VISUAL REVIEW | Vol. 17, No. 1, 2025 | ISSN 2695-9631
International Visual Culture Review / Revista Internacional de Cultura Visual
https://doi.org/10.62161/revvisual.v17.5357

VISUAL COMPONENTS IN WEB USABILITY
Analysis of e-Commerce

LAURA MELENDO-RODRÍGUEZ-CARMONA [1], PILAR YUSTRES-DURO [1], PABLO GUTIÉRREZ-RODRÍGUEZ [2], PEDRO CUESTA-VALIÑO[3]
[1] Universidad Camilo José Cela, Spain
[2] Universidad de León, Spain
[3] Universidad de Alcalá, Sapin

KEYWORDS

Visual design
Visual content
Usability
E-commerce
Retail
Consumer behaviour
User experience

ABSTRACT

The growth of e-commerce, coupled with the necessity to enhance the online experience of consumers, underscores the importance of examining the visual aspects of the web, particularly in terms of usability and its associated indicators. This research aims to make a contribution to the field of e-commerce studies through an empirical study based on structural equation modelling (SEM). In this study, the five usability indicators will be measured (learnability, efficiency, memorability, errors and satisfaction) and the extent to which they influence the usability of an e-commerce site will be determined. The study yields significant results within the research area.

Received: 02/ 09 / 2024
Accepted: 15/ 09 / 2024

1. Introduction

The growing significance of e-commerce has prompted brands to leverage it as a means of accelerating their growth, particularly in the fashion industry. This is evident in the pursuit of creating an experience that evokes the same level of satisfaction in both the online and physical domains (Gutiérrez-Rodríguez et al., 2020; Cuesta-Valiño et al., 2022). This experience is largely shaped by the design of these environments. Consequently, brands must adapt to the continuous changes in consumer behaviour, offering products and services aligned with their evolving needs (Lavanda Reyes et al., 2022). This includes the provision of visually appealing solutions that address some of these emerging needs promptly. This is primarily attributable to the surge in online purchases and the growing consumer inclination towards omnichannel shopping (Yustres Duro & Melendo Rodríguez-Carmona, 2022; Dogra & Kaushal, 2023). This preference is attributed to the convenience and cost-effectiveness of the online shopping experience, which is perceived as a more efficient alternative to traditional brick-and-mortar stores (Cavazos-Arroyo et al., 2024).

This adaptation can occur in various ways, primarily in the visual domain. For instance, the use of TikTok as a visualisation tool (Rodríguez Hernández & Vázquez Sacristán, 2024), the design of mobile applications (Ramos et al., 2023), brand authenticity or brand identification strategies (Jos Additionally, QR codes can be found in physical shops or on television (Gallardo-Camacho & Melendo Rodríguez-Carmona, 2023), as well as in corporate social responsibility strategies (Cuesta-Valiño et al., 2024) that are oriented towards responsible consumption (Cristancho-Triana et al. (2024) propose that this phenomenon can be observed in the visual composition of media advertising (Melendo Rodríguez-Carmona & Yustres Duro, 2023) or in the design of e-commerce web usability (Melendo Rodríguez-Carmona et al., 2024).

The primary objective of this research is to ascertain the dimensions that comprise the usability design of e-commerce. To this end, a survey of the Spanish population is conducted, which is then analysed through the lens of structural equation modelling using PLS-SEM. The ensuing results are subsequently presented, followed by a discussion thereof. Ultimately, conclusions, contributions and prospective avenues of inquiry pertinent to the subject matter are proffered.

2. E-commerce Usability Design

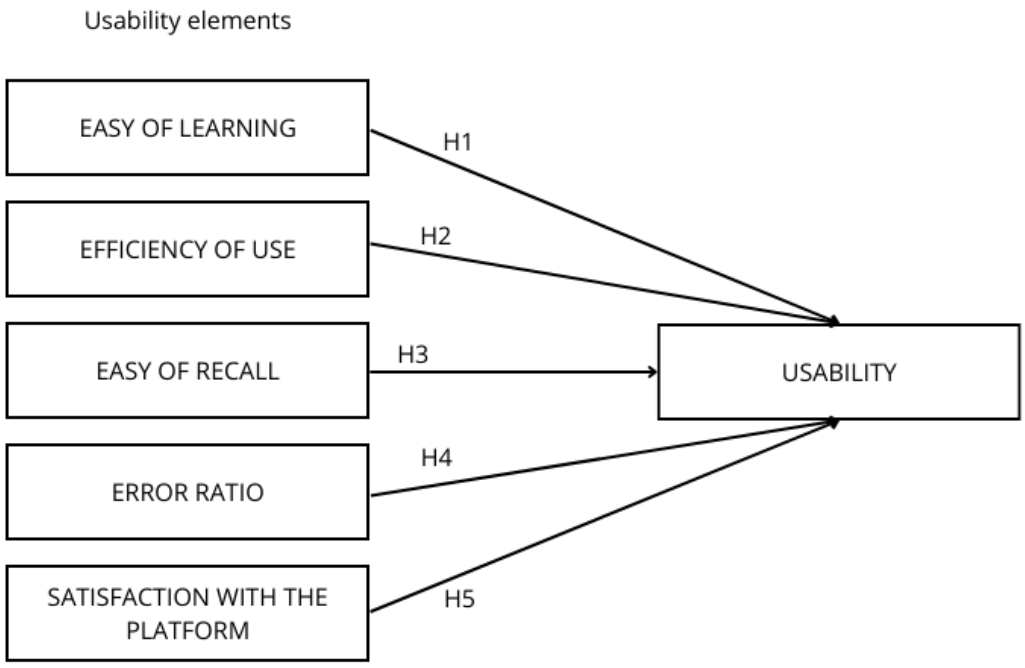
The concept of usability can be defined as the extent to which a website's design is functional, natural, desirable and effective. This encompasses the manner in which the content, design and aesthetics are presented. The concept of usability has been the subject of study by authors such as Nielsen (1993) since the 1990s. This author examines usability and usefulness as two key attributes of system functionality. Consequently, he posits that usability constitutes the visual aspect of functionality, namely the manner in which users can utilise this functionality. Additionally, he posits that usability is constituted by five primary attributes: ease of learning, efficiency of use, ease of recall, errors, and user satisfaction. Subsequently, Lewis (1995) posited a theoretical framework for usability, delineating it as a multidimensional construct comprising various attributes, including user satisfaction, task completion time, and the suitability of the information presented in the medium. Concurrently, Kreke et al. (1995) posit that the visual enhancement of usability can be achieved through the naturalness of the user interface, wherein the usability and user-friendliness of the user interface become the paramount determinants of consumer satisfaction with the platform's usability.

At the present time, Razzak et al. (2023) employ a methodology that encompasses user feedback, application features, user experience, comparative market values, design principles, error handling and general feedback in order to assess the usability of a given design. Saha et al. (2023) define the visual aspect of usability as a metric for evaluating the efficacy of any interface, ascribing to it characteristics such as efficiency, ease of recall, ease of learning, errors and interface aesthetics. Similarly, Samawi et al. (2023) identify navigation, information architecture, content value, satisfaction, aesthetics and coherence and functionality as attributes of usability design. Su et al. (2023) identify the following attributes of the visual part of usability: self-learning assistance, fidelity simulation, comparison, diagnosis, satisfaction, intention to use, usefulness, usability, ease of use, image and entertainment.

3. Visual Components of Usability Design

It is therefore of interest to examine the various visual elements of usability design in order to gain a deeper understanding of them and to identify which are the most pertinent. This study will analyse the classic visual usability components (Nielsen, 1993), which are: ease of learning (Ali et al., 2022), efficiency of use (Toraman et al., 2023), ease of recall (Weichborth, 2020), error rate (El-Asaar & Farghali, 2022) and satisfaction with the platform (Barakovic et al., 2023). Each of the components, although based on more classical literature, reflect contemporary characteristics and properties, thereby ensuring their continued validity over time.

Figure 1. Proposed model



Source: Own elaboration, 2024.

The following section will provide a more detailed examination of the various elements that comprise usability design, with the objective of establishing greater consistency within the proposed model (Figure 1). The initial focus will be on the ease of learning, efficiency of use, ease of recall, error rate and satisfaction with the platform.

3.1. Ease of Learning

The ease of learning is defined as the simplicity with which a user can interact with a system. This is contingent upon the visual content of the site and the user experience, which are fundamental to this attribute. Ease of learning is regarded as the most fundamental usability attribute (Nielsen, 1993). This is because the majority of systems should be straightforward to learn. Preece (2001) discusses a similar attribute, which he refers to as the 'speed of learning'. This is defined as the time taken to learn to perform actions such as reading and sending messages, as well as to read and understand the information displayed on a screen. In other words, it is the time taken to become proficient in using a web design. Subsequently, Jeng (2005a) posits that the capacity for learning is constrained to the assessment of learning exertion. Conversely, Brown et al. (2013) posit that learnability is defined as the ability of users to readily comprehend the operational nuances of a system design. In contrast, O'Malley et al. (2014) define learnability as the perception of relative simplicity in becoming acquainted with the visual aspects of the software. Russ et al. (2014) define learnability as the ease with which end users can perform fundamental tasks upon initial encounter with the design.

Furthermore, Dominguez Vila et al. (2021) incorporate learnability into the domain of application content design, delineating strategies for the development of learning processes and the enhancement of the consumer experience with the visual elements of the web. El-Asaar and Farghali (2022) posit that learnability can be defined as the user's capacity to utilise the design of a system in order to accomplish the requisite task from the initial attempt. Kureerung et al. (2022) define learnability as the ability to rapidly comprehend and utilise the visual components of information, as well as the readability and actionability of the content. Ruiz Ledesma et al. (2022) define learning as the ease with which users can perform basic tasks from the initial interaction with the system. Kumar et al. (2023) employ a three-pronged approach to assess the ease of learning afforded by websites, measuring completion, responsiveness and the sense of learning derived from their visual appearance. The investigation of the initial indicator of usability in e-commerce has led to the formulation of the following hypothesis:

H1: The ease of learning is a visual component that has a positive impact on the design of e-commerce usability.

3.2. Efficiency of Use

The efficiency of use can be defined as the extent to which a system is designed in a way that allows for optimal use. This encompasses not only the functionality of the system but also the visual components of its graphical interface, which are fundamental to navigating the web and finding information. As posited by Nielsen (1993), the system must be efficient to use. Once the user has become proficient in navigating the system design, a high level of productivity is achievable. Preece (2001) does not cite the term 'efficiency of use' as an attribute of usability, but rather describes other components related to the visual aspect of the web, such as navigation and productivity. Palmer (2002) also discusses navigability, defining it as the sequencing of pages, a well-organised design and the coherence of the navigation protocol. Additionally, he addresses interactivity, which encompasses the capacity to personalise the appearance, style and content of websites, as well as the manner of interaction with users, namely the configuration of the visual aspect of a website. Nielsen and Loranger (2006) emphasise the significance of effective navigation, which should be predictable and encourage user confidence. The more efficient the system design, the greater the user experience, as users visit the web for its utility. Furthermore, they emphasise the importance of a website having high-quality content, as a well-designed interface that provides clear information about products is crucial for online purchasing decisions.

Ruiz Ledesma et al. (2022) posit that efficiency is contingent upon both the user's prior experience with the system and the time required to complete tasks within the visual domain of the web. Alhejji et al. (2022) examine the concept of effectiveness, defined as the accuracy and completeness with which users achieve the specified goals. In their study, AlSalem and AlShamar (2023) examine efficiency as a function of the time required for users to complete each task. Kumar et al. (2023) indicate that effectiveness is measured in terms of its design sub-attributes, namely the appropriate organisation, self-service enablement and preferred communication channel of the website. Ormeño et al. (2023) define efficiency as the ratio between the percentage of usability requirements successfully obtained and the time spent by the analyst in eliciting the usability requirements and drawing the GUI prototype. This leads to the formulation of the second research hypothesis:

H2: The efficiency of use is a visual component that has a positive influence on the design of usability in e-commerce.

3.3. Ease of Recall

The ease of recall is defined as the simplicity with which a user can return to a system after a period of inactivity. This can be assessed by determining whether the user is able to recall the design of the system. Nielsen (1993) posits that the design of the system should be straightforward to recall so that the occasional user can revisit the site after a period of inactivity without the need to relearn it from scratch. Preece (2001) refers to this concept by calling it 'retention'. In this context, we define 'retention' as 'ease of recall', which refers to the extent to which users remember how to operate within the visual part of the software after using it, or how much they remember about the design of the information the next time they visit a digital community. In their 2013 study, Brown et al. maintain the term 'ease of learning' to refer to the ability of users to easily remember how to perform tasks through the design of the system. Lacka and Chong (2016) also adhere to the established terminology for this attribute,

defining it as the ability of users of any technology to readily recall the steps required to perform a specific task, even after a period of non-use. Conversely, Weichborth (2020) defines ease of learning as the extent to which users can readily comprehend the functionality and interface of an application.

Ali et al. (2022) investigate the recall of a system design by comparing the results of repeating the same tasks in different sessions over time. El-Asaar and Farghali (2022) define recall as the subject's ability to remember and recall the steps of using the system when returning to it after a period of time without doing so through the visual components of the system. Kureerung et al. (2022) identify ease of recall of web design as a system or application that is easily remembered and as the minimum memory load needed to remember it. In their 2022 study, Ruiz Ledesma and colleagues define ease of recall as the ease with which a user remembers the functionality of a system design after a period of non-use. In conclusion, Kumar et al. (2023) posit that ease of recall encounters are contingent upon the visual presentation of accurate and pertinent information that is consistently updated. This leads to the following hypothesis:

H3: The ease of recall of a visual component positively influences the usability of e-commerce design.

3.4. Error Ratio

The term 'error ratio' is employed to describe the frequency of user errors in a system. As postulated by Nielsen (1993), the system design should exhibit a low error rate, whereby minimal errors are committed during the utilisation of the system and any errors that are made can be readily rectified. As posited by Kreke et al. (1995), users place a high value on innovative visual functionalities such as online assistance, which is directly related to the minimisation of user errors. Preece (2001) examines the phenomenon of user error in the context of interface design. He puts forth the proposition that interfaces are designed with the explicit intention of preventing users from making errors. To this end, he assesses the prevalence, duration, and recovery time for errors occurring in different parts of the system. Furthermore, he evaluates the degree to which the system provides assistance to users in the event of an error. Calisir and Calisir (2004) posit that a system must satisfy the following criteria in its visual design: error messages must be readily comprehensible; the capacity to undertake valuable work with the program prior to its comprehension; the provision of an undo function to reverse control actions; and the confirmation of queries before the execution of commands that may pose risks, thus enhancing perceived usefulness and learnability. Jeng (2005a) defines an error as a test of the ease with which users can recover from errors and the extent to which they are susceptible to making errors due to system design.

AlSalem and AlShamari (2023) put forth the proposition that user satisfaction is contingent upon the absence of errors in the system design. Kumar et al. (2023) put forth the proposition that the error rate can be quantified by three parameters: the overall system accuracy, the error rate, and the average latency. Other authors, such as Leung et al. (2023), posit that customers may readily encounter issues stemming from technical difficulties during the utilisation of the visual component of the system. Ruiz Ledesma et al. (2023) investigate the error rate, defined as the number of errors made by users during the utilisation of the system design. The study's focus is on the severity of these errors and the ease with which they can be rectified after an error has occurred. In conclusion, Toraman et al. (2023) address usability design errors from the perspective of prevention, as the user's perception of error prevention and minimisation with visual components such as error messages or prompts is of great importance. This leads to the formulation of the following hypothesis:

H4: A low error rate is a visual component that has a positive influence on e-commerce usability design.

3.5. Satisfaction with the Platform

Satisfaction with the platform can be defined as the level of satisfaction derived from the utilisation of a website. This encompasses the visual aspects of the website, including its harmonious and aesthetic design, the presentation of its content, images, and graphics, among other elements. In this context, Nielsen (1993) posits that the system must be visually appealing to users in order to engender a subjective sense of satisfaction. Preece (2001) discusses user satisfaction in relation to a number of factors, including user satisfaction with different aspects of the system, such as information design and

responsiveness. Palmer (2002) discusses aspects such as the visual content of a system, including the quantity and diversity of content contained therein. Hornbæk (2006) employs a range of methods to assess user satisfaction with platform design, including the use of standardised questionnaires, measures of preference, ease of use, specific attitudes, attitudes influenced by other individuals, attitudes towards interface content, perception of results, perception of interaction, aesthetic appeal, the perceived clutter on a screen, and even measures of user embarrassment. Zviran et al. (2006) define user satisfaction as end-user confidence in the system design, accurate information presentation, use of a clear presentation format, assurance of information timeliness and perceived ease of use.

Barakovic et al. (2023) posit that the aesthetic quality of a website can be defined as a subjectively pleasurable experience. This definition is linked to the concept of user satisfaction with the platform, as evidenced by a review of the literature. Kumar et al. (2023) investigate satisfaction with web design based on an analysis of customer feedback and an emphasis on personalisation. Although Dominguez Vila et al. (2023) do not explicitly discuss user satisfaction with the platform in their study, they do examine the functionality dimension, where functional design is defined as a paradigm for simplifying the design of hardware and software devices. This directly relates to the concept of a satisfactory web design. Ormeño et al. (2023) examine various facets of satisfaction, including that of the analyst, which pertains to perceived usefulness, perceived ease of use, and intention to use, and that of the end user, which is gauged through questionnaires on the usability of computer systems and satisfaction, with the analysts' recommendations incorporated. In conclusion, Toraman et al. (2023) examine the visual aspects of a website, specifically graphics, images and multimedia content, from the user's perspective. This encompasses the appropriateness, controllability and speed of viewing the aforementioned content, which may also be related to the user's satisfaction with the platform. The investigation into user satisfaction with the platform has led to the formulation of the following hypothesis:

H5: User satisfaction with the platform is a visual component that has a positive impact on the usability of e-commerce design.

4. Methodology

4.1. Survey Design

The questionnaire is composed of different parts. Initially, respondents are asked a behavioural question. This is followed by 23 questions about e-commerce usability and its components. Among these 23 questions, an additional question has been included to assess the questionnaire's validity. Additionally, three further behavioural questions and four further demographic questions have been incorporated.

The questions are measured through a five-point Likert scale, whereby participants indicate their level of agreement with the statement posed by answering 1 when they completely disagree, 2 when they disagree, 3 when they are indifferent to the answer, 4 when they agree and 5 when they completely agree. All questions in the questionnaire are based on validated scales. The ease of learning component consists of four questions, three of which are based on the work of Preece (2001) and one on that of Lewis (1995). The efficiency of use is assessed through four questions, one based on the work of Lewis (1995), one on Huang and Benyoucef (2013), and the remaining two on Jeng (2005a). The construct of ease of recall is measured by four items, three of which are drawn from Lacka and Chong (2013) and one from Brown et al. (2014). Three questions are proposed for the measurement of the error rate, two of which are based on the work of Lewis (1995) and one on that of Preece (2001). To assess user satisfaction with the platform, four questions are proposed, all of which are based on the work of Lewis (1995). Ultimately, to assess the usability of e-commerce in general, four questions based on Chiu et al. (2005) are proposed.

Two of the behavioural questions are based on the literature of Cuesta-Valiño et al. (2022), one is based on Lim et al. (2023), and the last one is based on Ahmad et al. (2023). The demographic questions are based on those proposed by Theodorakis et al. (2019) and the Spanish National Institute of Statistics.

4.2. Size and Composition of the Sample

This research is a descriptive study (Hernández Sampieri et al. 2007) utilising primary data obtained through a survey of the Spanish population, completed between April and June 2024. A total of 502

questionnaires were collected, of which 455 were deemed valid. These data will be subjected to further processing in PLS-SEM with a view to validating the formative type model (Lacka & Chong, 2016) through a structural equation (Henseler, 2018; Henseler et al., 2018).

In March, prior to the final dissemination of the questionnaire, a pre-test was conducted with ten men and ten women. This was done to ensure that the questionnaire was understood and to make any necessary adjustments to questions that could cause problems. Once the questionnaire was readjusted, it was disseminated with the aim of obtaining a representative sample of the Spanish population.

Table 1. Sample information

	%	Total
Shopping in physical shop, digital shop or both		
Physics	18,68%	85
Digital	12,97%	59
Both	68,35%	311
Gender		
Man	45,49%	207
Woman	54,51%	248
Age		
Between 18 and 27 years old	32,53%	148
Between 28 and 43 years old	29,23%	133
Between 44 and 59 years old	29,89%	136
Between 60 and 78 years old	8,35%	38

Source: Own elaboration, 2024.

The sample comprises a total of 455 responses, representing the Spanish population. Of these, 18.68% of respondents indicated that they purchase items exclusively from physical stores, 12.97% stated that they buy exclusively through digital channels, and 68.35% indicated that they purchase items from both physical and digital stores. Of the total sample, 45.49% are male and 54.51% are female. Additionally, 32.53% of subjects are between the ages of 18 and 27, 29.23% are between 28 and 43, 29.89% are between 44 and 59, and 8.35% are between 60 and 78.

4.3. Measurement Model: Reliability and Validity

Prior to the final item validation, two EF1-US and BE3-US were excluded due to loadings below 0.707, while FA2-US and FR2-US were also excluded due to levels above 5 of the collinearity statistics (VIF). As illustrated in Table 1, all loadings exceed 0.741, thus aligning with the criteria set forth by Hair et al. (2011) for item acceptance.

Similarly, Cronbach's Alpha assesses internal consistency, which in our case is satisfactory overall, although the figures for Errors are slightly lower than anticipated. Therefore, we can conclude that it has a moderate internal consistency, in line with the recommendations of Nunnally and Bernstein (1994), who suggest that the figures should be above 0.8. Finally, a final check of internal consistency was conducted using the average variance extracted (AVE), which demonstrated that all values were above 0.50, meeting the acceptance threshold. The AVE values can also be interpreted in terms of discriminant validity. In the case of Errors and Recall, the discriminant validity is very good, as it is below 0.9. In the case of Learning, Efficiency, Satisfaction and Usability, the discriminant validity is moderate, as it slightly exceeds 0.9.

Table 2. Constructs, components, Cronbach's alpha, AVE, composite reliability and external loads

Constructs	External loads
Learning: Cronbach's Alpha 0.938; AVE 0.890; Composite Reliability 0.961	
FA1-US	0,934
FA3-US	0,948
FA4-US	0,949

Constructs	External loads
Efficiency: Cronbach's Alpha 0.936; AVE 0.886; Composite Reliability 0.959	
EF2-US	0,940
EF3-US	0,944
EF4-US	0,940
Errors: Cronbach's Alpha 0.556; AVE 0.686; Composite Reliability 0.813	
BE1-US	0,895
BE2-US	0,757
Recall: Cronbach's alpha 0.817; AVE 0.735; Composite Reliability 0.892	
FR1- US	0,899
FR3-US	0,741
FR4-US	0,920
Satisfaction: Cronbach's Alpha 0.880; AVE 0.737; Composite Reliability 0.918	
SP1-US	0,834
SP2-US	0,883
SP3-US	0,897
SP4-US	0,817
Usability: Cronbach's Alpha 0.884; AVE 0.740; Composite Reliability 0.919	
US1	0,850
US2	0,877
US3	0,849
US4	0,865

Source: Own elaboration, 2024.

In terms of internal validity testing, the Heterotrait-Monotrait (HTMT) test was also analysed. The results show that most of the constructs have good values, below 0.85-0.90. However, there are two exceptions: EFFICIENCY <-> LEARNING and REMEMBRANCE <-> EFFICIENCY, which are slightly above the acceptable range.

Table 3. Discriminant validity, HTMT criterion

	HTMT
EFFICIENCY <-> LEARNING	0,974
MISTAKES <-> LEARNING	0,495
ERRORS <-> EFFICIENCY	0,627
REMEMBERING <-> LEARNING	0,897
RECALL <-> EFFICIENCY	0,988
RECOLLECTION <-> ERRORS	0,607
SATISFACTION <-> LEARNING	0,736
SATISFACTION <-> EFFICIENCY	0,836
SATISFACTION <-> ERRORS	0,618
SATISFACTION <-> REMEMBRANCE	0,799
USABILITY <-> LEARNING	0,766
USABILITY <-> EFFICIENCY	0,852
USABILITY <-> ERRORS	0,636
USABILITY <-> RECALL	0,846
USABILITY <-> SATISFACTION	0,742

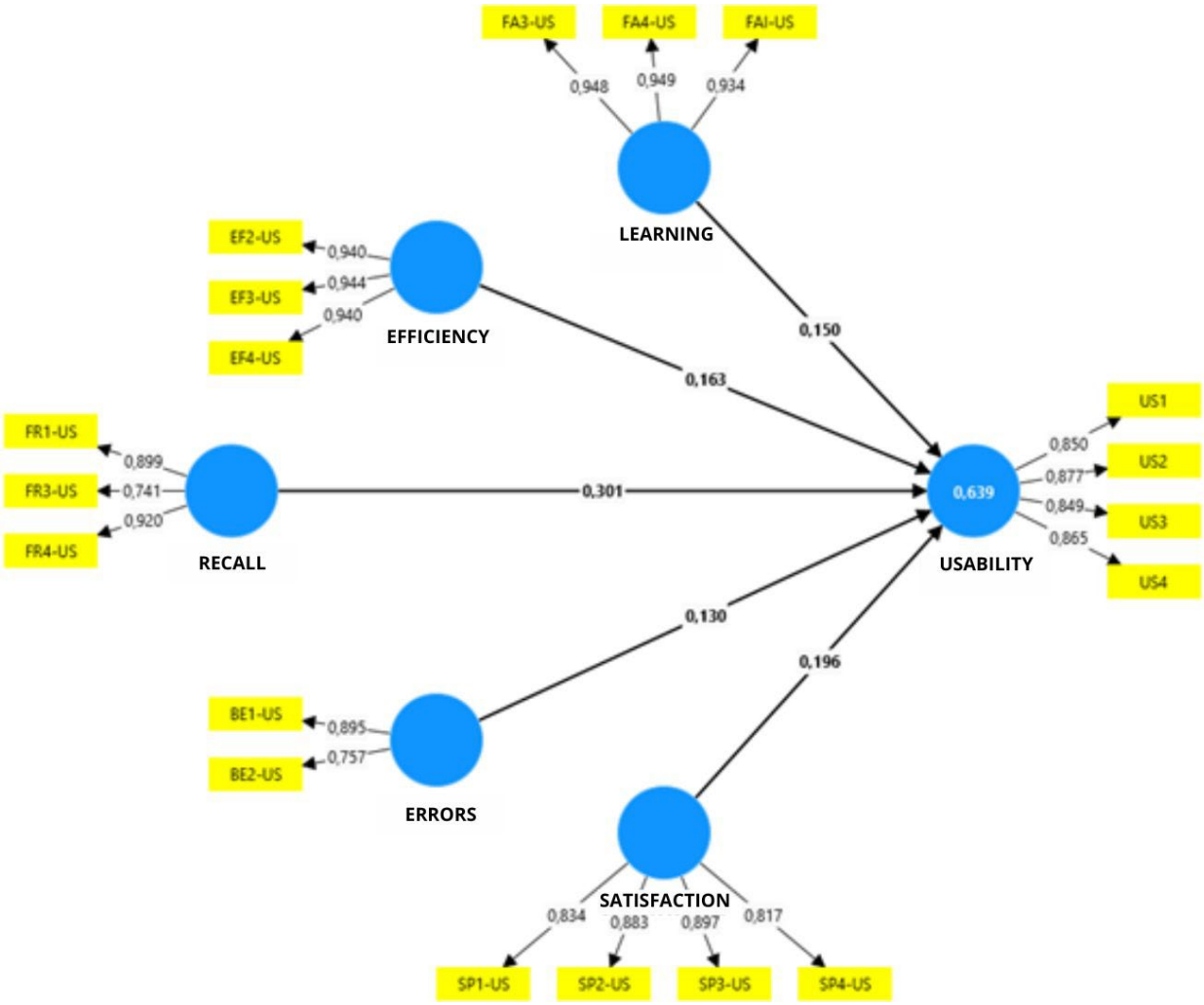
Source: Own elaboration, 2024.

5. Results

The results of the proposed conceptual model (Figure 2) indicate that the Recall component is the most significant within the usability of e-commerce, with a coefficient of 0.301. The next most significant indicator of e-commerce is satisfaction, with a coefficient of 0.196. Subsequently, Efficiency is indicated with a coefficient of 0.163, followed by Learning with 0.150 and Errors with a coefficient of 0.130.

The external loadings (Figure 2) for each of the usability components, Learning, Efficiency, Recall, Errors and Satisfaction, together with their significance coefficients (Figure 2), ensure that the model is robust and consistent in its results.

Figure 2. Result



Source: Own elaboration, 2024.

Furthermore, as illustrated in Figure 2, the positive and significant loadings of each of the usability attributes (learning, efficiency, recall, errors and satisfaction) support the hypotheses H1, H2, H3, H4 and H5, as indicated in Table 4.

It is also important to note that the usability, learning, efficiency, recall, errors and satisfaction components collectively explain the usability construct by 0.639, indicating that they are jointly significant and contribute to a comprehensive understanding of this construct.

The significance of the Usability construct in relation to its components, namely Learning, Efficiency, Recall, Errors and Satisfaction, is further supported by the construct's own internal validity. In other words, the external loadings for Usability are positive and significant, which validates and makes it a meaningful construct in its own right.

Table 4. Hypothesis testing

Hypothesis	Content	Verification
H1	Ease of learning is a visual component that positively influences the design of e-commerce usability.	Supported
H2	Efficiency of use is a visual component that positively influences the design of e-commerce usability.	Supported
H3	Ease of recall is a visual component that positively influences the design of e-commerce usability.	Supported
H4	The low error rate is a visual component that positively influences the usability design of e-commerce.	Supported
H5	Platform satisfaction is a visual component that positively influences e-commerce usability design.	Supported

Source: Own elaboration, 2024.

The successful attainment of these outcomes serves to affirm and validate the structural equation model outlined in Section 3. Please refer to Figure 1 for an illustration of the visual components of the usability design.

6. Discussion

This study offers theoretical implications by contributing to the academic literature on usability design in e-commerce. It identifies the visual components of usability design and corroborates their significance within the analysed construct. This study aims to demonstrate that the usability design components proposed by Nielsen (1993) remain valid in the present era, have adapted to new circumstances, and continue to exert a significant influence within the field of usability. At this juncture, the Remembrance indicator is of particular significance, exerting a considerable impact on usability. This is followed by the remaining components, which also have a notable but more moderate influence on usability.

Moreover, this research offers practical contributions. At this juncture, it is evident which visual components exert greater influence on usability design. Given their significance in e-commerce, it is possible to enhance the usability of users during the online shopping process by focusing on these components.

Firstly, the most significant visual component is that of ease of recall. This component is desirable to be taken into account by practitioners, as an easy-to-remember design will make users feel more comfortable and likely to use it again (Ali et al., 2022; Belk et al., 2017; El-Aasar & Farghali, 2022; Hornbæk, 2006; Kumar et al., 2023; Kureenrung et al., 2022; Lacka & Chong, 2016; Ruiz Ledesma et al., 2022), which indicates that frequent drastic changes in the system design are not advisable. Should the user be unable to identify the functionalities, they may become frustrated and perceive the usability as poor. This may result in the user not using the system again or, in the worst case, not purchasing from that website again.

Satisfaction with the platform represents the second most significant visual component of e-commerce usability (Alhejji et al., 2022; Ali et al., 2022; Allah et al., 2023; Alsalem & Alshamari, 2023; Behnam et al., 2023; El-Aasar & Fargali, 2022; Huang & Benyoucef, 2013; Jeng, 2005a; Kumar et al., 2023; Kureenrung et al., 2022; Lacka & Chong, 2016; O'Malley et al., 2014; Quifer-Rada et al., 2023; Razzak et al., 2023; Ruiz Ledesma et al., 2022; Russ et al., 2014; Samawi et al., 2023; Toraman et al., 2023; Tsakonas & Papatheodoru, 2008) published studies on the design of the platform, its images and the presentation of the content, i.e. whether the website is aesthetically pleasing to use. The significance of visual content in e-commerce is indispensable to its success. If a page captures and engages the user's attention immediately, it can be the determining factor between a purchase being made or the user continuing to browse the internet.

The efficiency of use represents the third most significant visual component within the field of e-commerce usability (Alhejji et al., 2022; Ali et al., 2022; Allah et al., 2023; Alsalem & Alshamari, 2023; Behnam et al., 2023; Belk et al., 2017; El-Aasar & Farghali, 2022; Hornbæk, 2006; Huang & Benyoucef, 2013; Jeng, 2005a; Jeng, 2005b; Kumar et al., 2023; Lacka & Chong, 2016; Ormeño et al., 2023; Quifer-

Rada et al., 2023; Razzak et al., 2023; Ruiz Ledesma et al., 2022; Samawi et al., 2023; Su et al., 2023; Toraman et al., 2023; Tsakonas & Papatheodoru, 2008), the ease of navigating the graphic interface design and finding in a simple way what one is looking for is vital for the correct use of an e-commerce. It is therefore evident that information architecture, content and the manner in which these elements are presented visually are of paramount importance for the optimal functioning of any website.

The ease of learning is regarded as a further aspect of web usability design (Ali et al., 2022; El-Aasar & Farghali, 2022; Hornbæk, 2006; Jeng, 2005a; Jeng, 2005b; Kumar et al., 2023; Kureenrung et al., 2022; Lacka & Chong, 2016; Ruiz Ledesma et al., 2022; Tsakonas & Papatheodoru, 2008), this attribute was defined as the visual content of the site, along with the experience it provides when used, in order to facilitate user assimilation during the initial interaction with the visual elements of the website. A positive initial interaction, which facilitates rapid familiarisation with the website design and functionality, increases the likelihood of the user returning to the site or making a purchase.

Additionally, a low error rate is regarded as a crucial visual aspect of e-commerce usability (Ali et al., 2022; Allah et al., 2023; El-Aasar & Farghali, 2022; Huang & Benyoucef, 2013; Kumar et al., 2023; Lacka & Chong, 2016; Razzak et al., 2023; Ruiz Ledesma et al., 2022; Toraman et al., 2023), that the design is easy to use and oriented to make as few mistakes as possible makes that website more reliable and therefore the user feels more confident and how to use it, which can lead to repeat use of that website.

In conclusion, each of the attributes is fundamental for the correct development of e-commerce usability. The following section presents a discussion of the results obtained, with the aim of exposing the different characteristics and potential of each of the usability attributes. Furthermore, it is important to emphasise the significance and applicability of the concept of usability as a whole. This highlights the necessity to approach usability as a unified concept, exploring the potential for enhancing its attributes in a coherent and interrelated manner.

7. Conclusions

This research demonstrates the significance of the various visual elements of usability in e-commerce. In light of the proliferation of this form of commerce, it is imperative to devote attention to the factors that facilitate its optimal functioning, with usability design being a pivotal aspect in this regard.

The identification and subsequent modification of the visual components of e-commerce usability design will influence the correct development and success of the design. The objective of this research is to ascertain which factors exert the greatest influence on the usability of a website, with a view to defining a roadmap for the development of usability in e-commerce.

Consequently, from a managerial perspective, the establishment of a hierarchy pertaining to usability is made more straightforward when improvements are to be made in the field of e-commerce. Accordingly, ease of recall is identified as the primary factor, suggesting that significant alterations to web design may be inadvisable. In addition, the remaining usability attributes are of secondary importance, as although they are also relevant, they must be considered in conjunction with ease of recall. Consequently, when implementing improvements to the website, whether related to efficiency or satisfaction, it is advisable to consider how these improvements may affect ease of recall and, subsequently, to adapt them holistically.

The aforementioned usability improvements will be perceived as a distinctive feature within the digital landscape. They will facilitate the attraction of users, the conversion of these users into consumers, and the development of customer loyalty as a result of the positive user experience offered by an effective web usability design.

References

Ahmad, I., Akbar, R., & Javed, M. A. (2023). Nexus between e-service quality and e-customer satisfaction through functional and hedonic values: case of online shopping in Pakistan. *Kybernetes*. https://doi.org/10.1108/K-06-2023-1146

Ali, W., Riaz, O., Mumtaz, S., Khan, A.R., Saba, T. & Bahaj, S.A. (2022) Mobile Application Usability Evaluation: A Study Based on Demography. *IEEEAccess*, 10, 41512-41524, https://doi.org/10.1109/ACCESS.2022.3166893

Allah, K.K., Ismail, N.A., Ghaban, W, Gazen, N.A. & Nasser, M. (2023) Adaptable Web Search User Interface Model for the Ederly. *KSII Transactions on Internet and Information Systems*, 17, 9, 2436-2457, https://doi.org/10.3837/tiis.2023.09.008

Alhejji, S., Albesher, A., Wahsheh, H. & Albarrak, A. (2022) Evaluating and Comparing the Usability of Mobile Banking Applications in Saudi Arabia. *Information*, 13, 12, 559, https://doi.org/10.3390/info13120559

AlSalem, T.S. & AlShamari, M.A. (2023) Assessing Interactive Web-Based Systems Using Behavioral Measurement Techniques. *Future internet*, 15, 11, 365, https://doi.org/10.3390/fi15110365

Barakovic, S., Skorin-Kapov, L. & Barakovic Husic, J. (2023) The Impacct of QoE Factors on the Perception of Constructs Comprising Information Quality, Usability, and Aesthetics in Mobile Web Browsing. *International Journal of Human-Computer Interaction*, https://doi.org/10.1080/10447318.2023.2260982

Behnam, F., Khajouei, R., Nabizadeh, A.H., Saedi, S. & Ghaemi, M.M. (2023) Usability evaluation of emergency information systems in educational hospitals in Kerman, Iran. *BMC Medical Informatics and Decision Making*, 23, 277, https://doi.org/10.1186/s12911-023-02357-3

Belk, M., Fidas, C., Germanakos, P. & Samaras, G. (2017) The interplay between humans, technology and user authentication: A cognitive processing perspective. *Computers in Human Behavior*, 76, 184-200, https://doi.org/10.1177/20503121231180413

Brown, W., Yen, P.-Y., Rojas, M. & Schnall, R. (2013) Assessment of the Health IT Usability Evaluation Model (Health-ITUEM) for evaluating mobile health (mHealth) technology. *Journal of Biomedical Informatics*, 46, 6, 1080-1087, https://doi.org/10.1016/j.jbi.2013.08.001.

Calisir, F. & Calisir, F. (2004) The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning (ERP) systems. *Computers in Human Behavior*, 20, 505-515, https://doi.org/10.1016/j.chb.2003.10.004

Cavazos-Arroyo, J., Máynez-Guaderrama, A. & Vargas-Salgado, M. M. (2024). Satisfaction with online clothing shopping: an analysis of its antecedents. *Retos Revista de Ciencias de la Administración y Economía, 14*(27), 35-50. https://doi. org/10.17163/ret.n27.2024.03

Chiu, C. M., Hsu, M. H., Sun, S. Y., Lin, T. C., & Sun, P. C. (2005). Usability, quality, value and e-learning continuance decisions. *Computers & education*, *45* (4), 399-416. https://doi.org/10.1016/j.compedu.2004.06.001

Cristancho-Triana, G. J., Cancino-Gómez, Y. A. & Ninco-Hernández, F. A. (2024). Factors influencing sustainable consumption behaviour in generation Z. *Retos Revista de Ciencias de la Administración y Economía, 14*(27), 51-67. https://doi.org/10.17163/ret.n27.2024.04

Cuesta-Valiño, P., Gutiérrez-Rodríguez, P., García-Henche, B., & Núñez-Barriopedro, E. (2024). The impact of corporate social responsibility on consumer brand engagement and purchase intention at fashion retailers. *Psychology & Marketing*, *41*(3), 649-664. https://doi.org/10.1002/mar.21940

Cuesta-Valiño, P., Gutiérrez-Rodríguez, P. & Núnez-Barriopedro, E. (2022) The role of consumer happiness in brand loyalty: a model of the satisfaction and brand image in fashion. *Corporate Governance*, Vol. 22 No. 3, pp. 458-473. https://doi.org/10.1108/CG-03-2021-0099

Dogra, P., & Kaushal, A. (2023). Investigating factors affecting trust and purchase intention towards online websites: structural equation modelling approach. *International Journal Of Internet Marketing And Advertising,* 18(1), 98. https://doi.org/10.1504/ijima.2023.128151

Domínguez Vila, T., Alén González, E., Araújo Vila, N. & Fraiz Brea, J.A. (2021) Indicators of Website Features in the User Experience of E-Tourism Search and Metasearch Engines. *Journal of Theoretical and Applied Electronic Commerce Research*, 16, 1, 18-36, https://doi.org/10.4067/S0718-18762021000100103

El-Aasar, S.A. & Farghali, G.F. (2022) Predictive study of the factors and challenges affecting the usability of e-learning platforms in the light of COVID-10. *International Journal of Education in Mathematics, Science, and Technology*, 10, 3, 568-589, https://doi.org/10.46328/ijemst.2428

Gallardo-Camacho, J. & Melendo-Rodríguez-Carmona, L. (2023) The use of QR codes to fuel transmedia strategy in the ecosystem of audiovisual media groups. *Profesional de la información,* v. 32, n. 2, e320216.https://doi.org/10.3145/epi.2023.mar.16

Gutiérrez-Rodríguez, P., Villarreal, R., Cuesta-Valiño, P. & Blozis, S. (2020). A PLS-SEM approach to understanding E-SQ, e-satisfaction and e-loyalty for fashion e-retailers in Spain. *Journal of Retailing and Consumer Services*, *57*, 102201. https://doi.org/10.1016/j.jretconser.2020.102201

Hair, J., Ringle, C. & Sarstedt, M. (2011) PLS-SEM: indeed a silver bullet, *Journal of Marketing Theory and Practice*, 19, 2, 139-151. https://doi.org/10.2753/MTP1069-6679190202

Henseler, J. (2018). Partial least squares path modeling: Quo vadis? *Quality & Quantity*, *52*(1), 1-8. https://doi.org/10.1007/s11135-018-0689-6

Henseler, J., Müller, T. & Schuberth, F. (2018) *New Guidelines for the Use of PLS Path Modeling in Hospitality, Travel, and Tourism Research*, Ali, F., Rasoolimanesh, S.M. and Cobanoglu, C. (Ed.) Applying Partial Least Squares in Tourism and Hospitality Research, Emerald Publishing Limited, Leeds, pp. 17-33. https://doi.org/10.1108/978-1-78756-699-620181002

Hernández Sampieri, R., Fernández Collado, C. & Baptista Lucio, P. (2007) *Fundamentos de metodología de la investigación*. Mc Graw Hill

Hornbæk, K. (2006) Current practice in measuring usability: Challenges to usability studies and research. *International Journal of Human-Computer Studies*, 64, 2, 79-102, https://doi.org/10.1016/j.ijhcs.2005.06.002

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Huang, Z., & Benyoucef, M. (2013). From e-commerce to social commerce: A close look at design features. *Electronic Commerce Research and Applications*, *12*(4), 246-259. http://dx.doi.org/10.1016/j.elerap.2012.12.003

Jeng, J. (2005a) Usability Assessment of Academic Digital Libraries: Effectiveness, Efficiency, Satisfaction, and learnability. *Libri*, 55(2-3), 96-121. https://doi.org/10.1515/LIBR.2005.96

Jeng, J. (2005b) What Is Usability in the Context of the Digital Library and How Can It Be Measured? *Information Technology and Libraries*, 24, 2, 47-56, https://doi.org/10.6017/ital.v24i2.3365

Joshi, R., Garg, P. & Kamboj, S. (2023). Examining the effects of brand authenticity and brand identification on consumers' willingness to pay premium. *International Journal Of Internet Marketing And Advertising*, 19(1/2), 1-19. https://doi.org/10.1504/ijima.2023.132717

Kekre, S., Krishnan, M.S. & Srinivasan, K. (1995) Drivers of Customer Satisfaction for Software Products: Implications for Design and Service Support. *Management Science*, 41, 9, https://doi.org/10.1287/mnsc.41.9.1456

Kumar, B., Roy, S., Singh, K.U., Pande, S.K., Kumar, A., Sinha, A., Shukla, S., Shah, M.A. & Rasool, A. (2023) A Static Machine Learning Based Evaluation Method for Usability and Security Analysis in E-Commerce Website. *IEEEAccess*, 11, 40488-40510, https://doi.org/10.1109/ACCESS.2023.3247003

Kureerung, P., Ramingwong, L., Ramingwong, S., Cosh, K. & Eiamkanitchat, N. (2022) A Framework for Designing Usability: Usability Redesign of a Mobile Government Application. *Information*, 13, 10, 470, https://doi.org/10.3390/info13100470

Lacka, E. & Chong, A. (2016) Usability perspective on social media sites' adoption in the B2B context. *Industrial Marketing Management*, 54, 80-91, https://doi.org/10.1016/j.indmarman.2016.01.001

Lavanda Reyes, F., Reyes Mejía, M. G., Ruiz Reyes, R., Samanamud, L. C., & Reyes Ruiz, J. L. (2022). Importance of digital communication and the peruvian consumer: Communication between company and consumer. *VISUAL REVIEW. International Visual Culture Review Revista Internacional De Cultura Visual*, *10*(1), 1–13. https://doi.org/10.37467/revvisual.v9.3564

Leung, Y.L., Chan, R.L.H. & Chiu, D.K.W. (2023) Investigating the consumption behavior of young adults using online food delivery platforms during the COVID-19 pandemic. *Aslib Journal of Information Management*, https://doi.org/10.1108/AJIM-05-2023-0177

Lewis, J.R. (1995) IBM Computer Usability Satisfaction Questionnaires: Psychometric Evaluation and Instructions for Use. *International Journal of Human-Computer Interaction*, 7, 1, 57-78, https://doi.org/10.1080/10447319509526110

Lim, A., Goi, C. L., Dell, P., & Goi, M. T. (2023). Generation Y's behavioural usage of small businesses' retail websites: gender difference. *Journal of Science and Technology Policy Management*. https://doi.org/10.1108/JSTPM-10-2022-0170

Melendo Rodríguez-Carmona, L. & Yustres Duro, P. (2023). Composición visual y contenido de la publicidad en prensa digital de la Comunidad de Madrid. *Zer. Revista de estudios de comunicación, 28*(55), 79-103, https://doi.org/10.1387/zer.25102

Melendo Rodríguez-Carmona, L., Yustres Duro, P., & Cuesta-Valiño, P. (2024). Keys to Usability in Retail E-Commerce: A Systematic Review of the Literature. *UCJC Business and Society Review*, (80), 778-815. https://dx.doi.org/10.3232/UBR.2024.V21.N1.17

Nielsen, J. (1993) *Usability Engineering*. Academic Press

Nielsen J. & Loranger, H. (2006) *Prioritizing Web Usability*. New Riders

Nunnally, J.C. & Bernstein, I.H. (1994) The assessment of reliability, *Psychometric Theory*, Vol. 3, 248-292.

O'Malley, G., Dowdall, G., Burls, A., Perry, I.J. & Curran, N. (2014) Exploring the Usability of a Mobile App for Adolescent Obesity Management. *JMIR Mhealth and Uhealt*, 2, 2, 29, https://doi.org/10.2196/mhealth.3262

Ormeño, Y.I., Panach, J.I. & Pastor, O. (2023) An empirical experimento f a usability requirements elicitation method to design GUIs based on interviews. *Information and Software Technology*, 164, 107324, https://doi.org/10.1016/j.infsof.2023.107324

Palmer, J.W. (2002) Web Site Usability, Design, and Performance Metrics. *Information Systems Research*, 13, 2, 151-167, https://doi.org/10.1287/isre.13.2.151.88

Preece, J. (2001) Sociability and usability in online communities: determining and measuring success. *Behaviour & Information Technology*, 20, 5, 347-356, https://doi.org/10.1080/01449290110084683

Quifer-Rada, P., Aguilar-Camprubí, L., Padró-Arocas, A. & Mena-Tudela, D. (2023) Evaluation of the usability and utility of LactApp, a mHealth for breastfeeding support. International Journal of Medical Informatics, 180, 105240, https://doi.org/10.1016/j.ijmedinf.2023.105240

Ramos, R. F., Rita, P., & Moro, S. (2023). Are social media and mobile applications threatening retail websites. *International Journal Of Internet Marketing And Advertising*, 18(1), 58. https://doi.org/10.1504/ijima.2023.128150

Razzak, M.A., Islam, M.N., Broti, T., Kamal, E.S. & Zahan, S. (2023) Exploring usability problems of mHealth applications developed for cervical cancer: An empirical study. *SAGE Open Medicine,* 11, 1-14, https://doi.org/10.1177/20503121231180413

Rodríguez Hernández, M., & Vázquez Sacristán, I. A. (2024). TikTok, the new social platform for luxury brands. *VISUAL REVIEW. International Visual Culture Review Revista Internacional De Cultura Visual*, *16*(3), 197–211. https://doi.org/10.62161/revvisual.v16.5255

Ruiz Ledesma, E.F., Chavarría Báez, L. & Viveros Veña, K. (2022) Mobile application to Support the Practice of Arithmetic Operative Skills with High School Students. *Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 13, 25, e336, https://doi.org/10.23913/ride.v13i25.1235

Russ, A.L., Zillich, A.J., Melton, B.L., Russel, S.A., Chen, S., Spina, J.R., Weiner, M., Johnson, E.G., Daggy, J.K., McManus, M.S., Hawsey, J.M., Puleo, A.G., Doebbeling, B.M. & Saleem, J.J. (2014) Applying human factors principles to alert design increases efficiency and reduces prescribing errors in a scenario-based simulation. *Journal of the American Medical Informatics Association*, 21, 2, 287-296, https://doi.org/10.1136/amiajnl-2013-002045

Saha, S., Senapati, A. & Maity R. (2023) An approach to predict the task efficiency of web pages. *Multimedia Tools and Applications*, 82, 25217-25233, https://doi.org/10.1007/s11042-023-14619-3

Samawi, G., Jraisat, L., Khlaif, F., Jreissat, M., Ta'amnha, M.A., Alomari, S. & Khawajah, A. (2023) Evaluating Usability and User Experience Amid COVID-19: The Case of Innovative Digital Retailers. *International Journal of Technology and Human Interaction*, 19, 1, 1-23, https://doi.org/10.4018/IJTHI.328090

Su, J.-M., Wu, C.-Y., Hong, W.-T-. Chen, P.-S. & Hung, K.-S. (2023) Application of mobile-based web app to enhance simple suturing skills of nurse practitioners. *Nurse Education Today*, 131, 105959, https://doi.org/10.1016/j.nedt.2023.105959

Theodorakis, N. D., Kaplanidou, K., Alexandris, K., & Papadimitriou, D. (2019) From sport event quality to quality of life: The role of satisfaction and purchase happiness. *Journal of Convention & Event Tourism* 20, 3, 241-260 https://doi.org/10.1080/15470148.2019.1637805

Toraman, N., Pekpazar, A. & Gumussoy, C.A. (2023) Conceptualization and Survey Instrument Development for Website Usability. *Informatics*, 10, 3, 75, https://doi.org/10.3390/informatics10030075

Tsakonas, G. & Papatheodoru, C. (2008) Exploring usafulness and usability in the evaluation of open access digital librarires. Information *Processing & Management*, 44, 3, 1234-1250, https://doi.org/10.1016/j.ipm.2007.07.008

Weichbroth, P. (2020) Usability of Movile Applications: A Systematic Literature Study. *IEEEAccess*, 8, 55563-55577, https://doi.org/10.1109/ACCESS.2020.2981892

Yustres Duro, P. & Melendo Rodríguez-Carmona, L. (2022). Comparative study of online shopping methods in Spain. *VISUAL REVIEW. International Visual Culture Review/Revista Internacional de Cultura Visual*, *10*(1), 1-8. https://doi.org/10.37467/revvisual.v9.3552

Zviran, M., Glezer, C. & Avni, I. (2006) User satisfaction from commercial web sites: The effect of design and use. *Information & Management*, 43, 157-178, https://doi.org/10.1016/j.im.2005.04.002