Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Identificación de perfiles en la satisfacción de los usuarios de repositorios digitales a través de un árbol de regresión

Identification of profiles in the satisfaction of users of digital repositories through a regression tree

Identificação de perfis na satisfação de usuários de repositórios digitais através de uma árvore de regressão

Ramón Ventura Roque Hernández
Universidad Autónoma de Tamaulipas, México
rvHernandez@uat.edu.mx
https://orcid.org/0000-0001-9727-2608

José Melchor Medina Quintero
Universidad Autónoma de Tamaulipas, México
jMedinaq@uat.edu.mx
https://orcid.org/0000-0003-3466-7113

Adán López Mendoza
Universidad Autónoma de Tamaulipas, México
aLopez@uat.edu.mx
https://orcid.org/0000-0003-4801-640X

Demián Ábrego Almazán
Universidad Autónoma de Tamaulipas, México
dAbrego@uat.edu.mx
https://orcid.org/0000-0003-0147-8834

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumen

En los últimos años, las universidades han promovido el acceso a los repositorios digitales para localizar fuentes de información que faciliten el proceso de investigación científica. Sin embargo, son escasos los estudios que han evaluado la satisfacción de los usuarios en relación con el empleo de estos recursos tecnológicos. Este trabajo, en consecuencia, tuvo como objetivo identificar perfiles en la satisfacción de estudiantes universitarios con el manejo de estas herramientas. Para ello, se aplicó un cuestionario con 26 preguntas agrupadas en 7 dimensiones que permitieron recabar respuestas de 219 participantes de una universidad con presencia en Nuevo Laredo y Ciudad Victoria (Tamaulipas, México). En esta labor, se analizaron dos variables como posibles predictores en la construcción de perfiles de satisfacción de uso: la primera se relacionó con la interfaz del repositorio (interactividad, confianza, oportunidad de acceso, facilidad de uso, atractivo visual e innovación), mientras que la segunda se vinculó con el estudiante (sexo, nivel de estudios máximo y lugar de origen). Para esta tarea se utilizó el paquete estadístico SPSS y se aplicó la técnica de minería de datos denominada *árbol de regresión*, con método de crecimiento denominado CRT (*classification and regression trees*). A partir de los datos recabados, se obtuvo un árbol que describe tres perfiles con niveles de satisfacción bajo, medio y alto. Las personas con bajo nivel de satisfacción fueron quienes percibieron que los repositorios no eran fáciles de utilizar. El nivel medio de satisfacción se observó en personas que consideraron que los repositorios eran fáciles de usar, aunque no tuvieron confianza en la seguridad que ofrecían ni percibieron un alto nivel de innovación en ellos. Por último, los más altos niveles de satisfacción se evidenciaron en estudiantes que opinaron que los repositorios eran fáciles de manejar y tenían un nivel confiable de seguridad. Los resultados hacen posible el entendimiento de la satisfacción de los usuarios en términos de las variables estudiadas, con el objetivo de priorizarlas en el diseño e implementación de nuevos repositorios institucionales para brindar mejores experiencias de uso orientadas al óptimo aprovechamiento de estos recursos.

Palabras clave: bibliotecas digitales, educación superior, repositorios digitales, satisfacción de usuario.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Abstract

In recent years, universities have sought to provide access to digital repositories in order to ease the location of information sources that aid the scientific research process. Nevertheless, there are few studies that address their user satisfaction. This paper presents the results of a research that was conducted with the aim of understanding the satisfaction of university students on the use of digital repositories. A 26-item questionnaire organized in seven dimensions was admnistered to 219 participants from the Autonomous University of Tamaulipas, from the Nuevo Laredo and Ciudad Victoria, Tamaulipas, Mexico campuses. The following variables were studied as possible predictors of user satisfaction: a) related to the interface of the repository: interactivity, confidence, access opportunity, ease of use, visual attractiveness, innovation and b) related to the student: Sex, maximum level of education, and campus location. SPSS statistical package was used to perform the data mining technique called "regression tree" with the Classification and Regression Tree (CRT) growth method. We obtained a tree describing three profiles with low, medium and high levels of satisfaction. Participants with low levels of satisfaction were those who found that repositories were not easy to use. An average level of satisfaction was observed in people who perceived the repositories as easy to use, not dependable, and with a low level of innovation. The highest levels of satisfaction were observed in students who perceived repositories as dependable and easy to use. The results contribute to the understanding of user satisfaction in terms of the studied variables with the objective of prioritizing them in the design and implementation of new institutional repositories to provide better user experiences and optimal exploitation of these resources.

Keywords: digital libraries, higher education, digital repositories, user satisfaction.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumo

Nos últimos anos, as universidades promoveram o acesso a repositórios digitais para localizar fontes de informação que facilitam o processo de pesquisa científica. No entanto, existem poucos estudos que avaliaram a satisfação dos usuários em relação ao uso desses recursos tecnológicos. Este trabalho, portanto, objetivou identificar perfis na satisfação de universitários com o uso dessas ferramentas. Para isso, aplicou-se um questionário com 26 questões agrupadas em 7 dimensões que permitiram reunir respostas de 219 participantes de uma universidade com presença em Nuevo Laredo e Ciudad Victoria (Tamaulipas, México). Neste trabalho, duas variáveis foram analisadas como possíveis preditores na construção dos perfis de satisfação do usuário: o primeiro foi relacionado à interface do repositório (interatividade, confiança, oportunidade de acesso, facilidade de uso, apelo visual e inovação), enquanto que o segundo estava vinculado ao aluno (sexo, nível máximo de escolaridade e local de origem). Para esta tarefa foi utilizado o pacote estatístico SPSS e aplicada a técnica de mineração de dados denominada árvore de regressão, com um método de crescimento denominado CRT (árvores de classificação e regressão). A partir dos dados coletados, foi obtida uma árvore que descreve três perfis com baixo, médio e alto nível de satisfação. Pessoas com baixos níveis de satisfação foram as que perceberam que os repositórios não eram fáceis de usar. O nível médio de satisfação foi observado em pessoas que consideraram que os repositórios eram fáceis de usar, embora não tivessem confiança na segurança oferecida ou percebessem um alto nível de inovação neles. Finalmente, os maiores níveis de satisfação foram evidentes em estudantes que achavam que os repositórios eram fáceis de gerenciar e tinham um nível confiável de segurança. Os resultados permitem compreender a satisfação dos usuários em termos das variáveis estudadas, com o objetivo de priorizá-los na concepção e implementação de novos repositórios institucionais para proporcionar melhores experiências de uso orientadas para o uso otimizado desses recursos.

Palavras-chave: bibliotecas digitais, ensino superior, repositórios digitais, satisfação do usuário.

Fecha Recepción: Febrero 2018 **Fecha Aceptación:** Junio 2018

Introduction

Due to the increase in recent years of the use of new technologies, universities have sought to promote access to digital repositories to locate sources of information that help in the process of scientific research. These repositories are available for use within the university campuses, although in some cases they can also be used from other places through special requests. Teachers, researchers and university students are the habitual users of these systems, hence it is common to find them in higher education schools. However, there are few works that have focused on the analysis of the satisfaction of people in relation to the use of these technological resources.

Digital repositories and the satisfaction of end users

Babini, González, Lopez and Medici (2010) explain that university digital libraries emerged some decades ago with the aim of gathering collections of complete texts that included materials produced in the same houses of studies. However, when the quantity of these works grew exponentially, it was necessary to make a distinction between the concept of digital library and institutional repository. Thereafter, the first was linked to a container of materials from various sources, while the second was associated with a digital file system in charge not only of preserving the scientific production of an institution, but also of disseminating it freely. and free through the Web, a task in which the participation of undergraduate and postgraduate students is determinant, since the scientific literature has confirmed the importance of familiarizing students with the interface of the repositories to promote their active participation as authors and users (Santovenia Díaz, 2010).

Reality, however, shows that the opinion of end users in the context of repositories has not been studied in depth (McKay, 2007), although this element is fundamental to understand the functioning of these systems. Technically, it is easy to have some data from users, such as the background of their searches and the number of visits they make, although it should also be emphasized that a broader perspective is required to improve the user experience and that the resources are better used. Although it has been recognized that there is no unique way to evaluate institutional repositories (Serrano Vicente, Melero Melero and Abadal, 2014), users are considered an important factor in this process (Casella, 2010), together with the interfaces and the accessibility

(Fushimi, Genovés, Pené y Unzurrunzaga, 2011; Sandobal Verón, Cernadas, Cuenca Pletsch y Maurel, 2016).

In this sense, the interfaces of the repositories must take into account the needs of the end users (Sulé Duesa, Estivill Rius and Gascón García, 2011) and provide an adequate level of accessibility. There are works such as Oliva Marañón (2012) aimed at evaluating the correspondence between the functionalities offered by digital repositories and the information needs of their users. Also, in recent years, institutional repositories have been designed as web applications that can be accessed from different devices, which allows us to investigate their impact from the point of view of their use (Adewumi, Omoregbe and Misra, 2016). The study of user satisfaction, therefore, is significant to understand and contribute to improving their use, as well as the perception of them. Therefore, Hernández Salazar (2011) states that it is not enough to analyze the storage and distribution of information offered in these media, but it is also essential to assess the opinion of users.

In this work, user satisfaction is defined as a mental state representative of responses to compliance with their information requirements. Some background on this subject is found in the research of Iriondo, Vázquez and Jiménez (2010), who consulted the users of the virtual campus of a university to know in which aspects that service could be improved. The three answers with the highest scores were: a) offer more resources, b) enable them to work when they are needed, and c) increase their speed. These answers provide an orientation about the functional nature of the requirements of the users in relation to the university academic platforms.

On the other hand, in the work of Velázquez et al. (2014) a study was conducted to investigate student satisfaction with learning objects within a technological platform that served as a repository of information. The results were synthesized in the following: a) that the operation is carried out without problems, b) that the operation is fast, c) quick access to the objects, and d) ease of use and navigation.

In short, the field of satisfaction and the use given to these resources are current issues that define areas of opportunity in the construction of new repositories (Huwe, 2017) and that constitute

challenges that must be overcome even for the redesign of functional existing repositories whose interface is perfectible.

Preliminaries of the study carried out

The objective of this study was to study the satisfaction of users in order to adequately weigh the relevant factors in the design and implementation of new repositories, such as the one that is being developed at the Autonomous University of Tamaulipas. Therefore, in this investigation the following factors were evaluated:

a) Interactivity: Quality of communication between the end user and the repository interface.
b) Trust: Level of security that the end user has in the service he receives from the repository.
c) Opportunity to access: Possibility of obtaining a service from the repository at the required time (Hernández Salazar, 2011).
d) Ease of use: Way in which the design of a system facilitates or hinders its management (Hernández Salazar, 2011).
e) Visual appeal: Degree in which the repository, by its appearance, arouses interest and pleasure in users.
f) Innovation: Level at which users perceive a novel design in the repository.
g) Satisfaction: Degree to which the repository covers the needs and expectations of the user.

These criteria were chosen based on the review of the literature and the aspects of interest of the research team, which agreed that these factors can be promoted and controlled in the process of creating a new institutional repository. Knowing which of these variables are relevant in the profiles of satisfaction of the users of the repositories is particularly important, since it would allow to have a guide to guide the decision making during the development activities of this type of software. In this sense, the contribution of this research is linked to the identification of profiles of satisfied users with institutional repositories based on the previously mentioned factors.

Materials and methods

219 undergraduate and graduate university students enrolled in the spring semester 2017 of the Faculty of Commerce and Administration of Ciudad Victoria, and of the Faculty of Commerce, Administration and Social Sciences of Nuevo Laredo, of the Autonomous University, were non-probabilistically selected. of Tamaulipas. Students who studied subjects related to applied research were included, who reported having used the digital bibliographic repositories available in the institution.

Instrument

A questionnaire designed for this study was applied. A printed sheet of paper was used with the questions, which were grouped into seven dimensions of interest: interactivity, confidence, access opportunity, ease of use, visual appeal, innovation and satisfaction. Each question could be answered using a five-level Likert scale, where the number 1 represented totally disagree and the 5 totally agreed. The complete instrument had a Cronbach's alpha of .93, whose values for each of the study dimensions are shown in table 1. Likewise, all the questions asked are presented.

Tabla 1. Instrumento utilizado para la recolección de datos

Pregunta	Dimensiones y descripciones
	Interactividad (alfa de Cronbach = .73)
1	Los repositorios digitales me permiten interactuar con ellos para recibir información personalizada.
2	Los repositorios digitales tienen características interactivas que me ayudan a cumplir mi tarea.
	Confianza (alfa de Cronbach = .87)
3	El depósito de un nombre de usuario y contraseña en los repositorios digitales son seguros.
4	Solo se proporcionan los datos personales necesarios para la autenticación en los repositorios digitales.
5	Los datos proporcionados por los usuarios en los repositorios digitales se archivan de forma segura.
6	Los datos proporcionados en los repositorios digitales se utilizan únicamente por la razón presentada.
7	Confío en los repositorios digitales para mantener mi información personal segura.
8	Confío en que los administradores en los repositorios digitales no abusen de mi información personal.
	Oportunidad de acceso (alfa de Cronbach = .801)
9	Los repositorios digitales se cargan rápidamente.
10	Las páginas en los repositorios digitales se descargan en poco tiempo.
	Facilidad de uso (alfa de Cronbach = .836)
11	Aprender a operar los repositorios digitales es fácil para mí.
12	Me parece que los repositorios digitales son fáciles de usar.
13	El texto en los repositorios digitales es fácil de leer.
14	Las etiquetas en los repositorios digitales son fáciles de entender.
	Atractivo visual (alfa de Cronbach = .901)
15	Los repositorios digitales son visualmente agradables.
16	Los repositorios digitales muestran un diseño visualmente agradable.
17	Los repositorios digitales son visualmente atractivos.
	Innovación (alfa de Cronbach = .885)
18	Los repositorios digitales son innovadores.
19	El diseño de los repositorios digitales es innovador.
20	Los repositorios digitales son creativos.
	Satisfacción (alfa de Cronbach = .893)
21	La información está de acuerdo a mis necesidades.
22	Los repositorios digitales usados son eficientes.
23	Los repositorios digitales usados son efectivos.
24	La información en los repositorios digitales es lo que necesito para llevar a cabo mis tareas.

25	Los repositorios digitales satisfacen adecuadamente mis necesidades de información.
26	La información en los repositorios digitales es efectiva.

Fuente: Elaboración propia

Analysis of data

For this work, the tree technique was used. According to Song and Lu (2015), a tree is an analysis tool that can be used to classify, predict, interpret and manipulate data. This has the following advantages: it simplifies complex relations between variables when creating subgroups, it is relatively easy to interpret, it is constructed with a non-parametric approach that does not require the fulfillment of statistical assumptions, it handles biased distributions without the need to make transformations on the data and It is robust to extreme scores. Some of the uses of this technique are the following: select variables from a broad set, evaluate their importance, make predictions and manipulate the data through the reduction of categories or profiles studied.

Trees are a technique that belongs to data mining, which in turn comes from artificial intelligence and statistics. Trees help to look for specific subgroups and relationships that might not be found with traditional statisticians; in this way, they help reveal hidden information (Berlanga, Rubio and Vilá Baños, 2013). To execute the tree technique, a study variable and several predictor variables are required.

Two of the most used methods for the creation of trees today are: CHAID and CRT (Pérez-Marqués, 2015). CHAID trees use the square J test for division of the nodes and can produce more than two child nodes. In contrast, CRT trees produce only binary trees.

However, once the data collection was carried out, it was captured in the statistical package SPSS, version 22, where preliminary reviews were made to identify missing data and capture errors. Subsequently, we proceeded to the creation of seven calculated variables, which corresponded to the sum of the answers within the study dimensions. This procedure is called summed scales computation (Zikmund, Barry, Carr and Griffin, 2013). In this way, the variable interactivity was created as the sum of the scores corresponding to questions 1 and 2 that are part of this dimension. Similarly, we proceeded to create the other six variables with the sum of the scores of their questions (confidence, access opportunity, ease of use, visual appeal, innovation, satisfaction). Then, the algorithm of the tree in which the variable calculated satisfaction was introduced as variable of interest for the construction of the tree was executed.

As variables for the construction of the profiles, the following were introduced: interactivity, confidence, access opportunity, ease of use, visual appeal, innovation, as well as the variables that correspond to the headquarters or place of origin (Nuevo Laredo or Ciudad Victoria) , sex (male or female) and level of education (undergraduate or graduate). The CRT growth method was used and the tree was requested in table format. The validation was configured to be performed by sampling division with a random assignment of 50% of the cases to the training sample and 50% of the cases to the test sample. The maximum depth of the tree was fixed in the automatic option, considering minimum 30 cases in each parent node and minimum 20 cases in the child nodes. The minimum change in the improvement was set at 0.0001 and tree pruning was not requested.

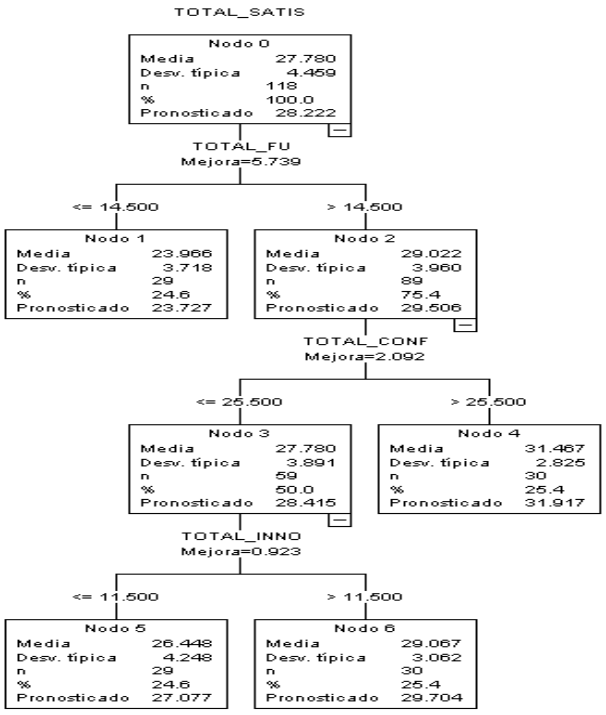
Results

Description of the tree

Figure 1 and Table 2 show the result of the classification technique applied to the data with the tree technique as part of the test sample. It can be seen that the average of all satisfaction scores was 27.78 and three profiles could be identified in relation to this average, which correspond to the following terminal nodes: high satisfaction profile (nodes 4 and 6), profile of average satisfaction (node 5) and low satisfaction profile (node 1).

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Figura 1. Árbol con los perfiles identificados



Fuente: Elaboración propia

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Tabla 2. Tabla de árbol para la variable *satisfacción*

							Variable independiente primaria		
Ejemplo	Nodo	Media	Desviación estándar	N	Porcentaje	Media pronosticada	Nodo padre	Variable	Mejora	Valores de división
Entrenamiento	0	28.2222	4.49843	99	100.0 %	28.2222				
	1	23.7273	5.27512	22	22.2 %	23.7273	0	TOTAL_FU	5.739	<= 14.500
	2	29.5065	3.29922	77	77.8 %	29.5065	0	TOTAL_FU	5.739	> 14.500
	3	28.4151	3.05359	53	53.5 %	28.4151	2	TOTAL_CONF	2.092	<= 25.500
	4	31.9167	2.46571	24	24.2 %	31.9167	2	TOTAL_CONF	2.092	> 25.500
	5	27.0769	2.54438	26	26.3 %	27.0769	3	TOTAL_INNO	.923	<= 11.500
	6	29.7037	2.98477	27	27.3 %	29.7037	3	TOTAL_INNO	.923	> 11.500
Prueba	0	27.7797	4.45900	118	100.0 %	28.2222				
	1	23.9655	3.71755	29	24.6 %	23.7273	0	TOTAL_FU	5.739	<= 14.500
	2	29.0225	3.95996	89	75.4 %	29.5065	0	TOTAL_FU	5.739	> 14.500
	3	27.7797	3.89105	59	50.0 %	28.4151	2	TOTAL_CONF	2.092	<= 25.500
	4	31.4667	2.82517	30	25.4 %	31.9167	2	TOTAL_CONF	2.092	> 25.500
	5	26.4483	4.24757	29	24.6 %	27.0769	3	TOTAL_INNO	.923	<= 11.500
	6	29.0667	3.06182	30	25.4 %	29.7037	3	TOTAL_INNO	.923	> 11.500

Fuente: Elaboración propia

Description of the identified profiles

The people with low level of satisfaction were those who perceived that the repositories were not easy to use. The average level of satisfaction was observed in the people who considered that the repositories were easy to use, although they did not feel confidence in the security they offered and they did not indicate that they were innovative. The highest levels of satisfaction were observed in two user profiles: 1) those that evaluated with high scores the ease of use and the trust that the repository provided, and 2) those that indicated a high facility to use the repository and an elevated level of innovation, despite having a low level of confidence in the safety of this.

As a result, it was found that the factors of ease of use, confidence and level of innovation were relevant in this study. In fact, the tree that was obtained described profiles with a higher level of satisfaction when in these aspects there were high scores; On the contrary, the presence of low scores gave rise to profiles of lower satisfaction. For this reason, it is recommended to contemplate the inclusion of these three factors in the development of new institutional repositories.

Software analysis and design activities - prior to the implementation of the repositories - are fundamental to incorporate elements that promote ease of use, trust, security and innovation. These are requirements that are identified as "non-functional", since they are more related to quality and to some restrictions of use than to the main functionality of the software. Therefore, in the analysis, these characteristics must be defined and clarified, with which the repository will count, while in the design, specific operative means must be specified with which it is possible to guarantee compliance with these requirements in the final version of the repository. which users will interact.

Prediction risk assessment

As shown in Table 3, the prediction error that was obtained was 12,092 units, measured on the same scale as the satisfaction variable, with a standard error of 1,745 in the test sample.

Tabla 3. Evaluación de riesgo de la técnica del árbol (método de crecimiento: CRT; variable de estudio: satisfacción)

Muestra	Estimación	Error estándar
Entrenamiento	11.290	3.019
Prueba	12.092	1.745

Fuente: Elaboración propia

Discussion

Through a regression tree, in this study profiles were identified regarding the satisfaction of university students with the use of digital repositories. When analyzing the results obtained, it was observed that the variables that contributed to the construction of the profiles in the analyzed data were: ease of use, confidence and innovation. These indicate that users base their level of satisfaction on features more related to usability and good functioning than with only visual appeal.

These functionalities can be foreseen in the design stages of the graphic interface of the repositories.

These findings, consequently, have an impact on the identification of the following needs aimed at achieving a high level of satisfaction among the users of an institutional repository: 1) having flexible search tools that lead to relevant results and suggestions, 2) promoting the fluid communication between the user and the repository through the graphical interface to satisfy their expectations, 3) use simple, creative and intuitive designs that are easy to understand, manipulate and remember, 4) properly classify the digital contents of the repository, 5) provide appropriate security mechanisms and management of personal information for users. These recommendations are consistent with those of Iriondo, Vázquez y Jiménez (2010), Velázquez *et al.* (2014), Oliva Marañón (2014) y Adewumi *et al.* (2016), así como con las perspectivas de Huwe (2017).

Conclusions

In this article, results related to the satisfaction of university students regarding the use of digital repositories were presented. Through the regression tree technique, we tried to build profiles based on the following variables: interactivity, confidence, access opportunity, ease of use, visual appeal, innovation, location, gender of the participant and level of studies. However, only the following variables were relevant for the study of satisfaction: ease of use (referring to the degree to which the design of a repository makes its functionalities accessible to the user), trust (linked to the level of security that users have about the repository) and innovation (related to the novel design elements in the graphic interface).

Consequently, the most important profiles were characterized as follows: people with low satisfaction were those to whom the repositories did not find them easy to use, while the highest levels of satisfaction were observed in the students who perceived that the repositories 1) were reliable and simple to use, or 2) they were innovative and easy to use, even though they were not very reliable. These results make possible the understanding and inclusion of these aspects in the design and implementation of new institutional repositories to provide better experiences to users and to optimize their benefits.

Acknowledgment

The authors wish to thank the Autonomous University of Tamaulipas and the National Council of Science and Technology (CONACYT) for the facilities and resources provided to carry out this work.

References

Adewumi, A., Omoregbe, N. y Misra, S. (2016). Usability Evaluation of Mobile Access to Institutional Repository. *International Journal of Pharmacy and Technology*, *8*(4), 22892-22905.

Babini, D., González, J., López, F. y Medici, F. (2010). Construcción social de repositorios institucionales: el caso de un repositorio de América Latina y el Caribe. *Información, Cultura y Sociedad*, (23), 63-92. Recuperado de http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S1851-17402010000200004.

Berlanga, S. V., Rubio, H. M. y Vilá Baños, R. (2013). Cómo aplicar árboles de decisión en SPSS. *REIRE Revista d'Innovació i Recerca in Educació*, *6*(1), 65-79.

Casella, M. (2010). Institutional Repositories: an Internal and External Perspective on the Value of IRs for Researchers' Communities. *Liber Quarterly*, *20*(2), 210-225. Doi: 10.18352/lq.7989.

Fushimi, M., Genovés, P., Pené, M. y Unzurrunzaga, C. (2011). Indicadores para evaluar repositorios universitarios argentinos, de la teoría a la práctica. *Segundo Taller de Indicadores de Evaluación de Bibliotecas*. La Plata, Argentina: Universidad Nacional de La Plata.

Hernández Salazar, P. (2011). La importancia de la satisfacción del usuario. *Documentación de las Ciencias de la Información*, *34*, 349-368. Doi: 10.5209/rev_DCIN.2011.v34.36463.

Huwe, T. (2017). Building Digital Libraries: Digital Repositories Face Changing User Expectations. *Computers in Libraries*, *37*(7), 16-18.

Iriondo, I., Vázquez, E. y Jiménez, J. (2010). Satisfacción y uso del campus virtual UCM: la perspectiva de los estudiantes. *VI Jornadas de Campus Virtual UCM*. Madrid, España: Universidad Complutense de Madrid.

McKay, D. (2007). Institutional Repositories and Their 'Other' Users: Usability Beyond Authors. *ARIADNE. Web Magazine for Information Professionals, 52, 1-3*.

Oliva Marañón, C. (2012). Bibliotecas digitales universitarias en España y TIC como paradigmas de las necesidades de información para docentes y discentes. *Biblios, 49*, 65-75. Doi: 10.5195/biblios.2012.69.

Pérez-Marqués, M. (2015). *Minería de datos a través de ejemplos.* México: Alfaomega.

Sandobal Verón, V., Cernadas, M., Cuenca Pletsch, L. y Maurel, M. (2016). ¿Pueden aplicarse las herramientas de evaluación web a la evaluación de repositorios de objetos de aprendizaje? *III Congreso Argentino de Ingeniería. IX Congreso de Enseñanza de la Ingeniería. Resistencia*. Argentina: NA.

Santovenia Díaz, J. R. (2010). Propuesta de un sistema de actividades docentes para el conocimiento de los repositorios científicos. *Ciencias de la Información, 41*(2), 39-44.

Serrano, R., Melero Melero, R. y Abadal, E. (2014). Indicadores para la evaluación de repositorios institucionales de acceso abierto. *Anales de Documentación, 17*(2), 1-12. Doi: 10.6018/analesdoc.17.2.190821.

Song, Y. and Lu, Y. (2015). Decision tree methods: applications for classification and prediction. *Shanghai Archives of Psychiatry, 27*(2), 130-135. Doi: 10.11919/j.issn.1002-0829.215044.

Sulé Duesa, A., Estivill Rius, A. y Gascón García, J. (2011). Evaluación de las interfaces de consulta de las colecciones digitales patrimoniales españolas. *Anales de Documentación, 14*(2), 1-21.

Velázquez, C., Álvarez, F., Muñoz, J., Cardona, P., Silva, A., Hernández, Y. y Cechinel, C. (2014). Un estudio de la satisfacción obtenida con el uso de objetos de aprendizaje. *IX Latin American Conference on Learning Objects and Technologies*. Manizales, Colombia.

Zikmund, W., Barry, B., Carr, J. and Griffin, M. (2013). *Business Research Methods.* Mason, Ohio, Estados Unidos: Cengage Learning.

Rol de Contribución	*Autor(es)*
Conceptualización	**Melchor Medina Quintero, Ramón Ventura Roque Hernández (igual)**
Metodología	**Melchor Medina Quintero, Ramón Ventura Roque Hernández, Demián Ábrego Almazán, Adán López Mendoza (igual)**
Software	**NO APLICA**
Validación	**Melchor Medina Quintero, Ramón Ventura Roque Hernández, Demián Ábrego Almazán, Adán López Mendoza (igual)**
Análisis Formal	**Melchor Medina Quintero, Demián Ábrego Almazán, Ramón Ventura Roque Hernández (igual)**
Investigación	**Melchor Medina Quintero, Ramón Ventura Roque Hernández, Demián Ábrego Almazán, Adán López Mendoza (igual)**
Recursos	**Universidad Autónoma de Tamaulipas, Consejo Nacional de Ciencia y Tecnología (CONACYT) (igual)**
Curación de datos	**Melchor Medina Quintero, Demián Ábrego Almazán, Ramón Ventura Roque Hernández (igual)**
Escritura - Preparación del borrador original	**Ramón Ventura Roque Hernández**
Escritura - Revisión y edición	**Ramón Ventura Roque Hernández**
Visualización	**Ramón Ventura Roque Hernández**
Supervisión	**Melchor Medina Quintero, Ramón Ventura Roque Hernández, Demián Ábrego Almazán, Adán López Mendoza (igual)**
Administración de Proyectos	**Melchor Medina Quintero, Ramón Ventura Roque Hernández, Demián Ábrego Almazán, Adán López Mendoza (igual)**
Adquisición de fondos	**Adán López Mendoza, Melchor Medina Quintero, Demián Ábrego Almazán (igual)**