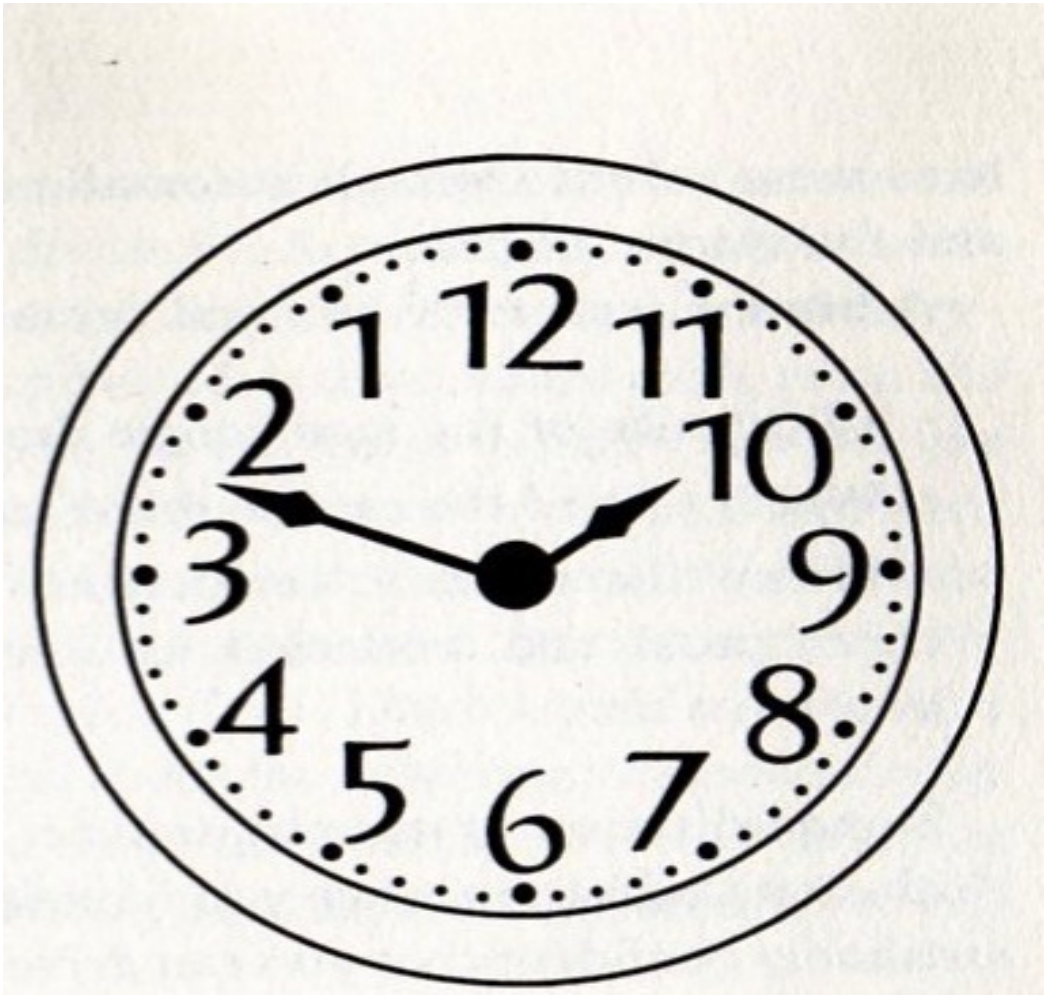
Outline

- Usability, general overview
- Usability evaluation methods
- Human-computer usability heuristics
- Considerations when developing usability evaluations
- Hands on usability evaluation experience → this afternoon
- Summarize usability evaluations tomorrow & plan for next training session

Overall objectives

- Expand knowledge and skills for conducting formal usability evaluations & apply results to continuously improve IT applications at GHS
- Create a network of usability coordinators to provide feedback & expertise on usability evaluations gained from continuous learning & experience associated with software design & implementation

We all have mental models…..



Software usability

- “The extent to which the product can be used by specified users to achieve specified goals .. [including].. effectiveness, efficiency & satisfaction.” (Karat, 1997)
- Also refers to methods for improving ease-of-use through user-centered design

Usability – through the eyes of Jakob Nielsen

- Usability is the degree to which the system is easy to use or “user friendly”
- Nielsen has defined 5 facets of usability:
  - learnability
  - efficiency
  - memorability
  - errors
  - satisfaction

Learnability

A system should be easy to learn so the user can rapidly catch on.

This is more likely if the system:

- is intuitive/logical to end user
- accounts for the end user transferring &/or unlearning skills from previous experience

How measure learnability?

- Amount of time it takes to achieve proficiency on system use
- Complexity of navigating through software (captured through mapping)
- User feedback
- Other

Efficiency of use

The system should be efficient to use, so once the user has learned the system, a high level of productivity is possible.

New system's efficiency should also motivate user to want to use it

Efficiency of use

Efficiency has been shown to be the most significant measure of physician satisfaction with CPOE – response time & ease of use (Bates group, VA groups, Patel group)

How measure efficiency of use?

- Amount of time for users to perform typical task(s)
- Number of keystrokes to accomplish a task

** Keep in mind levels of users: “super-users” through casual, less frequent users

Memorability

A system should be easy to remember so even the intermittent or casual user is able to return to the system after some period of not having used it, without having to learn everything all over again.

- logical
- some degree of repetitiveness
- consider what else users interact with

How measure memorability?

- Recall of casual users who haven't used/observed much
- Memory test with users after intro session
- Others

Errors

A system should have a low error rate, so users make few errors during the use of the system, and, if they do make errors, they can easily recover from them.

CATASTROPHIC ERRORS MUST NOT OCCUR!

If an error does occur…..

- What is the effect? (What risk/consequence? How great/severe?)
- Can the system recover? (How long? What's entailed?)

Satisfaction

A system should be pleasant to use, so users are subjectively satisfied with using it; they like it.

Getting at issues of "look & feel"

How measure satisfaction?

Most commonly measured by capturing user opinion – through:

- focus groups
- interviews
- questionnaires

Why conduct usability evaluations?

- Ensure user-centered design
- Increase user satisfaction
- Increase user productivity
- Decrease costs of redesign later, after system is implemented
- Others

When conduct usability evaluations?

- Prior to “system” procurement
- During in-house software design
- When developing training programs, policies & procedures
- In conjunction with FMEA, RCA, or other type of error analysis
- When designing work environments
- To replicate manufacturer’s testing
- Others

Common usability evaluation methods

- Heuristic evaluation – using common heuristic criteria
- Simulation, role playing – generally in a “lab”
- Field study/observation – actual use
- Rapid reflection – evaluators convene &, thru group process, develop consensus of reactions

Heuristic evaluation…

….. an inspection method requiring 3 to 5 evaluators,
who apply widely-recognized heuristics,
that provide an overview and
identify system difficulties.

Finish with assessment of the risk, severity, and priority of each “violation”.

Heuristics evaluations -- common scoring definitions… RISK

Potential risk for patient care

- none
- low = moderate event (rare instances of increased length of stay or level of care)
- medium = major event (permanent loss of bodily functioning – sensory, motor, physiologic, intellectual)
- high = catastrophic event; death or permanent loss of function (transfusion reaction, wrong-side surgery)

Heuristics evaluations -- common scoring definitions… SEVERITY

Severity of problems to users

- low = user delayed/annoyed
- medium = user accomplishes task with difficulty; frustrated
- high = user unable to accomplish task

Heuristics evaluations -- common scoring definitions… PRIORITY

Priority for redesign

- low = problem should be fixed when resources are available
- medium = problem should be fixed
- high = problem must be fixed

Fourteen human-computer usability heuristics ("Nielsen-Schneiderman Heuristics") per Zhang, et al 2003

1. Consistency – users should not have to wonder whether different words, situations, or actions mean the same thing. Standards & conventions should be followed.

Nielsen-Schneiderman Heuristics, cont'd.

2. Visibility – users should be informed about what's going on with the systems through appropriate feedback & display of information.

Nielsen-Schneiderman Heuristics, cont'd.

3. Match – the image of the system perceived by the users should match the model the users have about the system.

Nielsen-Schneiderman Heuristics, cont'd.

4. Minimalist – any extraneous information is a distraction & slow-down.

Nielsen-Schneiderman Heuristics, cont'd.

5. Memory – users should not have to be required to memorize a lot of information to carry out tasks.

Nielsen-Schneiderman Heuristics, cont'd.

6. Feedback – users should be given prompt & informative feedback.

Nielsen-Schneiderman Heuristics, cont'd.

7. Flexibility – users always learn & users are different. Give users the flexibility to create customization & shortcuts to accelerate their performance.

Nielsen-Schneiderman Heuristics, cont'd.

8. Message – the messages should be informative enough such that users can understand the nature of errors, learn from errors & recover from them.

Nielsen-Schneiderman Heuristics, cont'd.

9. Error – it is always better to design interfaces that prevent errors from happening in the first place.

Nielsen-Schneiderman Heuristics, cont'd.

10. Closure – every task has a beginning and an end. Users should be clearly notified about the completion of a task.

Nielsen-Schneiderman Heuristics, cont'd.

11. Undo – users should be allowed to recover from errors. Reversible actions also encourage exploratory learning.

Nielsen-Schneiderman Heuristics, cont'd.

12. Language – the language utilized should always be presented in a form understandable by the intended users.

Nielsen-Schneiderman Heuristics, cont'd.

13. Control – do not give users that impression that they are controlled by the systems.

Nielsen-Schneiderman Heuristics, cont'd.

14. Document – always provide help when needed.

Heuristic evaluation

Issues:

- need to identify evaluators who understand heuristics
- are all or only certain heuristics to be applied?
- clearly define risk, severity & priority scores

Heuristic evaluation, cont'd.

Pros:

- low cost
- efficient
- not difficult to implement

Cons:

- resources necessary
- take caution to not oversimplify

Simulation

…. a means of evaluating user interaction with a product/system/etc. in other than the actual setting &/or work place

Simulation

Issues:

- clearly identify objective – direct impact on design of simulation
- identify whom to evaluate – type of provider and/or level of user; recruitment or assign role playing?
- generally need to develop vignettes/scenarios
- data collection important – video? audio? notes?
- who act as evaluator(s)?
- need to pilot test prior to beginning

Simulation, cont'd.

Pros:

- provides thorough evaluation opportunity (get-to-the-point evaluation)
- because of repetition, provides objective means of assessment
- in some instances can also provide JIT training

Cons:

- time- & resource-intense for design
- if use think-aloud technique it's far from perfect

Field study/direct observation

…. means of evaluating user interaction with and use of “system” in their work environment while performing the task of interest

Field study/direct observation

Issues:

- clearly define objective – drives data collection & analysis
- ability to observe what most interested in
- find observers willing/interested in watching people perform their work
- find users willing to allow being observed
- Hawthorne effect ?
- how/who collect what observing – audio? video? notes?

Field study/direct observation, cont'd.

Pros:

- REAL use of system being observed
- no need to design scenarios, role-playing, etc.

Cons:

- may prove time-consuming (depends on what want to observe)
- data collection challenging

Rapid reflection

…. a means of capturing evaluators' observations & "gut reactions" of system use

Rapid reflection

Issues:

- no structure to data collection
- dependent on recall
- “group think” when evaluators convene?
- Hawthorne effect on users

So …. what method is “best”?

Consider objectives, constraints, circumstances of method and project

“Triangulation” (combination) of methods is becoming more common – frequently mixing more quantitative methods with qualitative methods

Results from one study….

(Kjeldskov, et al 2005)

Distribution of usability problems by degree

	Critical	Serious	Cosmetic
Field (direct obsevation)	■■■■□	■■■■■■□□■□□	□□□■■□
Lab (simulation)	■■■■□	■■■■■□□■□□□	■■■□□□
Heuristics (criteria-based)	■■■□■	■■■□□■■□□■□	■■■□□□
Rapid reflection (recall)	■■■■□	■□□■□□■■□□■	■■□■□■

Reference: Kjeldskov, J., Graham, C., Pedell, F., Howard, S., Balbo, S. & Davies, J. (2005). Evaluating the usability of a mobile guide: the influence of location, participations and resources. *Behaviour & Information Technology, 24* (1), 51-65.

Who to involve as users in usability evaluation (Laxmisan, Malhotra, Keselman, Johnson, Patel, 2005)

Sharp-end practitioners – focus on clinical & human aspects

- providers (considerations: type, previous dis/similar experience, level of use → rare, frequent, super users)

Blunt-end practitioners – focus on device/system, documentation & training

- engineers
- administrators

Who to involve as evaluators in usability evaluation

- Individuals with understanding of usability evaluation techniques
- Individuals who can communicate both ways and serve as interface between users and designers (i.e., analysts)

Measures / Usability benchmark

- Standard against which the testing is being analyzed
- Provides a threshold for objective evaluation

Collect measures of….

…performance

- amount of time
- number of key presses
- measurements
- errors post-task
- need for assistance
- comments
- subjective rating/ preference

…process

- mapping use
- reference to manual
- comments
- mode error
- device alarms
- screen displays
- subjective rating/ preference

Collect measures of…

... but what do you already have??

- system data
- incident reports
- other retrospective performance data
- performance data from manufacturer

User feedback methods

- Video
- Audio – “think aloud”
- Focus group
- Questionnaire
- Interview
- Measures …….

Capturing user satisfaction or perceptions

Issues:

- design of data collection instrument important – must understand issue being conveyed, unbiased instrument
- information collected may be difficult to "prove"
- synthesizing & summarizing data best if it entails both qualitative & quantitative information

User/evaluator feedback

Pros:

- generally easy to capture (once users willing to provide)

Cons:

- can be difficult to summarize
- depends on recall and perceptions

Quick review

- Determine objective(s)
- Determine method(s) & design/include necessary “materials”; this generally drives the setting
- Select whom to involve as users; recruit
- Select whom to involve as evaluators
- Identify what to collect & how to collect it
- Determine means of analyzing data
- Identify time constraints/timeline

CAUTION!!

Don’t try to address everyone’s issues – stick to those of importance

Keep design clear and simple

Questions??

Usability evaluations to be conducted this afternoon

Conduct usability evaluation of eMAR using Nielsen-Schneiderman criteria

{eMAR presentation excerpts as example}

eMAR Usability Evaluation

- One person (“mock end user”) will navigate through the system under direction of….
- …other person (“usability coordinator”) who will give instructions, provide direction on what “user” should do and record issues identified.
- Jointly, the two will identify system design issues, assign evaluation heuristics, and risk, severity & priority scores.
- Findings will be shared Friday morning in feedback session.

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