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Data Entry Form Designing Tools and Software Usability in DHIS2

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Abstract. The advent of configurable software has shifted the implementation of software solutions from total reliance on software developers to towards increased participation of end-users. End-users are now able to create software solutions without the need for writing code but through configuration and customisation. Despite the increasing use of configurable software challenges on designing the software platform architecture, process of testing and usability exists in configurable software. The research aimed at evaluating how available interface elements influence usability in DHIS2. Empirical data was collected by studying the design of custom data collection forms for routine health data collection with two groups of users. 80% and 90% were recorded as completion rates of the designed task and overall efficiency of 86.23% and 89.94% was achieved between the two groups. Lack of relevant editing features, increased distance between related objects, lack of conformity to Keep It Simple, Stupid (KISS) and minimalistic design principle were found to be the major challenges affecting the usability.

Keywords. Configurable software, DHIS2, usability, custom forms, data entry

1. Introduction

The starting point for health care information is data and the collection of data. Regardless of the kind of data being collected or whether it is collected manually or electronically, it is important to ensure that data is correct at the point of entry. It is believed that poor data collection occurs when data are not collected in a logical sequence, and when the instrument used to collect the data is deficient [1]. Poor data collection tools result in compromised data collection which leads to poor data quality and compromised decision making. Consequently, since health personnel rely on this data for generating guidance, the possibility that the medical decisions facilitated by this data may result in negative patient outcomes [2].

As a way of improving the quality of data at the point of entry, the World Health Organisation (WHO) suggests the improvement of the tools for data collection. It proposes that the improvement can be done through;

- Reviewing data collection forms and redesign as required.
- Design forms to collect data in a logical sequence.
- Maintain simplicity of design.

There is an increased uptake of configurable software in the development of patient care and the National Health Management Information System (HMIS) solutions. Notable ones include OpenMRS, Commcare and District Health Information System version 2 (DHIS2).

DHIS2 allows implementers and developers to design forms which are used for data entry into the system. As a configurable software platform, the designing is done through an embedded editor called CKEditor and the designing of the form is through clicks of different elements on the interface. The research aimed at evaluating how available interface elements in DHIS2's CKEditor influence its usability.

2. Methodology

The research process involved usability studies with 11 users from five organisations that actively use DHIS2 in Malawi. A test data entry form for HIV Testing and Counselling Combined Quarterly Report was used for collecting empirical data. There were two user groups, each user group was assigned similar tasks to accomplish (**Table 1**). Proficiency in using the DHIS2 custom form editor was the factor which led to having these two groups. There were some DHIS2 developers or implementers who had not used DHIS2 custom form editor before, as such they were grouped into "first-time users" group. While for those who had used the editor before were grouped as "experienced users". From the 11 respondents, 6 were experienced users while the remaining 5 were first-time users.

Table 1. Form design tasks

Task Number	Tasks For Experienced Users	Task For First-time Users
1	Insert form name	Insert form name
2	Add section headers	Add section headers
3	Create Table with rows for input fields and labels	Create a table on each section to hold the data elements and input fields
4	Add the corresponding data element in each cell	Add form labels for data elements
5	Styling form	Attach the data elements to each form label

Video recordings, observations and interviews were used to collect data. 11 videos were recorded from which data of usability metrics was extracted. Data like time taken to complete a specified task by a specific designer (in seconds), the number of committed errors during the process, the number of tasks completed by each designer, most used functionalities through the different icons which were used frequently. Personal interviews were conducted with respondents during the data collection process. Structured interviews were also conducted based on the 10 Nielsen heuristics. Notes were taken while observing how the users we designing the forms.

2.1. Data Analysis and Interpretation

The analysis was based on the ISO 9241-11 metrics. Data from interviews and observations were analysed using UI design principles.

2.1.1. ISO 9241-11

The ISO 9241-11 standard defines usability as the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use [3].

2.1.1.1. Effectiveness

Effectiveness is defined as the degree to which something is successful in producing the desired result. Effectiveness can thus be represented as a percentage by using this equation:

$$\text{Effectiveness} = \frac{\text{Number of Tasks completed successfully}}{\text{Total Number of tasks undertaken}} * 100. \quad (1)$$

2.1.1.2. Number of Errors

The number of errors the participant makes when attempting to complete a task.

2.1.1.3. Efficiency

Efficiency is measured in terms of task time, that is, the time (in seconds and/or minutes) the participant takes to complete a task. The equation can thus be represented as follows:

$$\text{Overall Relative Efficiency} = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} nijtij}{\sum_{j=1}^{R}\sum_{i=1}^{N} tij} * 100. \quad (2)$$

Where: N = the total number of tasks (goals), R = the number of users, nij = the result of task i by user j; if the user successfully completes the task, then Nij = 1, if not, then, Nij = 0, tij = the time spent by user j to complete task i. If the task is not successfully completed, then time is measured until the moment the user quits the task.

3. Results

3.1. Formatting Forms in DHIS2 CKEditor

Sometimes, designers had to go to the actual source code of the designed form using the *'source'* option in the menu. From the source code, designers will edit wherever they want to and the changes will be reflected in the form UI. But this requires someone with a computer programming background which is against the core principle of configurable platforms where the goal is that designers should create their solutions on the platform without the need for programming skills.

3.2. Editors Menu

The menu has 53 menu items and only 23 items were used during the design process representing 55.7% unused items on the menu. To add on to this, the data collected revealed that the editor's menu is not fixed to the top as such users had to scroll up and down during the design process to get hold of the menu. It was also observed that the editor does not have help function.

3.3. Tables

It was found out that the table has an auto fixed width by default which was changed by specifying the size in terms of pixels when you right-click table. Also, whenever you add a data element to a specific cell in a row, it shrinks the corresponding cells in the row. This reduction in the width of the other cells, made it difficult when selecting the shrunk cell. As an intuitive feature, users tried to increase the width and height by clicking and dragging the cell border but to their surprise, nothing happened.

3.4. Formatting Forms

It was reported that they use Microsoft Excel or LibreOffice Calc spreadsheet applications in Windows Operating System and Linux - Ubuntu OS respectively. The preference for these applications was that they offer the flexibility to merge cells, hide columns, resize cell width and height.

3.5. Usability Metrics

3.5.1. Effectiveness – Completion Rate

80% completion rate for experienced users and 90% completion rate for first-time users with an average time of 859.33 seconds (14.32 minutes) and 1015.4 seconds (16.92 minutes) respectively

3.5.2. Number of Errors

Task 3 and Task 4 have the most number of errors for experienced users while Task 5 has the most number of errors followed by Task 3 for first-time users.

3.5.3. Overall Efficiency

The overall efficiency for the experienced users was found to be 86.23% and 89.94% for first-time users. This infers that CKEditor is efficient and supports users achieving their goals.

4. Discussion

4.1. Fitts' Law in Interaction Design

Fitts' law states that "the amount of time required for a person to move a pointer (e.g., mouse cursor) to a target area is a function of the distance to the target divided by the size of the target. Thus, the longer the distance and the smaller the target's size, the longer it takes" [4]. The non-compliance with Fitts' law has affected the time-based efficiency of designers when designing forms as it has been presented in the findings where the time-based efficiency of 0.0067 goals/sec for experienced designers while for first-time designers is 0.009 goals/sec.

4.2. The KISS and Aesthetics and Minimalistic Design Principles

Keep it Simple Stupid is a design principle which emphasizes simplicity in design with the key objective being unnecessary redundancy and complexity should be avoided [5]. While minimalistic design expresses the need for presenting relevant information to users as irrelevant information distract the user and abstracts the user from important information [6]. These two principles emphasise the point of having unnecessary items on our application and grouping items based on their functionality to create sanity on the UI. Research findings revealed that half of the icons found on the editor's menu are unused during the design process.

5. Conclusion

In configurable software, users are supposed to create an application from the resources that are available on the user interface without having to change the source code to get the desired result. The built-in capabilities of the editor enable designers to customise the forms which agree with [7] and findings on the extent to which DHIS2 allows customisation flexibility. But the evidence of users using other applications to design the forms implies the technical design flaws that exist in the editor to meet established work routine and contextual conditions. As such the research recommends the redesigning of the editor to cater to all user needs.

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