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Usability Study on Two Handheld Computers to Retrieve Drug Information

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Abstract

Objective :Performing a usability study on two handheld computers (personal digital assistant and tablet PC), as tools for retrieving drug information.
Materials and methods: A randomised crossover study was performed: 34 students in pharmacy and medicine used the two handheld tools in a randomised order, to answer a questionnaire containing 12 questions covering all the aspects of a drug database and a qualitative analysis on six different items to measure access to drug information. The availability of the drug information database Vidal on PDA and on tablet PC implied our choice of the database. Three main criteria for evaluation were chosen: success rates, time-on-task, and number of clicks.
Results: There were no significant differences between the two groups neither on age, sex, medical discipline, study years nor previous computer practice. The success rate is significantly higher with the PDA for only one question. The PDA is significantly faster than the tablet PC on 7 of the 12 questions and generates fewer clicks for 3 questions. Compared to the tablet PC, it appears that the PDA is better in terms of clearness, navigability and usefulness for professional practice and it is the only tool which is significantly preferred to all other supports.
Conclusion: In this study with students, the PDA is significantly more effective quantitatively and qualitatively than the tablet PC to retrieve drug information.

Keywords:
Drug therapy, Computer assisted; Computers, Handheld; Ergonomics

1. Introduction

Since the last ten years, the handheld tools are diversified and numerous. Among them, the personal digital assistants (PDA) are already largely integrated into the professional and private life. They are used by the general population as well as the health community. Many physicians and pharmacists have integrated tools into their current bedside practice [1-2]. More recently, the tablet PC is a peculiar and new type of portable microcomputer. It did not reach yet neither all its applicability nor all the popularity which it may hope to reach. However, it already found a place of choice while being used at the bedside of patients in several French hospitals (Hospital European George Pompidou, Rouen University Hospital). The usability studies occupy an increasingly significant place in health informatics and telematics [1-2].

The objective of this study is to determine if there is a significant difference in use between the two handheld tools chosen, namely, the personal digital assistant and the tablet

PC, to retrieve drug information, and to measure, if there is any significant difference in their respective effectiveness.

2. Material and Methods

The Rouen Pharmacy and Medicine Faculty set up an evaluation of two of these handheld tools (PDA and the tablet PC) by a group of voluntary students in medicine and in pharmacy. The usability study was performed on the only French drug knowledge base available on these two tools, namely the Vidal® drug knowledge base. The Vidal accessible on the Tablet PC was the Intranet version of this drug knowledge base. This study was performed during a Master's degree of Medical Informatics (SL) [3].

The model of the study used as a starting point another usability study carried out in Rouen on the Doc'CISMeF search engine [4]. This previous study was a collaboration with the Lille Ev@lab [5], laboratory of ergonomics. The current study also benefits from a 12-year experience in the Rouen University Hospital (RUH) to access electronically the Vidal® drug knowledge base first on a mainframe [6] and later on the RUH Intranet.

This usability study was made on a test user without video recording. All the 34 participants are students in pharmacy and medicine. They were recruited on a voluntary basis. The participants had to fill a questionnaire inspired by another study in progress in the Lille laboratory of ergonomics.

This study has tested the three main aspects of usability : efficiency, effectiveness and satisfaction end-user. The principal criterion to measure the handheld tool efficiency is the success rate for each question of the questionnaire. The success is measured by finding the right answer to the question within a five-minute limit. Two secondary criteria were also selected to estimate the effectiveness of the handheld tool: time in seconds to answer one item of the questionnaire and the number of clicks to answer it. The final qualitative evaluation was used to estimate the user's satisfaction. After a development phase of the study, the evaluation were proceeded on two and half months (from February to April 2004). Thirty four students were included during this time period. Finally, the study was enclosed one month later after statistical analysis of the results.

The study is a prospective, randomised, cross-over study: any student which has participated in this study was his/her own witness. The order attribution of the handheld tools used by the students were chosen according to a randomisation table with two arms. The two arms defined in this study are: the PDA-TPC arm: answers to the questions series are initially required by using first the PDA and next the tablet PC (TPC). And the TPC-PDA arm : the answers to the questions series are initially required by using the tablet PC and secondly the PDA.

This study was an "in vitro" study, which took place in the conference room of the RUH Informatics and Networks Direction because it required a room provided with a wireless network and the handheld tools in the proximity, and furthermore it also needs silence to fill properly the questionnaire. That is why we preferred the choice of an in vitro study vs. an in vivo study in a clinical department, which was already feasible in 2004.

The sessions followed by each participant were carried out by the same trainer and appraiser and lasted each one approximately ninety minutes. The questionnaire of the study includes three parts. The first part checks the profile of the participant: their age, their previous practice in handheld tools use and on drug knowledge bases. The second part of the questionnaire is dedicated to the quantitative evaluation and comprises twelve questions which cover all the main aspects of the drug knowledge base. These questions were elaborated so that each one answers a given set of themes and a possible interrogation in clinical situation (e.g. question 9: Give the list of the drugs, which can be prescribed in case

of onchocerciasis or question 5: you wanted to prescribe Nordazepam to a patient, who is intolerant to gluten. Is it possible?). The last part of the questionnaire relates to the qualitative evaluation.

The user's satisfaction of these two handheld tools are appreciated by the participants with five criteria: design, presentation clearness, navigability, and estimated utility of these tools to facilitate the daily professional practice. Each criterion was analysed distinctly by using a 5-point Likert scale: very bad, bad, well, very well and without opinion. Finally, it was requested from the participants to establish a preferential classification of the drug databases available in French among six drug databases: Vidal PDA, Vidal Tablet PC on Intranet, Vidal Intranet via a "regular" microcomputer, Vidal on Internet (URL: www.vidal.fr), Vidal as paper textbook, and finally another drug database Theriaque (URL: www.theriaque.org), mostly used by pharmacists.

The data on the participants profile are compared between the two arms of the study (Wilcoxon nonparametric test for the age, Fisher test or chi-square test for the qualitative variables). A possible influence of evaluated by the Wilcoxon nonparametric test, as well as the possible influence of the preliminary knowledge of the PDA on the number of successes by PDA. The binary criterion of judgement (success/failure) was then evaluated for each of the twelve questions by the methods specific to the cross-over studies: interaction study between the support (PDA or T.PC) and the order (PDA-T.PC arm or T.PC-PDA arm), then study of the support effect. In the absence of interaction, the comparison between the two supports was carried out on the whole of the data by a Mc-Nemar test. In the other case, only the data of the evaluation first period were analyzed by a Fisher test.

The criterion "response time" was analysed by similar methods but specific to the continuous variables (Wilcoxon nonparametric test on the time differences during the two periods of evaluation if there is no interaction, and Wilcoxon test over time during the evaluation first period if there is an interaction). For the students having given up a search before the five-minute limit, time corresponding was fixed at five minutes. The criterion "numbers of clicks" was evaluated by the same methods for the criterion " response time" but for the only questions where all the students answered successfully for the two supports, in order to compare their ease of use. For these three criteria, a Bonferroni procedure was adopted to take account of the repetition of each criterion on the various questions. Was the degree of significance, p, thus regarded as significant for an two-tailed 5% error if $p \leq 0.050$ is divided by the number of questions (twelve for the binary criterion and for the time, i.e. $p<0.004$).

The qualitative criteria of evaluation (design, presentation clearness, navigability, and estimated utility of these tools to facilitate the daily professional practice) were evaluated by the sign nonparametric test (paired comparisons) and the criterion "preference" was evaluated by the Friedman's nonparametric test. For these criteria, the degree of significance, p, was regarded as significant for a 5 % two-tailed error if $p \leq 0.050$. The whole statistical analyses were carried out using SAS software.

3. Results

The compared analysis of the two arms populations of the study highlights no significant difference on sex, mean age, studied discipline and university level (pharmacy or medicine). No effect of the preliminary knowledge about the tablet PC or VidalCIM® could be highlighted on the successes number. Of the same Tablet PC, no effect of the knowledge of the PDA could not be highlighted on the number of successes by PDA. An effect of the knowledge of VidalPDA® could not be tested: the study counts only two preliminary users of VidalPDA®. The interaction between the order and the support on the twelve questions (Fisher's exact test, significant difference for an 5% error if $p\leq 0.004$) was

tested beforehand. No interaction was highlighted. In the absence of interaction, the handheld tools then could be compared with a McNemar's test (significant difference for an 5% error if $p \leq 0.004$) This test is based on the analysis of the unmatched pairs of results. Thus only three questions comprised unmatched pairs and were testable. The order and support interaction was carried out beforehand on the twelve questions (Wilcoxon's test, significant difference for a 5% error if $p=0.004$) about the time criterion. Except for Question 9, for the main criterion of this study "success rate for each question of the questionnaire", there is no significant difference between PDA and Tablet PC. For Question 9, the PDA has a significant better success rate; (Tablet PC success rate (SR) = 18% when randomised first and 18% when randomised second ; PDA success rate (SR) = 71% when randomised first and 100% when randomised second; $p<0.001$ using the Bonferroni procedure).

For the criterion "time in seconds to answer one item of the questionnaire", the PDA was significantly faster than the Tablet PC for 7 out of the 12 items of the questionnaire while Tablet PC were never significantly faster than PDA (e.g. for question 2: average time in seconds for Tablet PC = 54.3 ± 23.29 when randomised first and 40.71 ± 15.93 when randomised second; average time in seconds for PDA = 39.94 ± 31.43 when randomised first and 21,47 ± 5,38 when randomised second; $p<0.0001$ using the Bonferroni procedure).

For the criterion "number of clicks", only 4 items were testable, where all the students answered successfully on the two tools, and are tested in order to compare the ease of use of these tools. The Wilcoxon test highlights significant differences for each one of these questions. A less number of clicks are significantly necessary for three questions with the PDA compared with the tablet PC. For one question, a less number of clicks are significantly necessary with the tablet PC compared with the PDA.

For three out of four qualitative criteria (presentation clearness, navigability and assistance to the daily professional practice), the PDA was significantly better rated (see Table 1). No significant difference was found for the criterion "Design".

Table 1: Good quality of navigability?

	Disagree	**More or less disagree**	**More or less agree**	**Agree**	**No opinion**
	% (n)	% (n)	% (n)	% (n)	% (n)
PDA	2.9% (1)	2,.% (1)	17.6% (6)	76.5% (26)	0% (0)
Tablet .PC	0% (0)	29.4% (10)	55.9% (19)	14.7% (5)	0% (0)

p<0,001, sign test

The Friedman test analyses all the six drug knowledge bases proposed to the thirty four participants (see Table 2). If the test highlights a difference, the tools can then classified according to their mean score. Once classified and according to their classification order, a sign test is applied for a two by two test. The analysis of the user's choice with the sign test highlights a significant difference between Vidal on PDA and Vidal on the tablet PC ($p<0.0001$ using the Bonferroni procedure). Furthermore, Vidal on PDA is significantly preferred by the users vs. the four other bases. For the five others, no significant difference has been found, although theree B.78 69.9 0.96 ref217.872t]TJ0.00p<0.0001 ussphe thirty four