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ScienceDirect

Procedia Computer Science 181 (2021) 269–276

Procedia Computer Science

www.elsevier.com/locate/procedia

CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies 2020

A Usability Study of Pharmacists' Perceptions Toward an Online Course for Respiratory Infections and Antibiotic Use

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Abstract

Digital tools in healthcare have been rapidly emerging over the past decade, with these tools consisting of clinical decision support systems, diagnostic tools or educational materials, such as e-learning courses. eHealthResp comprises an online course, primarily aiming to support physicians and pharmacists on the management of upper respiratory tract infections. In order to assure the quality of the online course, not only in terms of scientific content, but also in terms of user-friendliness, it shall be evaluated by a group of pilot users prior to its implementation. This article focuses on the usability assessment of the eHealthResp online course by community pharmacists, in order to efficiently determine and maximize its educational impact and overall user-friendliness. A questionnaire, based on the System Usability Scale, was distributed among pharmacists, giving them the opportunity to fully explore the website. Overall, pharmacist's evaluation/experience on the usability of the eHealthResp online course was rated excellent (mean score of 83,75 points), with individual scores ranging from 55 to 100 points on a 1-100 scale, together with positive overall assessments regarding ease of use, complexity, functionalities integration and consistency.

Keywords: e-learning; e-health; usability; online course; System Usability Scale

1. Introduction

E-learning courses, defined by the provision of educational programmes through electronic systems, are globally delivered via digital services [1]. Audio, texts, illustrations, photos and videos are some examples of the most used resources on these types of

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10.1016/j.procs.2021.01.146

courses [2]. In particular, the use of educational interventions electronically mediated via internet, has steadily increased among health professionals worldwide [1].

For an educational website to be effective, several steps should be taken into account, namely: 1) the analysis of needs of the end-users and the specification of its main features and objectives; 2) the determination of technical resources; 3) the evaluation of pre-existing software; 4) the secure commitment from all participants and the addressing of potential barriers to implementation; 5) the development of content coordinated with the website design; 6) the encouragement for an active learning and its use by the learner; 7) the evaluation of both learners and the course. The website must also be piloted before full implementation and must be strictly monitored by periodically verifying hyperlinks, and regularly updating content [3].

The assessment of the usability constitutes an essential step for the overall design and development of these platforms. It consists of iterative evaluation cycles of prototyping, design and subsequent validation [4]. The usability assessment of an online course has a major impact on the final result, by improving the benefit obtained from using these e-learning resources, since its optimization allows the reduction of extraneous cognitive load, as well as the maximization of the potential educational impact [5].

On an ideal context, the usability evaluation must be present at all stages of the design and development processes. To allow a continuous improvement of the results, the assessment must be iterative [5]. One of the most common methods employed to assess the usability of a service or a product is by questionnaires. They have shown to assume a significant importance for qualitative self-reported data collection about the characteristics, thoughts, feelings, perceptions, behaviours or attitudes of the user [6]. Usability testing is an important formative evaluation technique, based on a thorough analysis of the user perceptions towards a specific product or service [7].

In this particular context, usability testing is used to guide the development and design processes of an online site, which includes an e-learning tool. Usability is defined as the degree to which the users can easily and efficiently use the online site in order to satisfy the goals and needs of the learner [8]. According to the ISO 9241-11 it relates to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use [9].

Among others, the System Usability Scale (SUS) can be used as an effective instrument to easily and quickly collect data during a usability evaluation. It provides a single reference score for participants' view of a product's usability, while also providing a global measure of system satisfaction [4].

Nevertheless, the main goals of this study are 1) to assess the usability of the online course; and 2) to uncover possible usability issues at an early stage, in order to avoid wasting resources while refining design concepts that are ultimately unviable. The online course (eHealthResp) for community pharmacists has been developed and its usability was assessed among a sample of the target population, applying a questionnaire based on the SUS. This paper will describe the study methodology followed, the obtained results' presentation and its discussion.

2. Methods

Designed under a multidisciplinary team of three experts in Pharmacology and Pharmacoepidemiology and two Human-Computer Interaction practitioners, the online course eHealthResp integrates, among other features, several presentations targeted to pharmacists. The course is embedded into an online site that also includes several other assets, namely information about the research project under which the course is being developed, details about the research team, a news feed and a contacts section.

This online course's main objective is to support pharmacists on upper respiratory tract infections (such as common cold, influenza, bronchitis, sinusitis, and pharyngitis), in order to assist patients on the management of these diseases. It consists of three modules, together with four clinical cases to be solved at the end of the online course. The clinical cases presented are inspired in four already validated algorithms included on a mobile app that was developed in parallel to the online course. To grant access to each lesson or the first clinical case, the user must mark the previous module as complete. Each of the other three clinical cases require the user to answer correctly to all of the questions of the previous clinical case.

Six community pharmacists, four women and two men, were recruited aged between 45 and 55 years old, from the North (n=3) and Centre (n=3) Regions of Portugal. The group was invited to participate in the study by two researchers and asked to pilot the site contents, with special focus to the online course [10,11]. The website's URL was sent, and a username and a password were attributed to each participant, granting them the access to the course contents. Full freedom was given to the participants to explore the website (Fig. 2). After exploring the website, these participants completed a usability questionnaire consisting of a mandatory question assessing the type of interface (computer, smartphone, tablet) used to visit the website, followed by ten mandatory questions related to their experience in using the online course. An optional section for possible suggestions/comments was also included at the end of the questionnaire. This questionnaire is based on a validated SUS, promptly translated to European Portuguese. The process is represented below (Fig. 1):

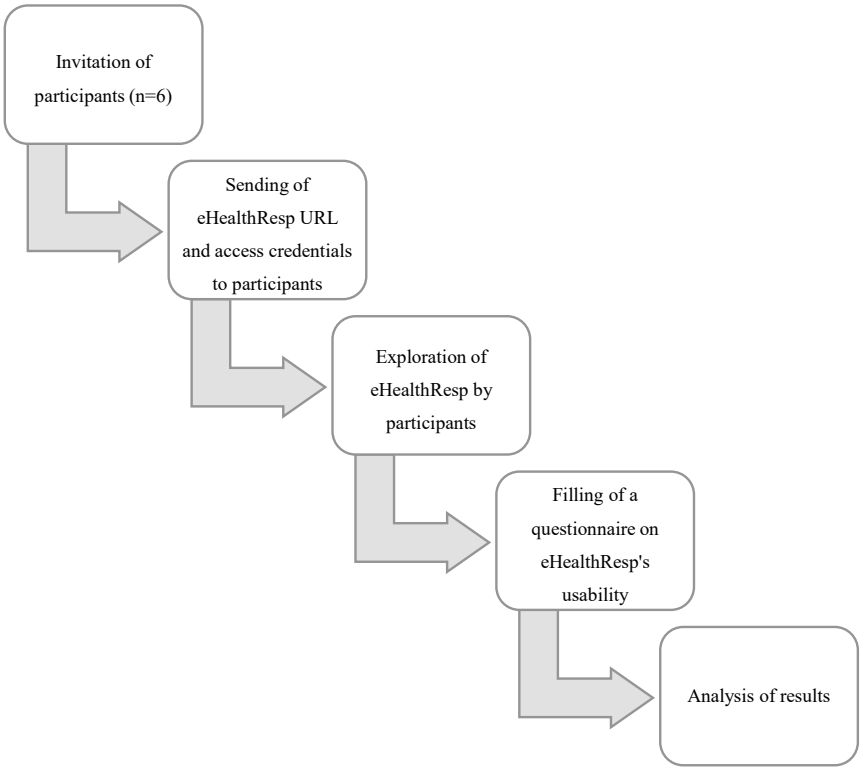

Figure 1 - eHealthResp usability study flowchart

The SUS is an effective and inexpensive tool not only allowing the usability of a product, as well as a wide range of user interfaces, including standard operative systems based on software interfaces, Web pages and Web applications. This scale presents the items to participants as 5-point Likert scale numbered from 1 (anchored with "Strongly disagree") to 5 (anchored with "Strongly agree"). Although the SUS has been further computed into two sub-scales of usability (items 1, 2, 3, 5, 6, 7, 8 and 9) and learnability (items 4 and 10) by several researchers, further reliability studies have shown that the SUS should be analysed as an unidimensional model for overall perceived usability [12,13].

The scores obtained were also analysed applying the qualitative scale developed by Bangor *et al* [13], based on the total usability scores, attributing adjectives to the overall experience in using the platform. These adjectives ranged from "worst imaginable", corresponding to usability scores from 0-25, to "best imaginable", with scores from 86-100 [14].

Descriptive statistical analyses were conducted in order to determine if the online course was overall well designed and highly usable.

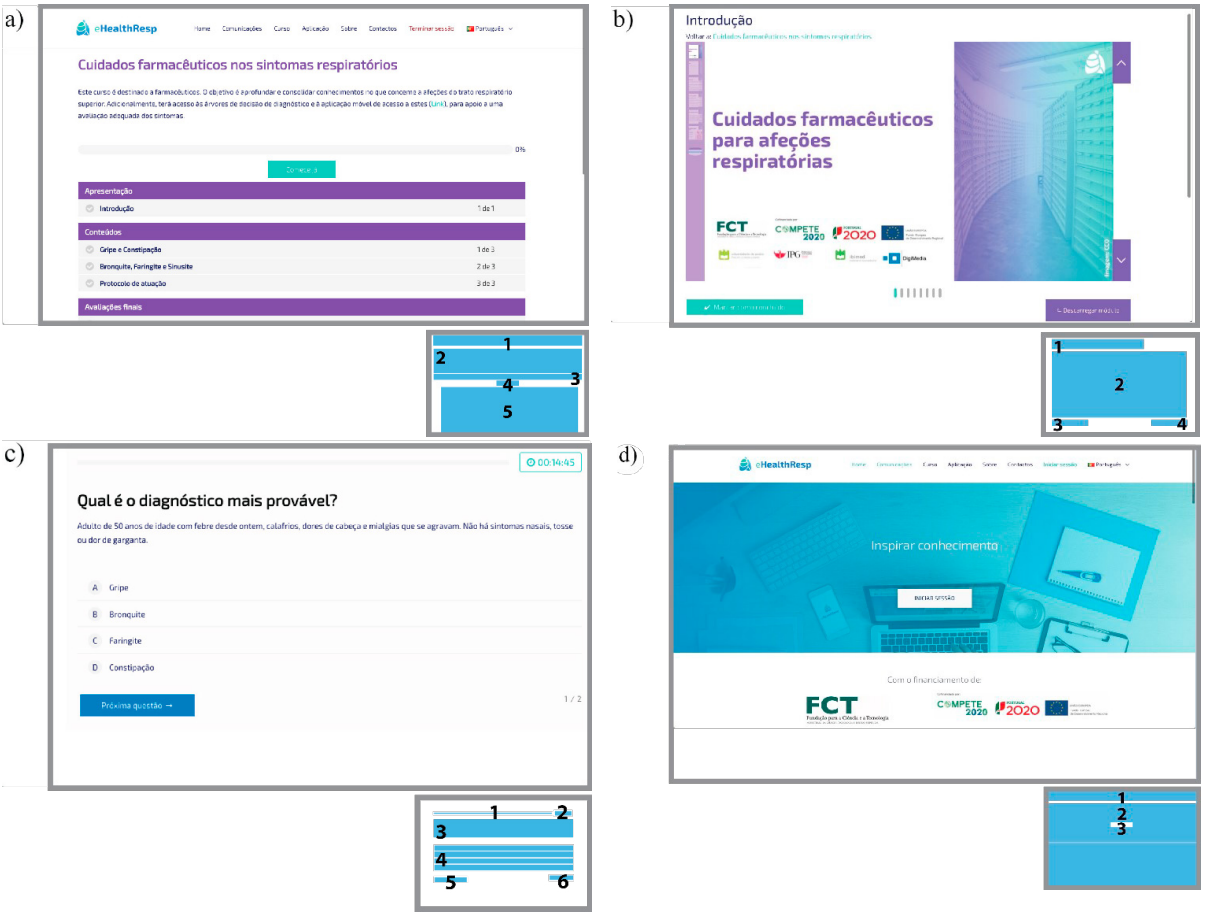

Fig. 2. Online course screen-shots (a) Course syllabus page: a1) Main navigation menu; a2) Course introduction; a3) User progress in the course; a4) "Continue course" button; a5) Course syllabus; (b) First slide of the first lesson: b1) Module title and link to the Course syllabus page ; b2) Contents slider; b3) "Check-as-completed" button; b4) "Download the lesson .pdf file" button; (c) Quiz page: c1) Quiz progress visual scale; c2) Time counter; c3) Question contents; c4) Question's answers input ; c5) "Next question" button; c6; Counter for number of questions to answer (d) Home page: a1) Main navigation menu; d2) Home page contents (banner and financial support); d3) "Link for Login" button.

3. Results

All six participants responded to the questionnaire over the course of ten days. To obtain the usability score for each respondent, the scores of the odd-numbered questions (SOQ) and the scores of the even-numbered questions (SEQ) were added up. Five points were subtracted to the sum of SOQ and the sum of SEQ was subtracted from 25 [12]. The scores were obtained by adding both sums and multiplying by 2.5, which resulted in a 100-point scale. The final scores ranged from 55 to 100 points. Three respondents accessed the online course using a smartphone, and the other three used a computer/laptop. Mean values were 73.33 (standard deviation of 21.84) and 94.17 (standard deviation of 8.04), respectively.

The scale was analysed in terms of reliability, in order to evaluate how well the ten statements correlate with the hypothetical statements regarding the concept of usability. For this analysis to be conducted, the absolute ratings obtained were used to compute Cronbach's alpha, achieving an internal consistency of $\alpha = .926$. Considering the relevance of the results obtained on each question of the scale employed to assess the usability of the online course eHealthResp, table 1 is presented here to describe the overall perception of the pharmacists:

Table 1 - Overall perception of pharmacists on the online course eHealthResp (results by item)

Item EN **(PT-PT)**	**Mean score (1-5)**	**Standard deviation**
1. I think that I would like to use this system frequently. **(Acho que gostaria de utilizar este produto com frequência.)**	4.17	1.169
2. I found the system unnecessarily complex. **(Considerei o produto mais complexo do que necessário.)**	1.67	.816
3. I thought the system was easy to use. **(Achei o produto fácil de utilizar.)**	4.50	.837
4. I think that I would need the support of a technical person to be able to use this system. **(Acho que necessitaria de ajuda de um técnico para conseguir utilizar este produto.)**	1.33	.516
5. I found the various functions in this system were well integrated. **(Considerei que as várias funcionalidades deste produto estavam bem integradas.)**	4.67	.516
6. I thought there was too much inconsistency in this system. **(Achei que este produto tinha muitas inconsistências.)**	2.00	1.265
7. I would imagine that most people would learn to use this system very quickly. **(Suponho que a maioria das pessoas aprenderia a utilizar rapidamente este produto.)**	4.50	.837
8. I found the system very cumbersome to use. **(Considerei o produto muito complicado de utilizar.)**	1.50	.837
9. I felt very confident using the system. **(Senti-me muito confiante a utilizar este produto.)**	4.50	.548
10. I needed to learn a lot of things before I could get going with this system. **(Tive que aprender muito antes de conseguir lidar com este produto.)**	2.33	1.633

Most of the positive items (3, 5, 7 and 9) revealed average scores of 4.5 or above, with relatively low standard deviation values, which reflects some homogeneity of the responses among pharmacists. Although item 1 had an average score above 4 points, it displayed a higher standard deviation when compared to the other positive items, thus demonstrating some heterogeneity on respondent's answers. Regarding the negative items (2, 4, 6, 8 and 10), 80% of the questions had an average score of 2.0 or lower. Only question no. 10 had an average score higher than two, together with the highest standard deviation value among all of the ten answers, consequently being the item displaying less homogeneity among the participants.

Overall, according to Bangor, et. al, [14] the mean evaluation of this study corresponded to "excellent", since a score of CI95%: 83.75-14.90, and a standard deviation of 18.62 were obtained. The individual results are presented on table 2:

Table 2 - Descriptive statistics of SUS scores for adjective ratings

Adjective	**Count**	**Mean SUS score**	**Standard deviation**
Worst imaginable	0	-	-
Awful	0	-	-

Poor	0	-	-
Ok	2	61.2500	8.83883
Good	0	-	-
Excellent	1	85	-
Best imaginable	3	98.3333	1.44338

4. Discussion

The study highlights the particular case of the Portuguese community pharmacists, considering that it lacks, up to date, educational information about upper respiratory complications and corresponding proceeding protocols. This informational gap gives rise to serious health problems, that can be caused by the misuse of antibiotics, inadequate antibiotic prescriptions, and consequent increase in antibiotic resistance among individuals. In order to tackle this issue, a group of e-learning tools were designed and implemented combining presential seminars, an online course and a mobile application to support clinical decision in the scope of upper respiratory symptoms.

In this particular stage of the study, we aimed at assessing usability values of the self-paced online course to stimulate knowledge and improve the practices regarding upper respiratory complications among the community pharmacists. The use of SUS with a group of pharmacists promoted this assessment by providing useful insights of the community and clear out eventual major flaws.

Taking into account that these are important issues that may influence the effectiveness of online e-learning approaches, the study used the SUS tool to quickly assess usability, ease of access, navigation, and also user-friendliness [15]. Most of the questions expressed highly positive results towards eHealthResp online course. As mentioned on the results section, the positive items presented an average score above four points, thus reflecting the ease of access/use of the course, as well as the integration of the contents and how enjoyable the experience of visiting the online course is. The negative items also showed positive results overall, with most of the average answers being equal or below two points. These results show that overall, the eHealthResp online course did not exhibit inconsistencies, and was not perceived as a complex e-learning tool. Since the main objective of using the SUS in this study was to evaluate the usability of the eHealthResp online course, it is important to note that the contents' relevance is yet to be evaluated. This assessment will soon be conducted throughout evaluations using Delphi's method [16] with healthcare experts in order to validate and provide feedback on the contents.

Although the SUS has been seen as a "quick and dirty" tool to assess a system's usability at the beginning, this paradigm has shifted throughout the years [17]. This scale has shown several advantages, namely in terms of content validity and high inter-rater reliability when assessing eHealth tools [4,7]. Literature also shows that the SUS scale has a high correspondence to other perceived usability tools, such as UMUX, UMUX-Lite and CSUQ [17]. Other tools could also be used to complement this study [18,19]. Since the SUS is comprised of only closed questions, other methodologies such as focus groups could also complement this study, in order to explore the overall perception of participants towards the eHealthResp online course. Although permitting a quick assessment, the lack of specificity of the SUS fails in promoting suggestions. To complement this weakness, a commentary section was added. As it was an optional evaluation parameter, most of the users (five out of six) did not feel impelled to answer it. This can both mean that no major suggestions arised during the questionnaire filling, or that the respondents simply did not feel the need to provide explicit feedback. Nonetheless, the only respondent who wrote a comment emphasized the viability of the eHealthResp online course, expressing the ease of access and objectivity of the contents. Since all the respondents were contacted in person by two researchers, some informal feedback was also provided: 1) suggestion of a "search" tool on the online course, in order to find specific information on the contents of the online course; 2) small discrepancies on the layouts of one of the presentations; 3) small semantic observations on specific locations of the online course. Considering that older adults tend to have lower e-health literacy levels, when compared to younger populations, is interesting to note that, although the ages of the participants were among 45 and 55 years, the online course has been evaluated very positively in terms of ease-of-use. [20] According to the literature, usability studies for problems detection should have between five to ten participants [10,11]. However, a review of usability studies showed that the mean percentage of total known problems was of 85.55% with a population of five participants, while a population of 10 participants identified, on average, 94% of the usability problems [11]. Nonetheless, the variability of the results of this study showed to be inferior to the one reported on the literature for the same confidence interval. [10]. The statistical analysis conducted on this study also shows that this scale exhibits high reliability ($\alpha = .926$), which highlights the suitability of using the SUS for studying the usability of the eHealthResp online course.

Another complementary measure taken into consideration in this study was to associate the question "Which device was used for testing?" and separating the answers between "computer/laptop", "tablet" and "smartphone". We believe this is a very important question considering the wide range of available devices able to be used and the big difference in experience that each of these devices provides. The results show a difference of more than 20 points on the average usability score between the use of smartphone, with 73.33 points, and the use of a computer/laptop, with 94.17 points, therefore being in agreement with the literature [14]. This can suggest that the website is more user-friendly when visited on a computer, rather than on the smartphone. This might

be explained since most of the online course educational contents are available in kind of a PowerPoint presentation mode, which might be more adequate for a computer/laptop screen. However, these contents can be easily downloaded as a PDF file, allowing not only to access to the presentations offline, but also to zoom in/zoom out the contents with ease and outside the browser. Nevertheless, the small sample of participants in this study make these comparations and assumptions hard to generalize. Moreover, it was also not possible to assess the usability scores on tablets, since none of the respondents employed this type of device to evaluate the online course.

The intended use of user interaction to move forward throughout the contents confers a self-paced navigation, giving the user-student the capacity to start and stop the learning process whenever he/she feels like so. Also, both the almost complete lack of instructions and t trust-based forwarding (the user choses to check each module as complete whenever he/she feels like so) in the course confers a level of trust that elevates the student as an element in control and not under it. The limitations only arise when it comes to obtain the final certificate, for which the student has to correctly respond to four quizzes of two questions each.

5. Conclusions

The usability study using SUS confirmed to be, once again, an easy way to gather qualitative outcomes from users, and aided as a preparation for a pilot-study involving health professionals. All will be selected from outside the ARS-C to assess and evaluate the online course and app. Following the pilot study, a cluster randomized controlled trial will take place, covering all general practitioners and community pharmacists in Centre Region of Portugal, belonging to the Regional Health Administration of the Centre of Portugal. The centre region will be divided into eight spatial clusters, four clusters allocated to the intervention group and other four to the control group. Both the pilot study and the cluster randomised controlled study will consist of an outreach visit with the presentation of the eHealthResp online course.

The evaluation of the developed e-learning tool presented positive overall assessments regarding ease of use, complexity, functionalities integration and consistency. The conclusion of the course contents by all participants without any assistance from the researchers also hints at an intuitive navigation.

This study validates the research into the next phase with an increased group of participants under the eHealthResp project.

Funding

This study was financially supported by Project eHealthResp [PTDC/SAU-SER/31678/2017], funded by the operational program of competitiveness and internationalization (POCI), in its FEDER/FNR component POCI-01-0145-FEDER-031678, and the Foundation for Science and Technology, in its state budget component (OE) and by Institute of Biomedicine – iBiMED (UIDB/04501/2020 and POCI-01-0145-FED- ER-007628)

Acknowledgements

We thank Tânia Magalhães Silva PhD, (iBiMED/UA) for her collaboration on the revision of the manuscript.

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