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A web-based platform for quality management of elderly care: usability evaluation of Ankira®

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Abstract

The use of web-based platform for data storage and data analysis in the context quality for elderly care is improving. This work reports the usability evaluation of Ankira® Platform based in a comprehensive methodology of testing in real contexts. The participants were recruited from elderly care institutions and completed different pre-established tasks. Observation, Critical Incident Records and Scales were used to collect data. The results shown a high level of usability for the platform and indicators of reliability of the methodology are discussed.

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1. Introduction

The technology and information systems are increasingly widespread in daily life and their importance for organizations increase efficacy is also recognized. However, it is necessary to develop methods for the targeted user.

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The acceptance and use of technological devices depends on large and different factors, including an appropriate design, financial resources, functions included in technologies, housing situation, and the competences and user skills¹.

Usability is the key factor in the development of successful applications². The usability definition for software arises from ISO 9126³, which is composed of a set of characteristics and parameters that should be accomplished. The usability definition is associated in *latu sensu* with "the capability of the software product to be understood learned, used and attractive to the user, when used under specified conditions"³⁻⁵.

A good level of usability has numerous benefits, such as increased productivity and efficiency, reduced error rates, reducing the need for training and improves acceptance^{6,7}. The evaluation of usability is an important step in user interface design and is composed of methodologies to measure the usability aspects of the system's user interface and identify specific problems⁽⁸⁾. This evaluation consists of interactive cycles of design, prototyping and validation^{9,10}.

The importance of usability evaluation can be demonstrated by the number of papers published. In Pubmed between the years 2001 and 2005 were published 767 articles. Between 2006 and 2010 the number of articles was 1639, and from 2011 until March 2015 were published 2946.

Usability testing is a technique oriented to the user, involving his observation while performing tasks with a particular product or service⁹. Usability testing method consists mainly in the collection of quantitative data of individuals. This method focuses on people and their jobs, and seeks empirical evidence on how to improve the usability of an interface¹¹. Usability testing usually involves the systematic observation under controlled conditions to determine how well participants can use the product.

1.1. Services for Seniors

The increasing number of elderly people raises several challenges to the society. The promotion of quality of life in a phase characterized by the change of body functions involves the consideration of many multidimensional criteria. World Health Organization has promoted policies and active aging programs¹², but the integration of older people in institutional environment is a reality. Gerontological services arise in order to address and support the needs of this age group, through the provision of formal, rehabilitation and health care to preserve and promote the quality of life of their users¹³.

The association between the quality of the services, especially in nursing homes, and quality of life of their users is well established. Through the application of several rules and procedures it is possible to operationalize quality in a way that makes it able to be measured and monitored. Regardless of the quality standards that each organization adopt, these implies the production of a series of information and the filling of numerous documents leading to the need of tools to reduce the inherent workload.

Electronic records are already a reality, with a number of advantages over records in paper format. Appropriate personnel have access to the same updated information at any time, the access and changes are easily made and controlled, the distribution of information is immediate and easily controlled, with the possibility of being printed¹⁴.

However, it is important that electronic systems are easy to use so that their potential is fully exploited and that, in fact, they facilitate the work of professionals. The evaluation of electronic systems / platforms / applications is rarely made from the users' point of view. The introduction of user-focused development methods ensures the suitability of the products to the people who will use them in its real context⁶.

1.2. Ankira® Platform

Ankira Platform (<http://ankira.pt>) was first presented in mid-2013, with the aim to support the operational management of nursing homes and other elderly services. The product is distributed to clients in the SaaS model (software as a service) and thus hosted and provided over the internet with no additional software or hardware required.

The platform is organized into four main areas: potential clients are managed in 'Candidates', which automatically sorts them according to each institution's criteria. Once they're admitted, personal data is transferred into 'Clients' where individual plans are created and services are programmed. 'Care' is planned in three different

domains: ‘daily life activities’, ‘health care’ and ‘psycho-social care’. Finally, the ‘Management’ area provides tools for controlling and monitoring services.

The aim of this study is to evaluate the usability of Ankira Platform.

2. Methodology

Participants who joined the study received an information sheet given by the researcher, while study objectives and aspects related to data collection were orally explained to them. All people were given the opportunity to request additional information on the study and were informed that if they wished, they could withdraw at any time without personal prejudice and without further explanation about their decision. After being provided this information, each person was asked to sign and date an informed consent.

The stages of evaluation were pre-test, test and post-test.

- Pre-test: It consisted of a questionnaire for sample characterization, including demographic data and a question about the frequency of electronic devices usage.
- Test: The participants performed the tasks described in the task script, which were verbally explained by the researcher, one at a time. Simultaneously, a second researcher recorded the participant's performance in a performance evaluation grid and the observer noted the critical incidents in a sign-in sheet.
- Post-test: The researcher applied the instruments defined for the assessment of usability: The Post-Study System Usability Questionnaire (PSSUQ)², ICF based Usability Scale I (ICF-US I) and ICF based Usability Scale II (ICF-US II)^{15,16}.

To assess the usability of the Ankira Platform, scales / evaluation questionnaires, evaluation of performance and Critical Incident Register were applied. Usability was tested by end users in real life context, which means that was used in daily life labor.

2.1. Scales / Evaluation Questionnaires

The PSSUQ consists of 19 items that are rated on a 7 point scale (strongly agree [1] to strongly disagree [7]). The PSSUQ consists of an overall satisfaction scale and three subscales: system usefulness - SysUse (items 1–8); information quality - InfoQual (items 9–15); and interface quality - IntQual (items 16–18).

Lowest scores indicate better usability. Missing data were interpolated by averaging the remaining domain scores¹⁷. One item was not included as it was not applicable.

The International Classification of Functionality – Usability Scale (ICF-US) consists of two subscales: ICF based Usability Scale I (ICF-US I) and ICF based Usability Scale II (ICF-US II)^{16,17}, which reflects the assessment of the researcher taking into account the participants performance and a set of questions answered also by the participants. The ICF-US I is used to make an overall assessment of usability, while the ICF-US II allows the sorting of the components as barriers and facilitators, identifying the strengths and weaknesses of it. The ICF-US I scores all items from -3 to 3, with the value 3 being the most positive response and the value -3 the less positive. The value -3 corresponds to "complete barrier", -2 "great barrier" and -1 "small barrier". The positive value 1 corresponds to "small facilitator", 2 to "great facilitator" and the value 3 to "complete facilitator". If a participant fails to respond to an item or classifies it as "Not Applicable", this item receives the average value of the remaining, rounded to the unit. The final score of the ICF-US I is calculated by adding the scores of all the scale items. A value above 10 points is considered to be good usability and less than 10 is considered as a prototype with improvement opportunities. ICF-US II was divided into two parts. In the first, five components are evaluated: the menu bar, submenus, separators, functions of support and information on the screen. The second part consists in the overall evaluation of the application. Each item is then rated, as it was in ICF US-I: barrier (-1 to -3) or facilitator (1 to 3). Whenever an item is classified as a barrier, the user must pinpoint the feature that is causing the classification as a barrier. For example, the text size can be considered as a barrier due to a small or large font size. Thus, it is possible to identify which components still need to be mended in order to improve.

A task script was designed where all the tasks that each participant made during the Ankira® Platform test session were described in detail. These tasks included: login, data entry, save, edit, data query and logout.

2.2. Evaluation of Performance

Throughout the test, while the participant was doing the required tasks, a second investigator recorded information about the implementation of each task in a Performance Assessment Inventory. The participant's performance evaluation is a user and tasks-oriented usability evaluation technique and involves the collection of quantitative data. For each script task the data recorded were the success or failure in carrying out the task, the execution time (in seconds) and the total number of errors.

2.3. Critical Incident Register

Critical incidents recorded during the execution of the tasks were recorded by an observer. With this record we sought to identify the systematic behavior of the participants who contributed to its success or failure in specific situations. Details were considered such as easy / difficult interaction with the application or learning ability of the sequence of bases steps to complete a task. For the analysis of Incident Records Critics, categories that relate similar items were created and the number of occurrences of each incident was recorded.

2.4. Sample

The sample was selected by convenience between employees with technical and administrative function, in six Private Institutions of Social Solidarity (IPSS) of Aveiro, according to previous defined inclusion and exclusion criteria. Three people were recruited in each institution, with two of them with care management functions and the third one as administrative.

For the selection of the sample, inclusion criteria considered were age over 18 years; ability to read; and provide informed consent. Exclusion criteria were defined as limitations in terms of global motor functions; and other conditions or circumstances which, in the opinion of the researcher, could compromise the subject's ability to integrate the study.

The total sample consists of 18 participants, of which twelve (66,7%) were care managers and six (33,3%) administrative. Only one participant was male (5,6%) and seventeen were female (94,4%). The sample had an average age of 37 years (SD = 7,2) and all participants reported daily use electronic devices. Regarding the level of education the majority (66,6%) has university education.

3. Results

3.1. PSSUQ

Results from the PSSUQ showed that the participants were, overall, satisfied with the usability of the Ankira® Platform (Table 1).

Table 1. Results of PSSUQ subscores.

	Mean	SD
Overall satisfaction	2,7	0,83
System usefulness (SysUse)	2,2	0,92
Information quality (InfoQual)	3,3	0,89
Interface quality (IntQual)	2,4	1,11

Note: Lowest scores indicates better usability.

By domain, the lowest average was for 'System usefulness' (Mean = 2,2; SD = 0,92) and the highest for Information quality' (Mean = 3,3; SD = 0,89).

The results are very similar when analyzed each question of PSSUQ (Table 2), with the lowest score observed in the question number 17 'I liked using the interface of this system' and the highest observed in the question number 10 'Whenever I made a mistake using the system, I could recover easily and quickly'.

Table 2. Results of PSSUQ items.

	MED	IQ1	IQ3	MIN	MAX
1. Overall, I am satisfied with how easy it is to use this system	2,0	1,0	3,0	1	3
2. It was simple to use this system	2,0	1,0	3,0	1	5
3. I could effectively complete the tasks and scenarios using this system	2,0	2	3,0	1	6
4. I was able to complete the tasks and scenarios quickly using this system	2,5	1,8	3,3	1	6
5. I was able to efficiently complete the tasks and scenarios using this system	2,0	1,0	3,0	1	6
6. I felt comfortable using this system	2,0	1,0	3,0	1	4
7. It was easy to learn to use this system	2,0	1,0	3,0	1	4
8. I believe I could become productive quickly using this system	2,0	1,0	3,3	1	5
10. Whenever I made a mistake using the system, I could recover easily and quickly	3,0	1,0	4,0	1	5
11. The information (such as on-line help, on-screen messages, and other documentation) provided with this system was clear	2,5	1,0	3,0	1	4
12. It was easy to find the information I needed	2,0	1,8	4,0	1	4
13. The information provided for the system was easy to understand	2,0	1,0	3,0	1	4
14. The information was effective in helping me complete the tasks and scenarios	2,0	1,0	3,0	1	5
15. The organization of information on the system screens was clear	2,0	1,0	3,0	1	4
16. The interface of this system was pleasant	2,0	1,0	3,0	1	4
17. I liked using the interface of this system	1,5	1,0	2,3	1	4
18. This system has all the functions and capabilities I expect it to have	2,0	1,0	3,0	1	5
19. Overall, I am satisfied with this system	2,0	1,0	3,0	1	4

3.2. ICF I

In ICF-US I Ankira® Platform was classified as a facilitator by 17 participants and a barrier for one (Table 3). A range from -30 to 30, the median of the total score of the participants was 23,5 (IQ1 – IQ3 = 18,0 – 28,5). The participant with the highest score had a score of 30 and the lowest score was -13. Overall all the items evaluated in the ICF-US I were considered facilitators.

Table 3. Items results for ICF I.

	MED	IQ1	IQ3	MIN	MAX
The ease of use	2,0	1,0	3,0	-1	3
The degree of satisfaction with the use	2,5	2,0	3,0	-2	3
The ease of learning	2,5	1,8	3,0	-2	3
The obtain obtainment of expected results (e.g. I wanted to write a text and I did)	3,0	1,8	3,0	-1	3
The similarity of the way it works on different tasks (e.g. to confirm an action is always equal)	2,0	1,0	3,0	-1	3
The ability to interact in various ways (e.g. keyboard, touch or speech)	2,0	2,0	3,0	-2	3
The understanding of the messages displayed (e.g. written or audio)	3,0	1,8	3,0	-1	3
The application responses to your actions	3,0	1,8	3,0	-1	3
The knowledge of what was happening in the application during its use	3,0	2,0	3,0	-2	3
Overall, I consider that the application was	2,5	2,0	3,0	-2	3

3.3. ICF II

In ICF-US II the platform was classified as a facilitator by all participants. The median of the total score of 18 participants was 71 (IQ1 – IQ3 = 61 – 79), in a range of -84 to 84. The ICF-US II was divided into two parts. The first is the assessment of five components (Table 4), including: menu bar; sub-menus; separators; support functions (buttons to print, export, edit, and import function) and information on the screen (screen layout). Relative to information on the screen, the last two questions refer to text size and the color contrast.

The second part is the overall evaluation of the application (Table 5). The responses range from -3 to 3.

Table 4. Items results for ICF II (MED (IQ1– IQ3)).

	Menu bar	Sub-menus	Separators	Functions of Support	Information on the screen
1. The spatial position of this component on the monitor was	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (1 - 3)	3,0 (3 - 3)
2. The size of this component was	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (3 - 3)	1,5 (-1 - 3)	3,0 (3 - 3)
3. The size of this component relative to the other was	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (3 - 3)	2,5 (1 - 3)	3,0 (3 - 3)
4. The correspondence of the icons to the respective action was	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (3 - 3)	2,5 (1 - 3)	3,0 (2 - 3) ^a
5. The size and quality of the icons were	3,0 (3 - 3)	3,0 (3 - 3)	3,0 (3 - 3)	1,0 (-2 - 3)	3,0 (2 - 3) ^b

In general, the components were classified as facilitators. Where there was a smaller usability, it is considered by some participants as a barrier, was in Functions of Support relative to the size of this component (MED = 1,5 (IQ1 – IQ3 = -1,0 – 3,0)) and the size and quality of icons (MED = 1,0 (IQ1 – IQ3 = -2,0 – 3,0)).

A general review of the application (Table 5), for the session course (MED = 3,0 (IQ1 – IQ3 = 2,0 – 3,0)) was rated by seventeen participants as a facilitator and barrier by one. In the question "If this application was installed at your institution would be" seventeen participants considered it a facilitator (MED = 3,0 (IQ1 – IQ3 = 3,0 – 3,0)). In the item for motivation to use the ANKIRA® Platform the median was 3,0 (IQ1– IQ3 = 3,0 – 3,0).

Table 5. Results of ICF II items – General evaluation.

	MED (IQ1 - IQ3)	MIN	MAX
1. The course of the session was	3 (2 – 3)	-1	3
2. If this application was installed at your institution would be	3 (3 – 3)	-2	3
3. Their motivation to use this application	3 (3 – 3)	-3	3

3.4. Evaluation of Performance

Overall, the tasks requested to the participants have been successfully concluded (Table 6).

Lower success rate were found in the T3, T5, T7, and T9 tasks. More than one error made by participant’s occurred in tasks T3, T7 and T10.

In task T5 was asked to the participant to register the retirement pension amount, and eight were unable to complete the task. The same number of non-accomplished of success was found in the task T9.

Table 6 - Results of Evaluation of performance

	Number of errors per task			Run Time (sec.)	
	0	1	2	Med (IQ1 - IQ3)	Min-Max
T1 – Access	18	0	0	20 (10-33)	1-50
T2 – Login	17	0	1	26 (20-38)	15-188
T3 - Enter data	8	8	2	153 (119-165)	90-201
T4 – Save	14	3	1	10 (8-30)	2-90
T5 - Edit 1	7	10	1	45 (30-52)	20-90
T6 - Edit 2 and save	18	0	0	50 (30-60)	20-85
T7 - Enable registration	9	6	2	38 (27-58)	20-99
T8 - Consult data	17	1	0	20,5 (10-31)	6-83
T9 - Insert clinical data	8	9	1	62 (50-90)	27-170
T10 - Analysis and statistics	11	5	2	54 (40-65)	4-205
T11 – Logout	18	0	0	2 (2-4)	2-18

3.5. Critical Incident Register

Resulting from observation process, it was found that when asked the participant to insert a date, a considerable percentage of these did it by using the manual feed option (n = 7). People showed confused by having to insert separators between the data manually, and it was noted that if they were previously defined would be an asset. Also

if the participant chose to enter the date the calendar and needed a place last year to 1951, had to select 1951 and only after that arose prior years.

Of the 18 participants, 8 not found the functions of support of save when asked for it. The most frequently observed mistake was that these participants sought to keep the icon at the bottom because they are used to have it at the end of the sheet in other software.

Seven of the 18 participants mentioned difficulty in understanding the correspondence of the function icons to the respective action. They suggested to have a text clue when the mouse is placed over the icons.

Some participants suggest that could be useful to have a prompt message to save the data.

The majority of participants (n = 10) showed a hard time realizing that to edit the data would have to first select the icon "edit".

Finally, when asked to export the data after filter selection (task T10), from the Platform to Excel an error occurred (n = 5).

4. Discussion

Overall, the platform had a good level of acceptance by the participants in the study. Participants were quite tickled with the soft colors of the Platform and expressed an intention of using it if available.

It was clear despite the general opinion of classifying the platform as a facilitator that improvements could be made in some components:

- Fields for entering data, should be in 'edit' mode automatically.
- Configure by default separators between 'day-month-year' in data fields.
- The function of support 'Save' should be placed at the end of the page.
- Include text clues when mouse is placed over an icon.
- Increase the size of text and icons.
- On 'Statistics menu', applying filters should have more contrast.

5. Conclusions

This study allowed assessing the use of Ankira® Platform in a real context with a structured methodology for testing the main tasks and functions. Despite the high results showing a very good usability in the user's perspective this methodology was able to capture some details that could be improved.

The possibility of crossing information from the scales with Critical Incident Register improves the reliability of the assessment. For example the values in PSSUQ in questions 7 and 17 were in agreement with what users expressed, such "I found the system easy" (ID 16), "It's really cute!" (ID 18), "The system is simple! (...) 20 or 30 minutes were enough to dominate the program" (ID 13). Another example that confirms this assumption is the association between the scores indicating lower usability and the number of errors recorded in the Performance Assessment Inventory.

In the same way the ICF-US allows to get important information about the features of the products in evaluation. It was clear despite the general opinion of classifying the platform as a facilitator that improvements could be made in some components as the size and placement of icons.

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