Improving the Usability of a Kiosk for Elderly Users to Aid in Medication Reconciliation

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USABILITY

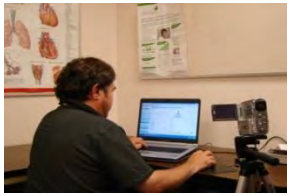
Usability – measure of “ease of use” of a system in terms of (Preece et al., 1993):

1. Learning
2. Effectiveness
3. Efficiency
4. Enjoyability
5. Safety

- Usability Engineering - scientific approaches to designing and testing usable systems

Low-cost Rapid Usability Engineering

- Usability engineering does not require an expensive fixed usability laboratory
  - Observe *representative users* doing *representative tasks* with system under study in *representative environments*
  - "Think Aloud" Protocols
  - Video Recording



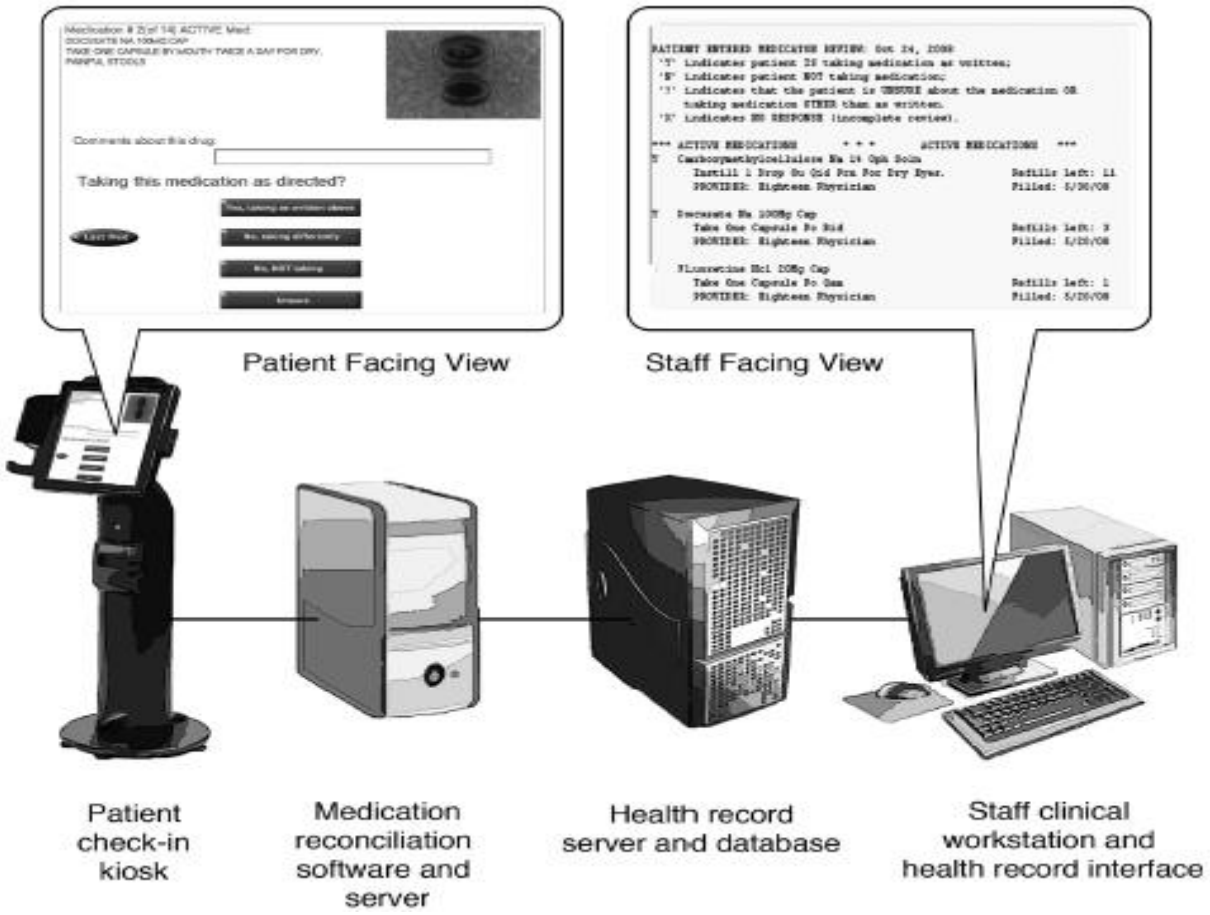
- Can be used to predict and rectify errors and user problems
- Highest level of fidelity and can be taken into real clinical settings

Applying Usability Engineering to Improve the Usability of Medication Reconciliation

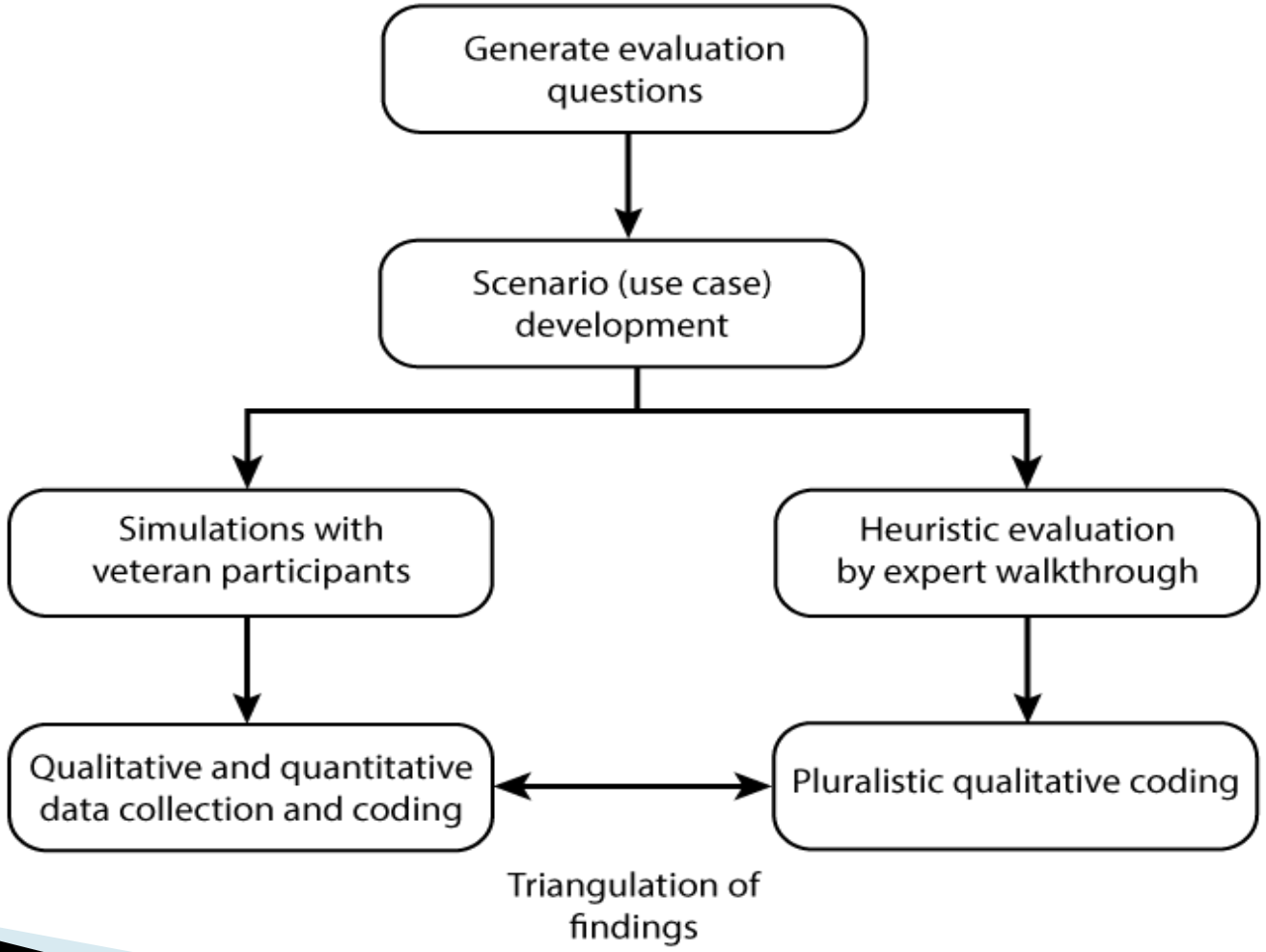
- A process in which providers work with patients and other providers to ensure accurate **medication information** is **communicated across transitions** of care
  - Admission, transfer, discharge
  - Intended to prevent harm from ineffective communication of medication information
- The patient should be an important part of this (Kushniruk, Borycki, Monkman, 2013)

Background – Portland VA approach

- Automated patient history intake device (APHID) was developed at the NorthWest VA Innovation Center
- Allows patients to enter information about their medication using a Kiosk in the waiting room – automatically generates report for patient record and provider


Taking this medication as directed?
Patient Facing View
Staff Facing View
Patient check-in kiosk
Medication reconciliation software and server
Health record server and database
Staff clinical workstation and health record interface

Evaluation Approach



Method

- **Phase 1** – Generation of evaluation questions
  - Can elderly patients understand the information displayed?
  - Can they identify discrepancies in their medications?
  - Can they learn how to enter new medication information
  - Are they satisfied with the interface?

- **Phase 2 – Scenario/Use Case development**
  - 15 use cases were developed for: (a) review medication information, (b) identify medication discrepancies, and (c) enter new medications
  - For each use case, a single corresponding simulation was written

Use case: Enter medication discrepancies

Description: A patient has medications on file in the local electronic health record. The patient completes a medication review session and must indicate information changes. The patient adjudicates perceived errors in the prescription list using the touch-screen controls and the comments input capability.

System state:
- active local prescription for lisinopril
- active over-the-counter record for vitamin D
- expired prescription for albuterol

Goals:
- Determine to what extent participant understands on-screen information.
- Verify the participant can designate a descrepancy in the prescription.
- Assess how easy a participant can add information about a new medication.

Conditions and inputs:
- Patient is on time for appointment.
- Patient is taking lisinopril and requests a refill.
- Patient is taking vitamin D according to a different schedule.
- Patient is not taking albuterol and indicates it causes tremors.

Figure 2. Example use-case.

Phase 3 – Heuristic Evaluation

- For each task, subject matter experts on the team completed a heuristic evaluation using Nielsen's ten heuristics

  - Visibility of System Status
  - Match the System to the Real World
  - User Control and Freedom
  - Consistency and Standards
  - Error Prevention
  - Minimize Memory Load – Support Recognition rather than Recall
  - Flexibility and Efficiency of Use
  - Aesthetic and Minimalist Design
  - Help Users Recognize, Diagnose and Recover from Error
  - Provide Help and Documentation

- **Phase 4 – Clinical Simulations**
  - 17 veterans – average age of 68
  - Participants were observed while carrying out 15 use cases with the system
  - The study team recorded interface performance on an instrument that included
    - task goals
    - anticipated workflow
    - recording of sample interface screens

- **Phase 5 – Data analysis and coding**
  - For each task (identified in Phase 2), the team noted in a summary table:
    - heuristic violations
    - interface design problems identified from clinical simulations
    - A consolidated list of user problems (prioritized by frequency)

- **Phase 6 – Triangulation of findings**
  - The team determined the degree of correspondence between the problems identified through heuristic evaluation and the problems identified from simulations with users

Method	Requirement	Screen	Finding/Heuristic Violation
Simulation	Patient should be able to enter a comment about each prescription	"Current medication review"	Participants did not notice or identify the "Add comment" button
Simulation/ heuristic inspection	Patients can select a comment using pre-filled response buttons	"Add comment"	Participants did not know if selections were confirmed or saved; consistency of design violation
Heuristic inspection	Saved input should match pre-filled response buttons	"Add comment"	Pre-filled response buttons inserted string fragments; mental model violation
Simulation	Patients should be able to enter a free text comment	"Add other comment"	Participants did not notice or identify "Other" option
Heuristic inspection	Patients should be able see and verify their input	"Add other comment"	Cannot determine what content is saved with multiple entries; visibility of status violation
Simulation/ heuristic inspection	Patients should be able to enter a free text comment	"Keyboard and entry dialog"	Participants did not understand instructions; participants struggled with format and entry; consistency of design violation
Heuristic inspection	Patients should be able to see when entries are large	"Keyboard and entry dialog	Limited ability to view and scroll through large text blocks; mental model violation
Simulation/ heuristic inspection	Patients should be prompted to report any over-the-counter agents	"Additional products prompt"	Participants thought the instructions were difficult to understand; help documentation violation
Simulation/ heuristic inspection	Patients should enter and save each product name one at a time	"Additional products entry"	Participants typed multiple responses in one entry; participants could not recall prior entries; mental model violation
Heuristic inspection	Patients should be able to see that new items have been saved	"Additional products entry"	Information did not clearly indicate information was saved; visibility of status violation
Simulation/ heuristic inspection	Patients should be able to modify entries with frequency and instructions	"Frequency and direction"	Participants did not understand how to complete task; error prevention and recovery violation
Simulation/ heuristic violation	Patients should be able to confirm or correct entries	"Summary and confirmation screen"	Participants did not recognize the entries could be edited individually; mental model violation
Heuristic inspection	Contents should be consistently rendered on screen	"Summary and confirmation screen"	Order of items shifted unpredictably when editing contents
Simulation	Patients should be furnished with controls to correct entries	"Additional products edit"	Participants did understand goals of interface or how to update frequency/instructions
Simulation	Patients should be able to close a session at any point and receive confirmation	"Exit program feature"	Participants did not always notice or identify the "Exit" button and feared losing data

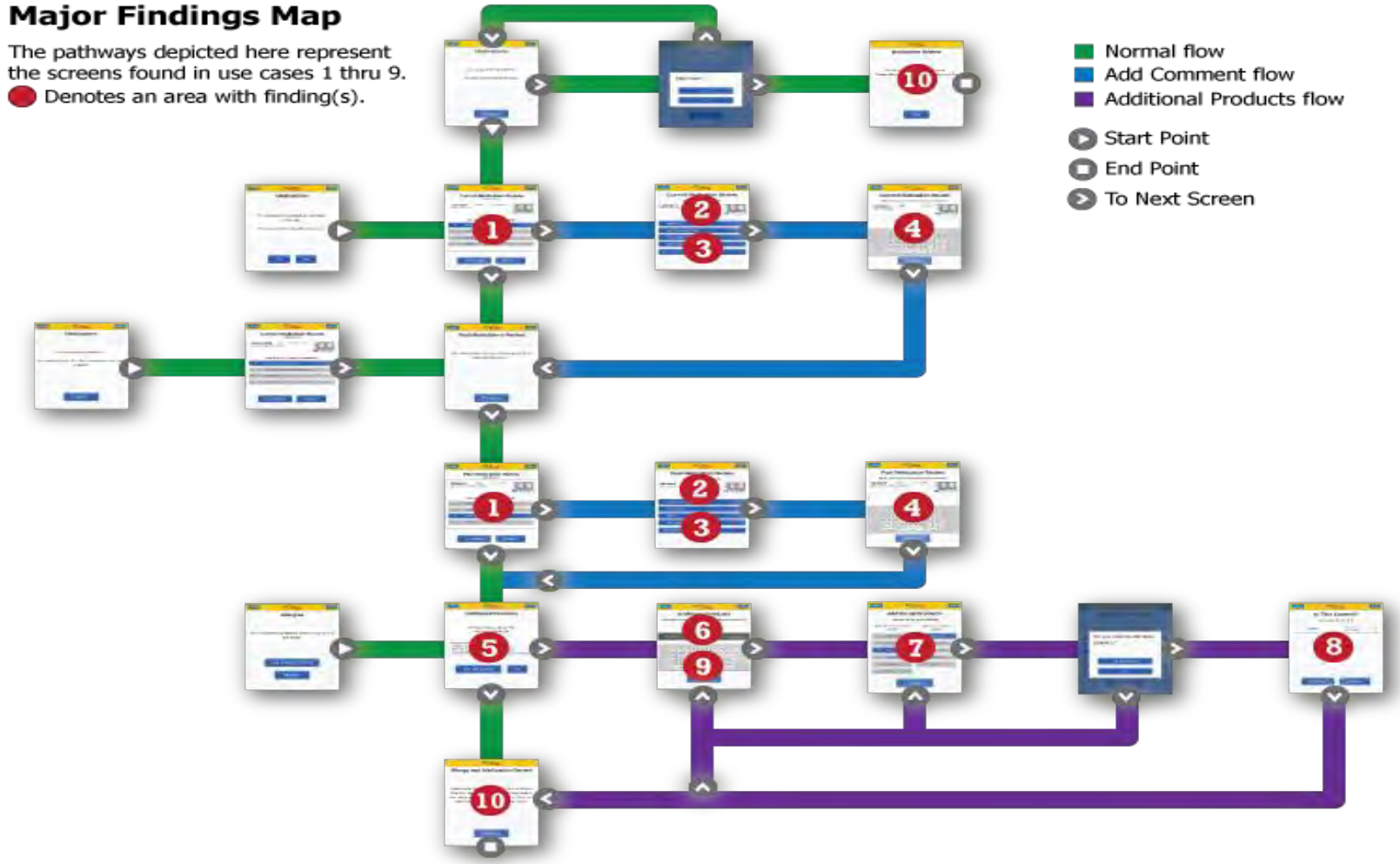


Figure 2. Major findings map showing where usability issues were identified in screen sequences in carrying out tasks