

Usability Tool to Support the Development Process of e-Commerce Website

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Abstract. Inappropriate usability features in virtual stores can be verified by the high dropout rate of the shopping cart, the increase in maintenance costs and the low conversion rate on the site [1, 2]. Some factors and characteristics, such as inadequate site navigation, the difficulty of finding the shopping cart, the lack of detailed information about the product, a long and confusing checkout process, and few or only image of the product indicates usability problems in e-commerce website [3, 4]. The quality of this type of site can be considerably improved when usability is integrated into the development process of e-commerce site. This work aims to propose a tool to assist and support the development process of e-commerce site focused on usability. This research is characterized, as regards its nature, as a qualitative-quantitative research and, in terms of its objectives, as an “exploratory” research, since it provides greater knowledge of the problem in order to make it more explicit. The creation of the tool will help development teams to create efficient, effective and satisfactory e-commerce sites from the specification of usability requirements, usability metrics and usability evaluation methods.

Keywords: Usability · e-Commerce · Requirement · Metric · Evaluation method

1 Introduction

Electronic commerce is the buying and selling of products or services through electronic media, such as Internet and other computer networks [5]. An online store is an advanced website that gives the ability to buy products over the Internet. Online shops are one of the forms of electronic commerce and work mostly in the business-to-consumer (B2C) business model; so products offered by companies are directed to individual customers. This form is becoming each year more and more popular due to convenience and the lower cost of sales and also allows one to quickly compare prices from various suppliers [6].

An online store is currently one of the most popular forms of doing business on the Internet. Its effectiveness is dependent upon many external factors such as brand recognition, the volume offered and level of the offered prices. However, the popularity and willingness to use the selected store by Internet users is also affected to a large extent on internal factors of ease of use of the this store. These factors include consideration of various aspects of the discipline known as usability [6]. Usability can be

defined as “the degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [7].

In this paper we present a tool to assist and to support the development process of e-commerce website focused on usability. The creation of the tool will help development teams to create efficient, effective and satisfactory e-commerce websites from the identification of usability requirements, usability metrics and usability evaluation methods. The identification of requirements is the basis for the software development process and it is recommended that teams devote time and effort to the correct lifting of the same. The metrics are fundamental to obtain indicators regarding the use of the site, being possible to analyze and identify possible usability problems. Usability evaluation methods can be used throughout the development process, from idea, design, simulation, test prototype or final software, and it is critical to assess whether the site is effective, efficient and user-friendly.

Presently, no tools exist that would enable e-commerce teams to develop their e-commerce websites without engaging usability engineers [8]. It was identified more than 100 articles that shows tools to help teams in applying usability heuristics, recommendations and metrics, but none shows requirements, metrics and evaluation methods combined.

2 Background and Related Work

What constitutes a good website has been traditionally explained by relating it to user and usability. In other words, a successful and preferable web site generally refers to one with high usability, which is user-friendly and user-centered in interface and functional aspects. Nielsen [3] stated that usability is associated with learnability, efficiency, memorability, errors and satisfaction.

The literature currently offers several definitions of Usability:

1. The capability of the software product to be understood learned, used and attractive to the user, when used under specified conditions [9].
2. 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 [10].

We briefly introduce three topics, which are the basis of our research; first we explain what is usability requirement and show some that can be used in e-commerce websites. Next, we reference usability metrics and show some examples. Finally, we explain what usability evaluation method is and show examples that can be used in e-commerce websites.

2.1 Usability Requirements

Several studies suggested guidelines and requirements to help design a better web site. Their focuses mainly lie in usability, although a few guidelines include aesthetic

aspects [7]. The quality of e-commerce websites can be improved by abiding such web design guidelines, increasing the high level of usability.

Numerous authors have proposed ergonomic principles, recommendations and heuristics, which constitute a set of ergonomic qualities that interfaces should have [11–13]. The literature currently offers several examples of usability requirements [3, 4, 8]: interface elements (e.g. menus) should be easy to understand; the system should be easy to learn; actions which cannot be undone should ask for confirmation; error messages should explain how to recover from the error; the interface actions and elements should be consistent; the screen layout and colour should be appealing; the homepage of e-commerce websites should display numerous product offerings rather than just displaying one or two products; the ‘Add to Cart’ button should be obvious, bright, and prominent in comparison to other features on product page such as wish-lists, view product, email to friend, or check out buttons.

The purpose is to establish usability requirements which can be tested later in the development process.

2.2 Usability Metrics

It is necessary to measure those requirements using metrics. “A metric relates a defined measurement approach and a measurement scale. A metric is expressed in units, and can be defined for more than one attribute” [12]. A metric is a way of measuring or evaluating a particular phenomenon or thing. In the usability field, there is a set of specific metrics, like task success, user satisfaction, and errors, among others. Usability metrics can help reveal patterns that are hard or even impossible to see [13].

Some authors have proposed usability metrics, which constitute a set of indicators to use in evaluations [8, 12, 14–16]. Gabriel [8] developed a set metrics measures usability of Business-to-Consumer (B2C) e-commerce sites. The metrics consist of multiple usability indexes. Each of these indexes assesses usability of a particular aspect of the site. The developed usability indexes measure usability of: Navigational support (UI navig); Product search mechanism (UI srch); Product listings (UI pl); Product comparison mechanism (UI cmp); Product information presentation and product selection aspects of a site (UI pips); and others.

These metrics should be used during the development process and collected using a questionnaire or other usability evaluation method.

2.3 Usability Evaluation Methods

It is necessary to evaluate how much websites made by considering the web design guidelines actually satisfy users. For this, many researchers have traditionally emphasized usability: usability of a website is measured taking into account users’ perspectives, and thus it can be continuously improved for the benefit of target users through an iterative cycle of development. Over time, methods and techniques to measure usability – usability evaluation methods – have been developed. The goal of the usability evaluation methods is to make a website more usable and preferable by

finding what needs to be changed or developed in the website as much as is possible in terms of time and cost.

The usability evaluation methods are classified by two criteria: analytic methods or empirical methods; and expert evaluation, model evaluation, user evaluation, or evaluation location [7]. The literature currently offers several examples of usability evaluation methods [3, 4, 7, 14, 16, 17]: Heuristic evaluation, Focus group, Usability testing, Questionnaire, Scenarios, Card Sorting, Surveys, Interview, and others. Usability evaluation methods focuses on how well users can learn and use a website to achieve their goals [15]. It also refers to how satisfied users are with that process. To gather this information, those and other methods can be used to gather feedback from users about an existing website or plans related to a new website.

3 Methodology

This research is characterized, as regards its nature, as a qualitative-quantitative research and, in terms of its objectives, as an “exploratory” research, since it provides greater knowledge of the problem in order to make it more explicit. Initial interviews were conducted to identify the barriers and difficulties that team members have during the e-commerce websites development process in relation to the usability application. The interviews were composed of three questions and were attended by six team members, one project manager, two interface designers, two programmers and one tester. The professionals interviewed were, on average, 33 years, 2 to 10 years of experience in general website development and different levels of experience in the development of e-commerce websites. After that, usability requirements, usability metrics and usability evaluation methods were identified to be used during the development process of e-commerce websites.

Next steps of this work will be connecting all the requirements, metrics and evaluation methods to each other. From the association between usability requirements and metrics, it will be possible to obtain indicators to ensure that the requirements are being accomplished. The connection between the usability requirements and the metrics aims to facilitate the identification of the indicators; however, only with this relation is not possible to build more effective, efficient and pleasant e-commerce websites for different types of users. To ensure that the requirements are indeed accomplished, it will be necessary to collect usability metrics, from empirical or non-empirical evaluations, and analyze them to identify possible usability issues that users may face in interaction. By doing so, it will be possible to build the tool being necessary to make tests and to validate the previous results.

4 Results and Analysis

4.1 Questionnaire

Initial interviews were conducted to identify the barriers and difficulties that team members have during the e-commerce websites development process in relation to the

usability application. The interviews were composed of three questions. The professionals interviewed were men and women who have, on average, 33 years, two to ten years of experience in general website development and different levels of experience in the development of e-commerce websites. Six professionals were interviewed (four men and two women) and they belonged to development teams: one as project manager, two as interface designers, two as programmers and one as tester. Among the professionals, five were graduated in Information Technology field and one was in college.

Based on the premise that there are usability recommendations and tools that evaluate usability, available on websites, books, articles and other researches, it is intended to identify why these teams do not use the material available about usability, or if it is used, what are the most common difficulties during the process. The first question was: **“What is(are) the reason(s)/barrier(s) that makes you (or your team) do not use or use in the wrong way or only partially the usability recommendations? Why?”**. From this initial questioning, the greatest barriers for the use of usability are:

- Time: some interviewees said that sometimes it is not possible to design using usability principles because the website must be developed quickly in the required time, and there is no time left to include the usability.
- Requirements: some interviewees said that the requirements do not cover usability, so, who plans, design or implements does not use it in the website what is not in the requirements passed to them.
- Knowledge: some interviewees reported that have some knowledge about usability but recognize that they need to read and to learn more about usability in e-commerce websites and update themselves on usability recommendations. Some interviewees said that the reason of lack of knowledge is the lack of time to study. Two interviewees said that use finished template and just modify some interfaces elements; however, they did not consider many usability elements for do it.

The second question were due to identify what is(are) the more difficulty phase(s) of development process to apply the usability and why. The question was: **“What is(are) the phase(s) of development process of e-commerce websites that you have more difficulty to apply the usability principles? Why?”**. To help the interviewees answer the question without hesitation, the generic phases, proposed by Sommerville [18], presents on software development (Specification, Design, Implementation, Validation and Evolution) were presented.

It was verified that the teams members have difficulties during the development of e-commerce websites and the phases that most require the application of usability principles are: Specification and Design. During the Specification, the principles are used to help the team to define the requirements, content, behavior and the virtual store's functions. During the Design, principles are used to define layout, architecture, graphic design, content sketching, navigation flow and others common structures of store. All interviewees commented that if in these first two phases (Specification and Design) the usability principles were incorporated into the development of the e-commerce website, the following phases would be simpler to apply usability.

One person commented *“Early phases [Specification and Design] is more important to think more about usability. In those phases is that the team will define how the interface should be. The usability requirements should be very thorough, as this will impact everything that happens next [in the next phases]”*. Another interviewee commented, *“If in those phases [during the Specification and Design phases] everything is correct about usability, I’ll code as they designed. If designed with usability, I’ll code with usability. That’s simple!”*. Another interviewee commented, *“I test the website according to the specifications and requirements defined. If the usability is not defined there, I will not test it on the website”*.

The third question was based on the purpose of this word. Interviewees were asked about the utility of the proposed tool. The question was: **“If there were a tool focused on usability that could assist and support team members during the process of developing e-commerce sites, would it be useful? Would you use it? Why?”**. All interviewees reported that if there were a tool focused on usability it would be useful and used to diminish potential risks involved in the Specification and Design phases. However, some interviewees noted that this tool should be easy to use. *“The tool would fall from the sky for us, but it has to be easy and practical, otherwise it will give more work,”* said one interviewee.

4.2 Identification of Usability Requirements, Usability Metrics and Usability Evaluation Methods

A systematic review was conducted to identify usability requirements, metrics and evaluation methods. According to Biolchini et al. [19], a systematic review is a method that allows identifying and evaluating all the research carried out around a certain topic. The protocol, proposed by Biolchini et al. [19], served as the basis for this work and researches were carried out in three different databases: EBSCO, Scopus and ProQuest. All five stages of the protocol were followed: (1) Propose research questions; (2) Make the selection of the sources and define the research strategies; (3) Define the criteria for inclusion and exclusion of researches; (4) Collect the results and review all selected articles; and (5) Answer the research questions.

Table 1 shows the number of researches identified in each database.

Table 1. Number of researches identified in each database.

Description of terms searched	ProQuest	EBSCO	Scopus	Total
Usability requirements for e-commerce websites	26	13	1	40
Usability metrics for e-commerce websites	59	27	4	90
Usability evaluation methods for e-commerce websites	25	4	0	29

After reading the papers, it was identified 160 usability requirements, 78 usability metrics and 10 usability evaluation methods.

4.3 The First View Tool

The tool is under construction. Its purpose is to relate all the requirements, metrics and evaluation methods identified with the phases of the development process. Figure 1 shows one requirement and the relations among metrics and evaluation methods.

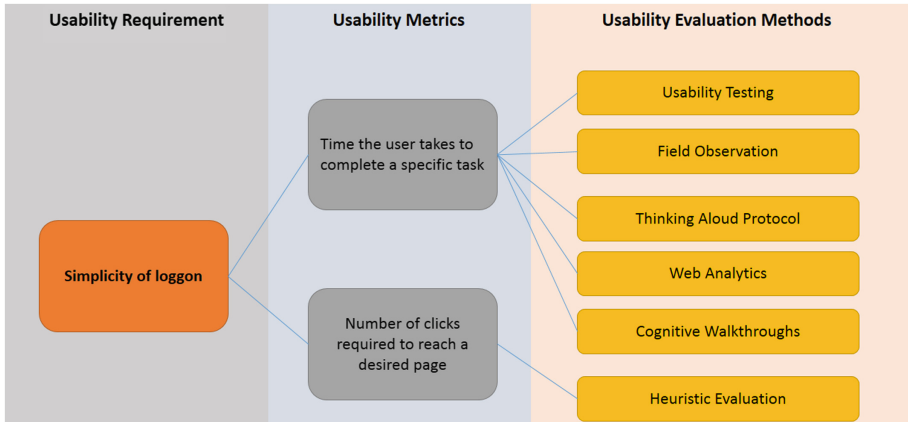


Fig. 1. Relation between usability requirements, metrics and usability evaluation methods.

It will be necessary some steps to finish the tool:

1. To connect all the requirements, metrics and evaluation methods to each other;
2. To relate all the requirements, metrics and evaluation methods to the development process's phases. The tool will propose a list of the requirements, metrics and evaluation methods that can be used in each phase of the process, giving professionals a more focused view of each phase individually;
3. To make tests with real users to validate the previous results.
4. To implement the tool using some programming language.

5 Conclusion and Discussion

The present work aimed to propose a tool to assist and support the process of e-commerce website development with a focus on usability. The purpose of the proposed tool is to integrate usability into the process of developing e-commerce sites, supporting and assisting development teams during all phases of this process.

In the first place, this work considers that the user's tool is a member of development teams, being able to exercise countless positions, such as developer, tester, software architect, systems analyst, among others. The research is based on the creation of the tool, which relates requirements, metrics and usability assessment methods, to be used by the defined audience.

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References

1. Alshehri, M., et al.: Adopting e-commerce to user's needs. *Int. J. Comput. Sci. Eng. Surv. (IJCSSES)* **3**(1), 1–11 (2012)
2. Kosciński, A.: *Qualidade de Software: Aprenda as Metodologias e Técnicas Mais Modernas Para o Desenvolvimento de Software*, 2nd edn. Novatec Editora, São Paulo (2007)
3. Nielsen, J.: *Ecommerce usability improvements*. Nielsen Norman Group, 24 October 2011. www.nngroup.com/articles/e-commerce-improvements/
4. Cybis, W., Betiol, A.H., Faust, R.: *Ergonomia e Usabilidade: Conhecimentos, Métodos e Aplicações*, 3rd edn. Editora Novatec, São Paulo (2015)
5. Carmona, C.J., et al.: Web usage mining to improve the design of an e-commerce website: *OrOliveSur.com. J. Expert Syst. Appl.* **39**(12), 11243–11249 (2012)
6. Nowakowski, M.: Application of usability test for the analysis of a search system in online stores. *Stud. Proc. Pol. Assoc. Know. Manag.* **72**, 39–49 (2014)
7. Distant, D., Garrido, A., Camelier-Carvajal, J., Giandini, R., Rossi, G.: Business processes refactoring to improve usability in e-commerce applications. *Electron. Commer. Res.* **14**(4), 497–529 (2014)
8. Gabriel, I.J.: Usability metrics for measuring usability of business-to-consumer (B2C) e-commerce sites. In: *Proceedings of the 6th Annual ISOOneWorld Conference*, Las Vegas, NV, 11–13 April 2007, pp. 74.1–74.19 (2007)
9. ISO/IEC 9126-1:2001: *Software Engineering—Product Quality—Part 1: Quality Model*, June 2001
10. ISO 9241-11:1998: *Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) – Part 11: Guidance on Usability*, March 1998
11. Bastien, C., Scapin, D.: RT-0156 – Ergonomic criteria for the evaluation of human-computer interfaces (1993). <http://www.inria.fr/rrrt/rt-0156.html>
12. Shneiderman, B., Plaisant, C.: *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 4th edn. Addison-Wesley Publishing Company, Boston (2004)
13. Nielsen, J.: *Usability Engineering*. Morgan Kaufman, San Francisco (1994)
14. Bertoa, M.F., Vallecillo, A.: Usability metrics for software components. In: *Proceedings of the 8th ECOOP Workshop on Quantitative Approaches in Object-Oriented Software Engineering (QAOOSE 2004)* (2004)
15. Tullis, T., Albert, B.: *Measuring the User Experience: Collecting, Analyzing and Presenting Usability Metrics*. Morgan Kaufmann, Burlington (2008)
16. Rogers, Y., Sharp, H., Preece, J.: *Design de interação: além da interação humano-computador*, 3rd edn. Bookman, Porto Alegre (2013). 585 p.
17. Usability.GOV. *Usability Evaluation Basics*. <https://www.usability.gov/what-and-why/usability-evaluation.html>. Accessed Feb 2017
18. Sommerville, I.: *Software Engineering*, 9th edn. Addison-Wesley, Boston (2010)
19. Biolchini, J., Mian, P.G., Natalli, A.C.C., Travassos, G.H.: *Systematic Review in Software Engineering*. Technical report RT-ES 679/05, COPPE/UFRJ (2005)

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