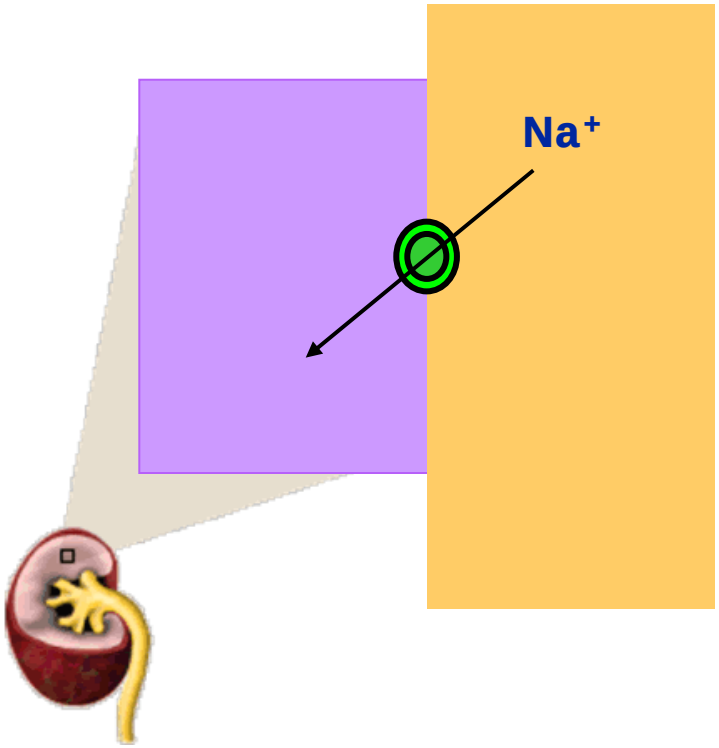
Usability evaluation of a multimedia e-learning resource for electrolyte and acid-base disorders



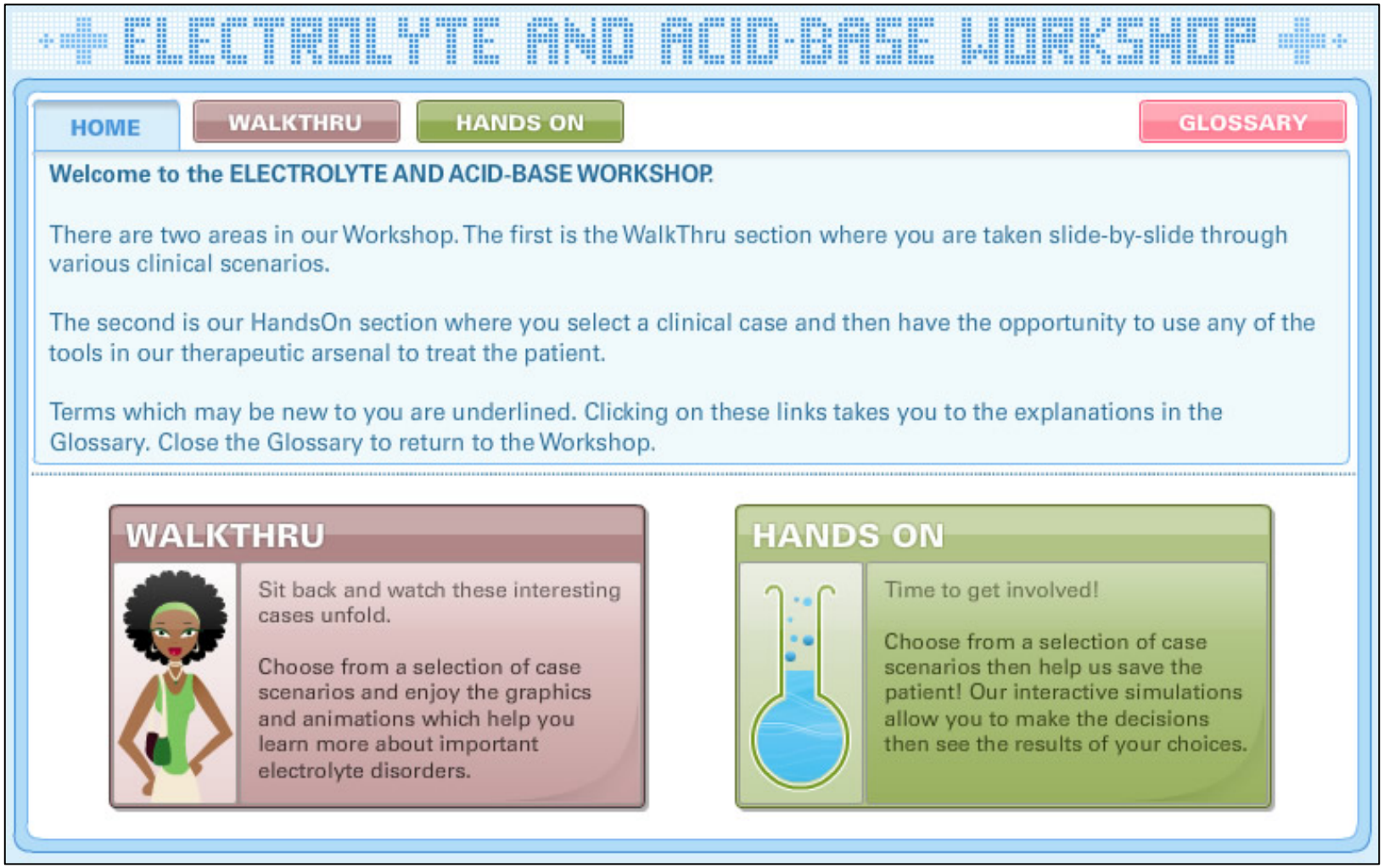
Razeen Davids
Division of Nephrology

Usuf Chikte
Department of Interdisciplinary Sciences

Mitchell Halperin
University of Toronto

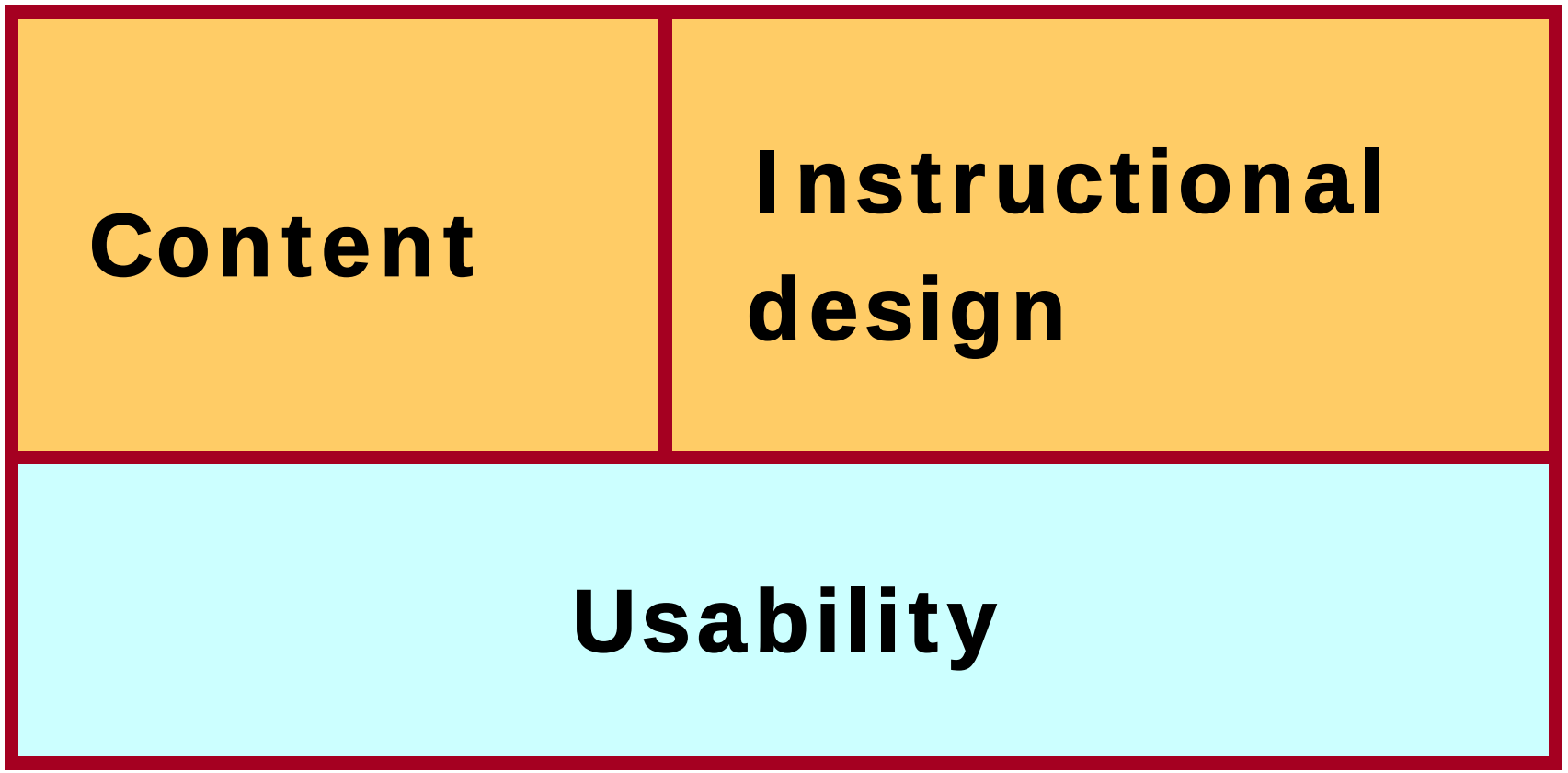
Supported by FINLO

Turning students into experts



www.learnphysiology.org/sim1

Maximising educational impact



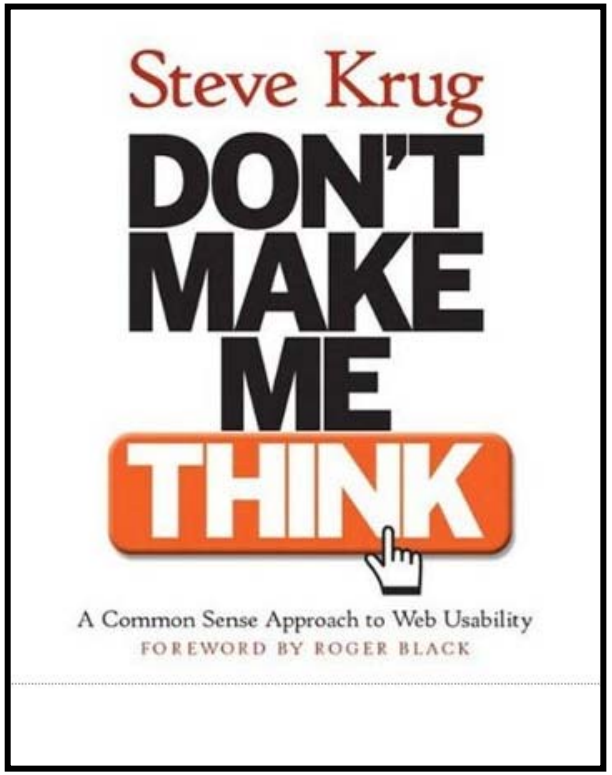
Usability

“Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction...”

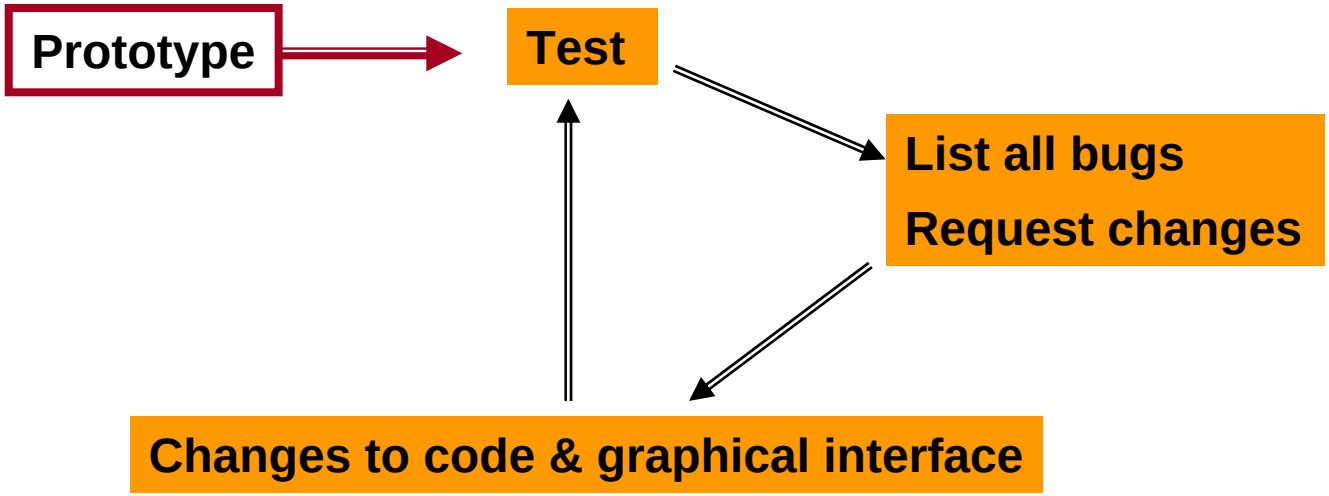
ISO 9241-11

Usability

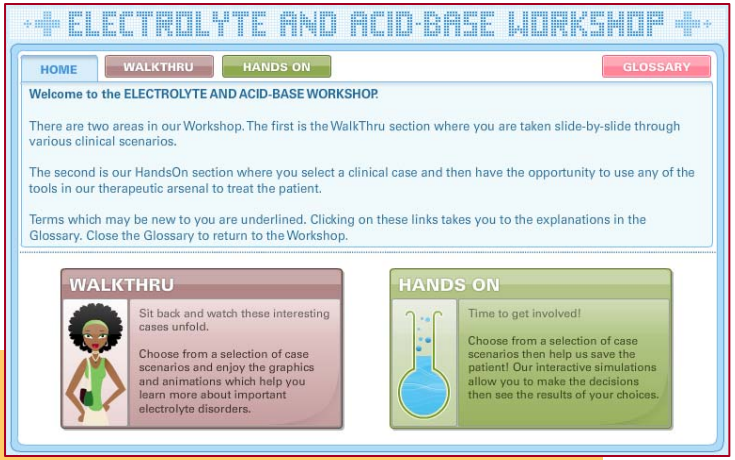
...so intuitive and self-evident that even inexperienced users can accomplish their tasks successfully



Iterative development



Methods



1. User testing

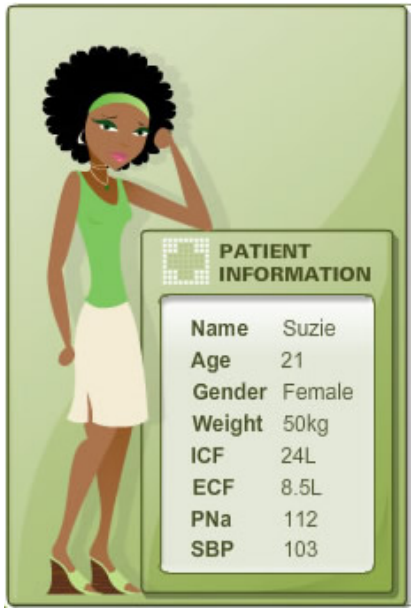
2. Usability inspection

1. User testing

Registrars and specialists

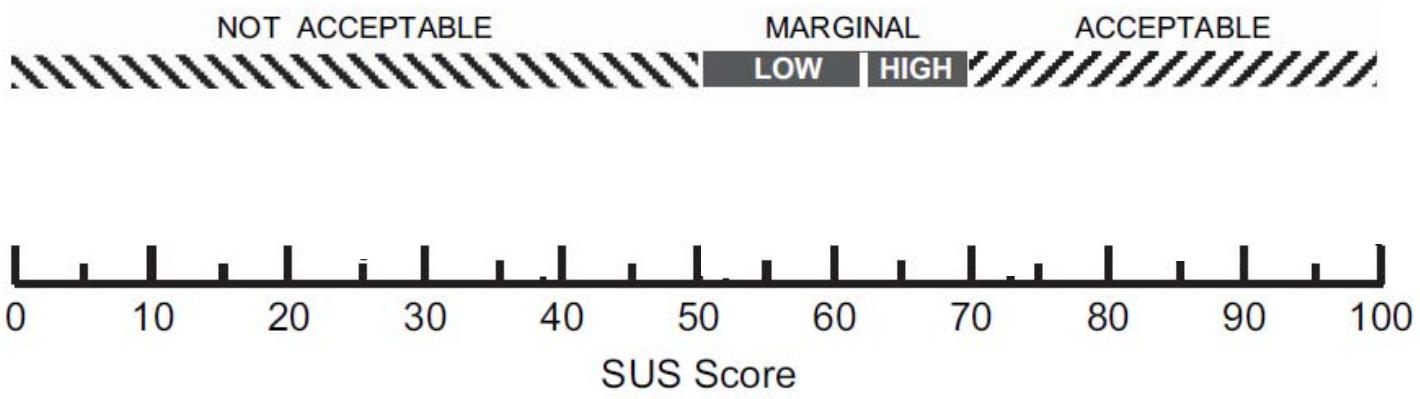
Data collection

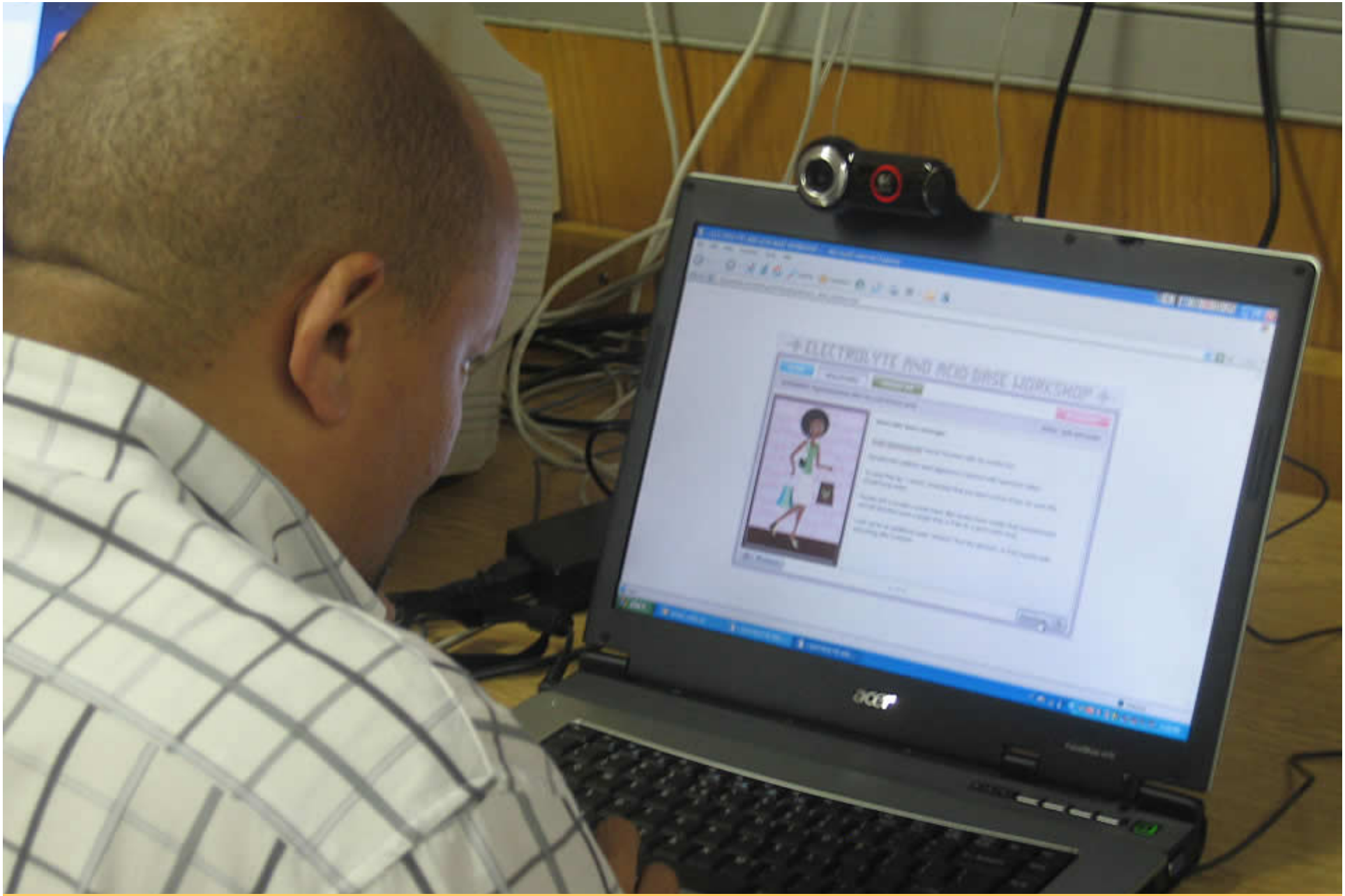
- **by questionnaire**
- **by observing users**



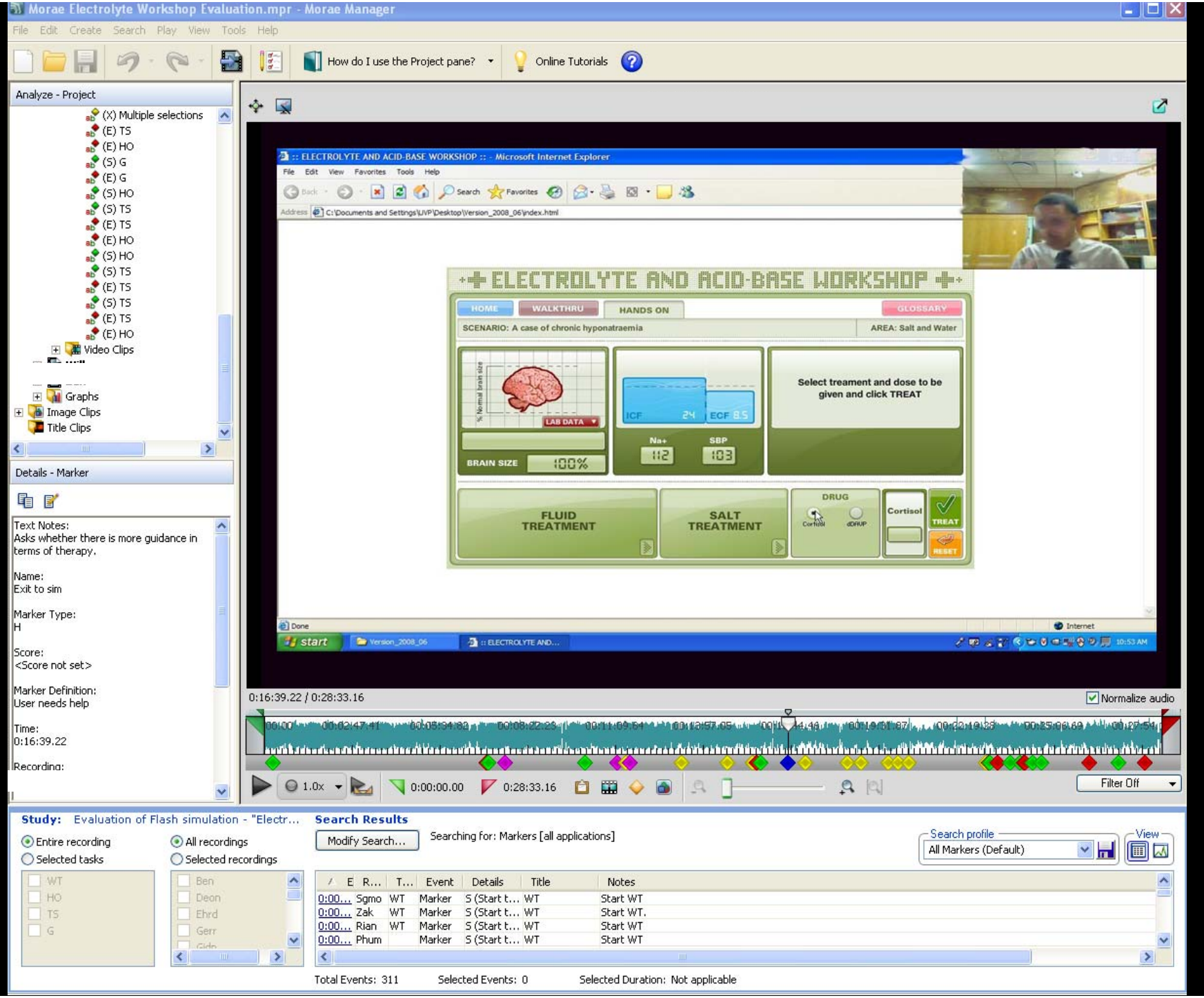
Brooke's System Usability Scale

		strongly disagree		neutral		strongly agree
1	I would like to use this application often if more cases are added	1	2	3	4	5
2	I found the application complex	1	2	3	4	5
3	I thought the application was easy to use	1	2	3	4	5
4	I need the support of an expert to be able to use this application	1	2	3	4	5
5	I found the various parts of the application well integrated	1	2	3	4	5
6	I thought there was too much inconsistency in the application	1	2	3	4	5
7	I would imagine that most of my colleagues would learn to use this application very quickly	1	2	3	4	5
8	I found the application cumbersome/clumsy to use	1	2	3	4	5
9	I felt very confident using the application	1	2	3	4	5
10	I'll need to learn a lot of things before I could use this application	1	2	3	4	5
		strongly disagree		neutral		strongly agree


NOT ACCEPTABLE
MARGINAL
ACCEPTABLE
LOW
HIGH
0
10
20
30
40
50
60
70
80
90
100
SUS Score



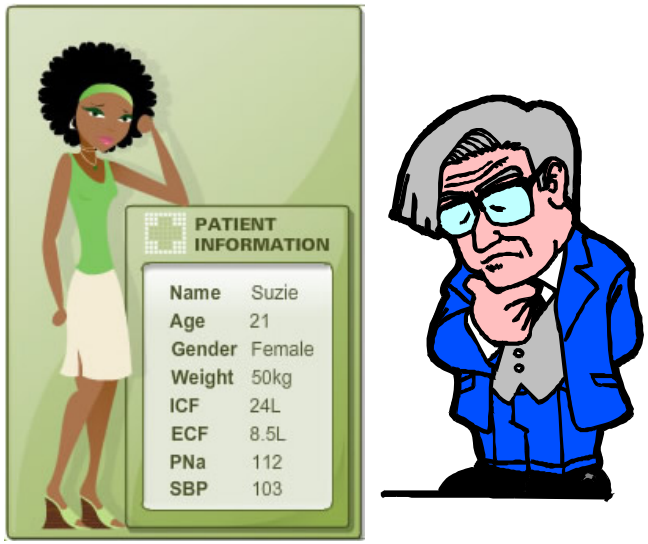
Morae® - www.techsmith.com


Morae Electrolyte Workshop Evaluation.mpr - Morae Manager
File Edit Create Search Play View Tools Help
How do I use the Project pane?
Online Tutorials
Analyze - Project
(X) Multiple selections
(E) TS
(E) HO
(S) G
(E) G
(S) HO
(S) TS
(E) TS
(E) HO
(S) HO
(S) TS
(E) TS
(S) TS
(E) TS
(E) HO
Video Clips
Graphs
Image Clips
Title Clips
Details - Marker
Text Notes:
Asks whether there is more guidance in terms of therapy.
Name:
Exit to sim
Marker Type:
H
Score:
<Score not set>
Marker Definition:
User needs help
Time:
0:16:39.22
Recording:
:: ELECTROLYTE AND ACID-BASE WORKSHOP :: - Microsoft Internet Explorer
ELECTROLYTE AND ACID-BASE WORKSHOP
HOME
WALKTHRU
HANDS ON
GLOSSARY
SCENARIO: A case of chronic hyponatraemia
AREA: Salt and Water
LAB DATA
BRAIN SIZE
100%
ICF
24
ECF 8.5
Na+
112
SBP
103
Select treament and dose to be given and click TREAT
FLUID TREATMENT
SALT TREATMENT
DRUG
Cortisol
TREAT
RESET
0:16:39.22 / 0:28:33.16
Normalize audio
1.0x
0:00:00.00
0:28:33.16
Filter Off
Study: Evaluation of Flash simulation - "Electr...
Search Results
Entire recording
Selected tasks
All recordings
Selected recordings
Modify Search...
Searching for: Markers [all applications]
Search profile
All Markers (Default)
View
WT
HO
TS
G
Ben
Deon
Ehrd
Gerr
E R... T... Event Details Title Notes
0:00... Sgmo WT Marker S (Start t... WT Start WT
0:00... Zak WT Marker S (Start t... WT Start WT.
0:00... Rian WT Marker S (Start t... WT Start WT
0:00... Phum Marker S (Start t... WT Start WT
Total Events: 311
Selected Events: 0
Selected Duration: Not applicable

2. Usability inspection

Heuristic evaluation

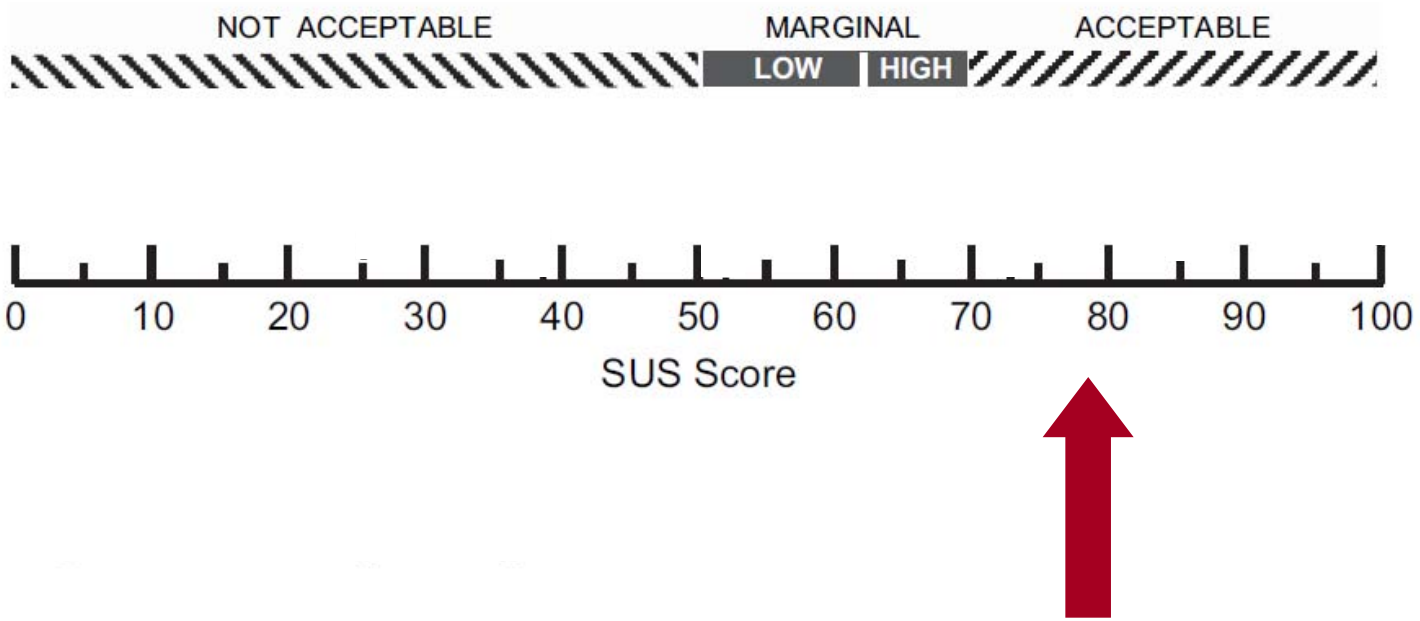
- **panel of experts**
- **usability principles**



No.	Heuristic	Descriptors
1	Suitability for the user's task and skill level	The user is enabled to focus on the task rather than the technology.
2	Visibility of system status; feedback	Keep users informed through timely appropriate feedback. They always know where they are, which actions can be taken and how they can be performed.
3	Match with the real world – language, conventions	Speak the users' language, use familiar terms and concepts; follow real-world conventions.
4	Consistency and conformity to standards	Words, situations and actions mean the same thing; application uses commonly accepted conventions and conforms to user expectations.
5	Intuitive visual layout	
6	Minimize memory load; recognition rather than recall	Objects, actions and options accessed easily. The user should not have to remember information from one part of the application to another.
7	Aesthetic and minimalist design	No irrelevant information as it competes with relevant information and diminishes their relative visibility. Animation and transitions should be used sparingly.
8	Help and documentation	It is better if the system can be used without documentation. If required it should be concise, easy to search and task-centered.
9	User control and freedom	The user can control the direction and pace of the application. Clearly marked exits if they take wrong options by mistake. Support undo and redo.
10	Flexibility and efficiency of use	Users can modify the application to suit their individual capabilities and needs e.g. use shortcuts.
11	Error prevention and tolerance	Careful design to prevent errors occurring. Despite user errors, the intended result may still be achieved by error correction or good error management.
12	Help users recognize, diagnose and recover from errors	Error messages should be in plain language (no codes or jargon) and suggest a solution.

Nielsen, ISO 9241

Results of user testing: Questionnaire data (n=16)



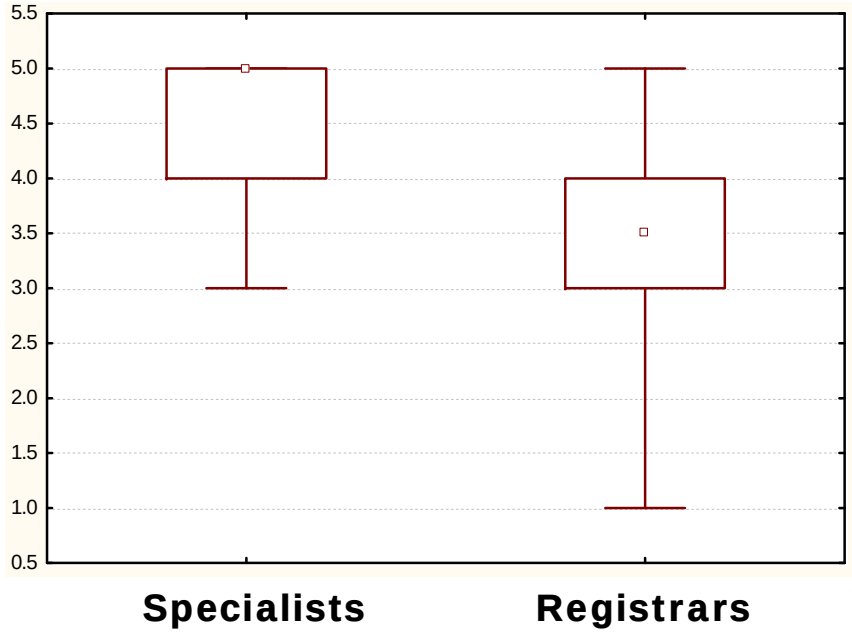
SUS score

78.4 ± 13.8

Questionnaire data (n=16)

Scientifically sound (15)
Liked teaching approach (14)
Application held their interest (14)
Increased understanding (14)
Would recommend to others (15)

Confidence in using the program



(p=0.037)

Representative comments:

Relevant character with real-life problem.

Extremely well designed… funky layout & illustrations.

… easy to use and understand.

User friendly. Colourful, fun.

Simple uncluttered presentation.

Logical integration of physiologic principles.

Very practical and allows a realistic experience…

Representative comments:

Treatment console – not enough options, difficult to understand.

Navigation difficult – can't go back from treatment console.

Did not know what a "radio button" was.

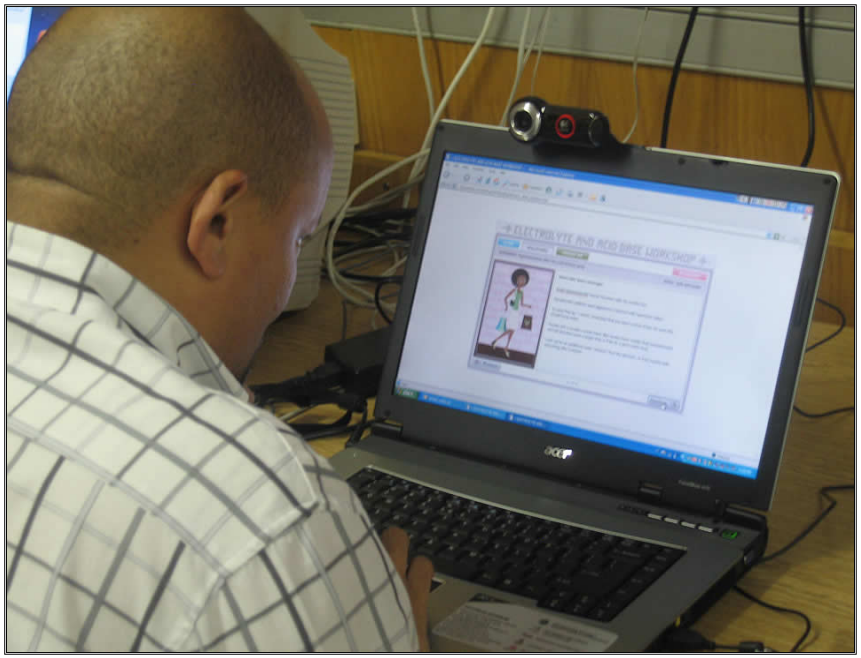
Cannot click directly onto scroll bar.

A bit stressful!

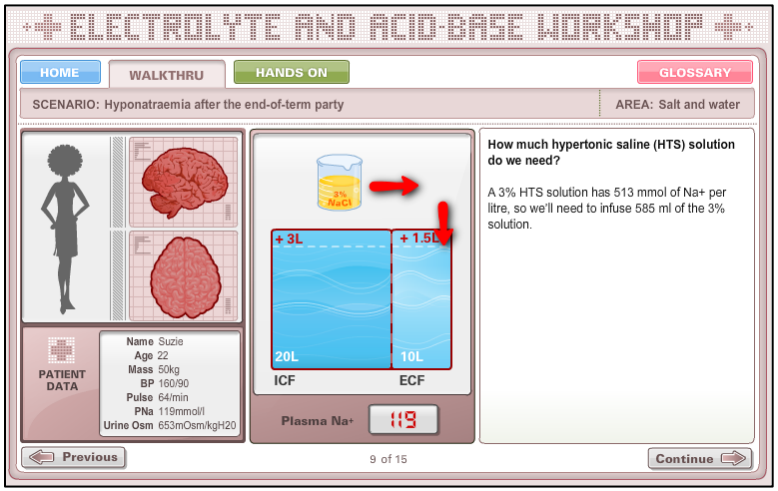
Summary of serious errors

	Survey
Feedback & error messages	
Navigation difficulties	

Results of user testing: Morae data (n=15)



WalkThru:



Task completion 100%

4 errors

- **information/feedback**
- **navigation**
- **case accuracy**

HandsOn:

Task completion only 3/15 (20%)

Multiple (26) usability errors identified

Summary of serious errors

	Survey	Morae
Feedback & error messages	■	■
Navigation difficulties	■	
Hidden lab data panel		■
Multiple treatment selection		■
Slider control – zero doses		■

Results 2:
Heuristic evaluation

WT: **Font sizes too small**

Eliminate words & animation

Allow user to replay animation

Results 2:
Heuristic evaluation

HO: **Lab Data panel**
Navigation
Multiple treatment selection
Feedback & error messages
Need new character for HO case
All users need summary at end

Summary of serious errors

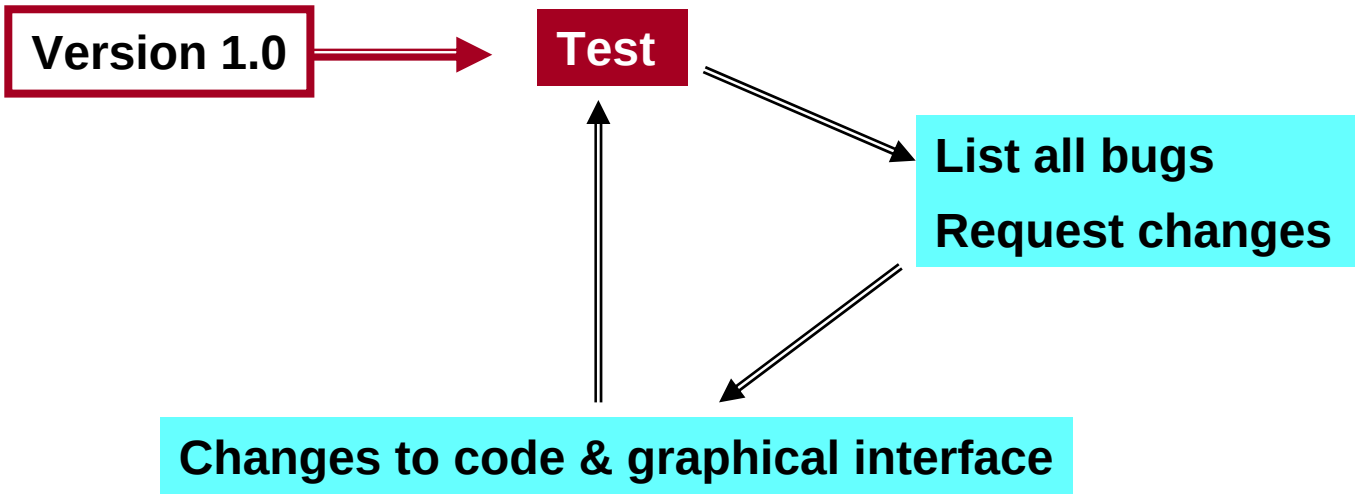
	Survey	Morae	HE
Feedback & error messages	■	■	■
Navigation difficulties	■		■
Hidden lab data panel	■	■	■
Multiple treatment selection		■	■
Slider control – zero doses		■	
Text font size too small			■

Conclusions

Overall response positive as judged by questionnaire and heuristic evaluation

Evaluation uncovered serious usability issues

Different methods detect different problems


Version 1.0
Test
List all bugs
Request changes
Changes to code & graphical interface

Electrolyte Workshop v2.0

www.learnphysiology.org/sim2

ELECTROLYTE AND ACID-BASE WORKSHOP

HOME | WALKTHRU | HANDS ON | GLOSSARY

Area: Salt and Water

PATIENT DATA

CLINICAL	
Mass	60 kg
BP	85 / 55 mmHg
PLASMA	
Na	112 mmol/l
K	4.9 mmol/l
Urea	11 mmol/l
Cr	131 umol/l
Hb	16 g/dl
Albumin	47 g/l
URINE	
Na	62 mmol/l
K	12 mmol/l
Cl	70 mmol/l
Osm	595 mOsm/kg

Your mission 2:

How will you re-expand Chantelle's severely contracted ECF volume? Think about your fluid prescription in terms of tonicity and volume required. What dangers should you anticipate and how can they be prevented?

It's time to practice your skills with our treatment simulation. Take time to appreciate the effect of each treatment on fluid compartment volumes, PNa and brain cell size. Try to find the safest and most effective approach to treatment in the crucial first 24 hours.

Good luck!

ELECTROLYTE AND ACID-BASE WORKSHOP

HOME | WALKTHRU | HANDS ON | GLOSSARY

Suzie has hyponatraemia after the end-of-term party

Area: Salt and water

PATIENT DATA

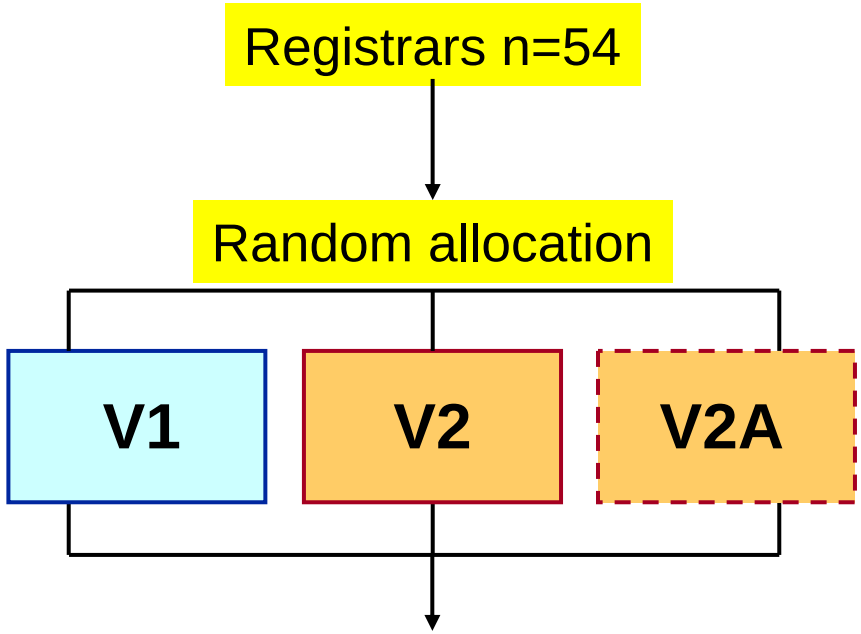
Mass	60kg
BP	160/90mmHg
Pulse	64/min
PNa	119mmol/l
Urine Osm	653mOsm/kg

Suzie has acute hyponatraemia

AUDIO:

Continue

Effect of optimizing usability of a multimedia learning resource: a randomized controlled trial



Exposure

Data collection

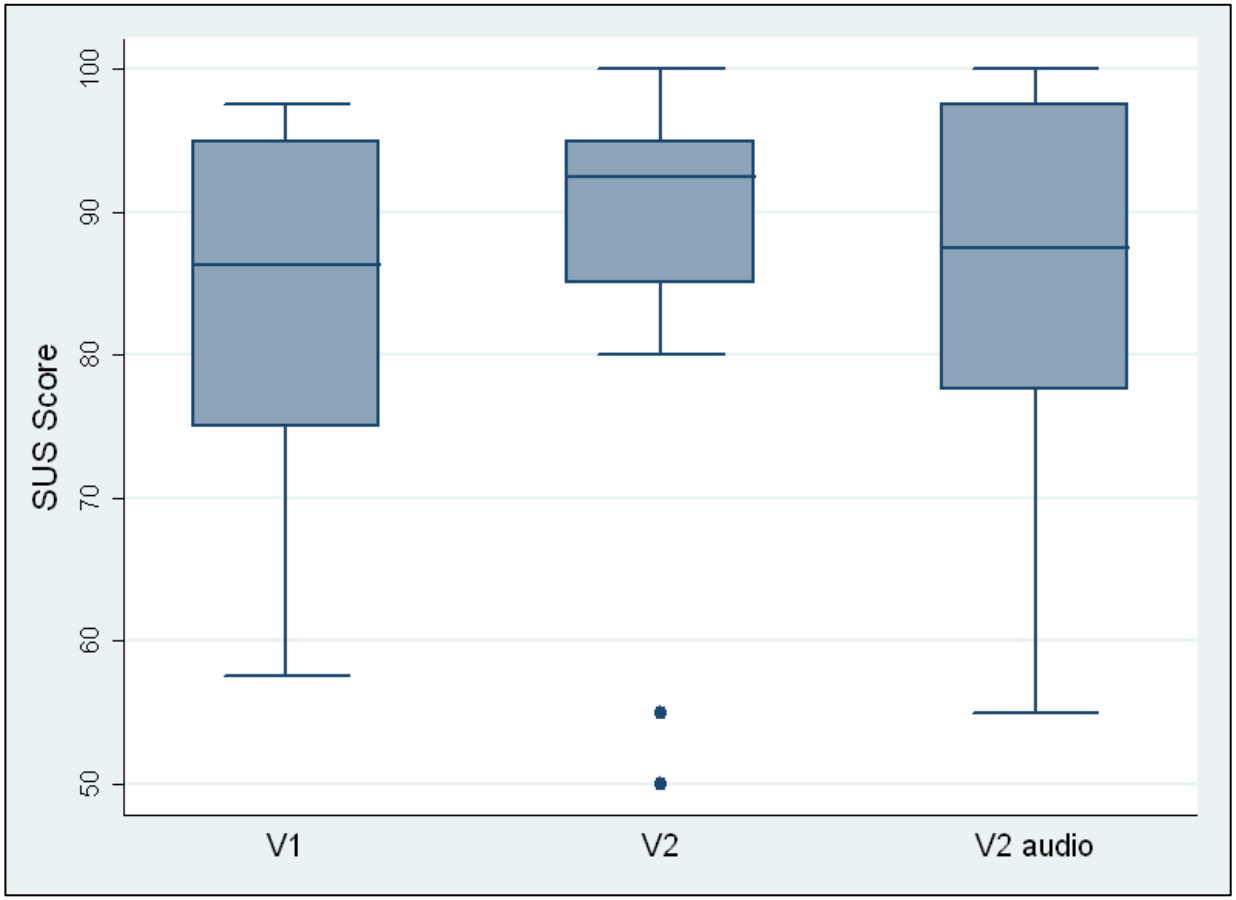
- Recording participants
- User satisfaction questionnaire
- Tests of retention and transfer

Outcomes of interest

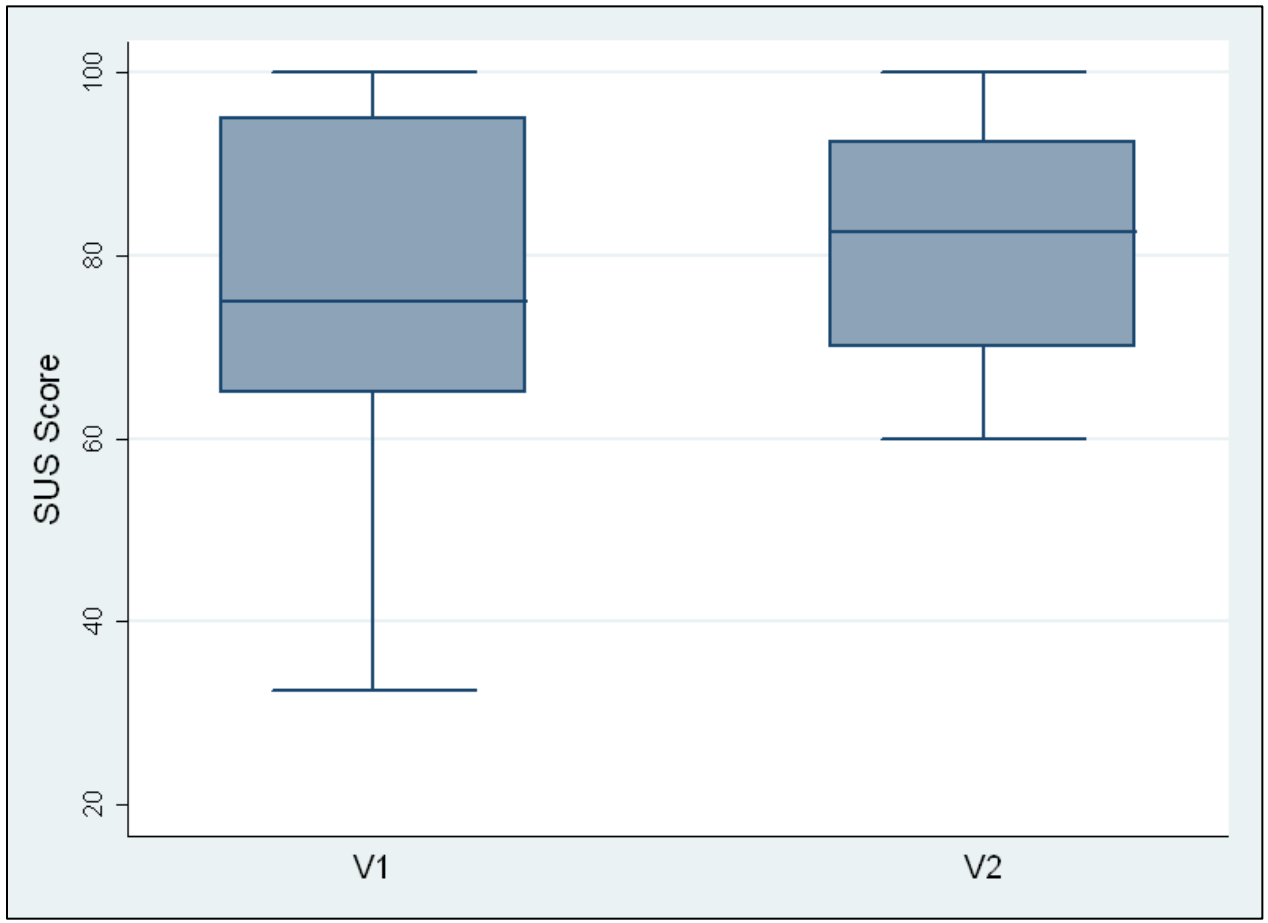
Usability – task completion, errors, efficiency, user satisfaction, engagement…

Learning – measures of knowledge retention, measures of transfer of problem-solving ability

Preliminary results: SUS scores



Preliminary results: SUS scores



Preliminary results: Comments

LIKED…	V1	V2
Easy to use	11	10
Graphics, animation, layout good	7	8
Excellent interaction and feedback	4	8
DID NOT LIKE…	**V1**	**V2**
Difficult to use treatment simulation	7	4
Case clarity not optimal	4	0
Insufficient support: glossary, etc.	3	2
Design faults	2	0

Recommendations

Follow an iterative approach when developing e-learning materials or programs

Usability evaluation essential to realize the potential of the electronic medium

Using a combination of evaluation methods will ensure detection of all major usability issues

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