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User Experience in Museum for the Year 2019-2024: Bibliometric Analysis

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ABSTRACT

The aim of this study is to analyse the bibliometric aspect of User Experience in museum literature from Scopus database whereby 486 papers were extracted. The study utilisedpublishing or perishing software to collect the data, while VOSviewer was used to visualise the data. Data analysis was also carried out using SPSS and Microsoft Excel. The publication of articles between 2019 to 2024. Most of the publications are from journals and conferences , mainly in English. Subject area most the research are Computer Science. The publication of articles between 2023 and 2024 increased to 98 articles in 2023 and this is the highest publication to date. Based on the analysis of the co-occurrence map of all keywords in the articles published, the keywords frequently used by the authors are User Experience/ UserExperiences (332), Museum/Museums (218) and Cultural Heritage/ Cultural Heritages (130). Most of the research related to User Experience in museum was conducted in China, Italy and United Kingdom and the researchers prefer multi-authored publications. Most of the research author are Koutsabsis, P (8), Hakkila, J (6) and Nikolakopoulou P (6)This study presents the history of scientific literature in user experience museum and will provide guidance for future research.

Keywords : User Experience, Museum, Bibliometric

INTRODUCTION

The word "user experience" (UX) originated in the Human Computer Interaction (HCI) community twenty years ago. "Person's perceptions and responses resulting from the use and/or anticipated use of a product, system, or service" is how the ISO defined user experience (Hammady et al., 2018). The methods and expectations of the user coming from the use and/or expected use of a system, product, or service better clarify user experience (UX) and can help develop an initial subjective assessment of the quality of the product(Hassenzahl, 2003).

A museum is a structure that houses and displays artifacts with historical, scientific, artistic, or cultural significance (Reddy, 2021). Recent studies of the literature user experience or usability: user experience evaluation(Yusof et al., 2021). Museum have technologies like Mixed Reality (MR), Augmented Reality (AR) and Virtual Reality (VR).

According to (Trunfio & Campana, 2019) UX model performed on the Italian Masterpiece, the Ara Pacis Museum, they propose a new conceptual model that represents the effects of mixed reality on the experience and satisfaction of museum visitors. Other any User Experience Research, Experience Design, and Evaluation Methods for Museum Mixed Reality Experience (Yi & Kim, 2021). Latest research by (Ji Hyun Yi, 2024) with User Experience Research , Experience Design , and Evaluation Methods for Museum Mixed Reality.

Its design uses relevant literature and the user experience model of (Han et al., 2017) for augmented reality in urban heritage tourism. Other research from (Gong et al., 2022) with Augmented Reality (AR) as a Tool for Engaging Museum Experience: A Case Study on Chinese Art Pieces.

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Now Augmented Reality with mobile (MAR), as research (Lim, 2019) by ttile Usability Measures in Mobile-Based Augmented Reality Learning Applications. Then research (Do et al., 2020) with Effects of mobile augmented reality apps on impulse buying behavior: An investigation in the tourism field.

Research (Tcha-Tokey et al., 2018), a Model of User Experience in Immersive Virtual Environments with Modified UXIVE Model. In museum Virtual with title "Beyond virtual museums: adopting serious games and extended reality (xr) for user-centred cultural experiences"(Doukianou et al., 2020).

Therefore, in order to provide researchers with a useful overview of the UX topics and inspiration for their future study, this paper analyses research publications that are connected to the User Experience (UX) Museum. This section explains the goal of a bibliometric analysis; the methodology used is covered in the second part. The following part then discusses the findings of the linked bibliometric analysis. The final section provides a summary of the findings and suggestions for future research areas.

2. LITERATURE REVIEW

One of the domains in the analysis is bibliometrics, which includes text and data analysis. Large volumes of data from earlier publications can be analyzed using bibliometric analysis, and its importance is well acknowledged.

The idea of bibliometric analysis can also be understood as the research publications' trends and academic activities that are gathered from internet databases.

This analytic method yielded outcomes, including research trends and papers published in prestigious journals and conferences. This method can also investigate different study areas, the most significant articles, the best places to publish, and potential future research avenues.

Research (Rokhsaritalemi et al., 2020) To accomplish these goals, a variety of computer concepts have been developed, including mixed reality (MR), augmented reality (AR), and virtual reality (VR). Virtual reality (VR) offers a computer-generated environment that users may interact with by donning a VR headset and entering. Virtual reality (VR) had a difficulty with its lack of relationship to actual space, but AR technology addressed this issue and offered a new visualization technique that allowed computer-generated content to be added to the real environment. The user can engage with an augmented reality created by this technology. Even while augmented reality is important, it might be difficult to distinguish between the real and virtual worlds. This issue lowers the degree of user immersion in augmented reality situations.

According to Dieck and Jung (2015) the current UX trend is now also using AR technology such as parents' user experience of reading AR books Cheng (2018), user experience and needs in a complex AR environment by Kim et al. (2015), and evaluation of mobile AR games for primary school children (López-Faican & Jaen, 2020). Implementation user experience in museum field Augmented Reality (Hammady et al., 2018)(Han et al., 2017)(Hersyah, 2021)(Stumpp et al., 2019)(Kim et al., 2015)(Cheng, 2018), mobile augmented reality (Irshad & Rambli, 2016).

Study virtual reality (Davidavičienė et al., 2019) (Davidavičienė et al., 2021) dan mix reality (Trunfio & Campana, 2019)(Yi & Kim, 2021)(Lang et al., 2019)(Hughes et al., 2004), websites (Aranyi & Van Schaik, 2016).

3. RESEARCH METHODS

User experience museum projected number of publications in 2019, to be perhaps the highest since 2009. However, several publications have already been prepared and indexed in the Scopus database prior to 2019 (Norhanisha, 2021).

At the beginning the process of review is identifying the databased used. The method used in this study is data collection from Scopus database as at 16 March 2024. However, this study analyses the data and analytically produces the results from Scopus database which focus on the document and source type, document year, language, subject area, keywords, Country and author name. Document types are based on the title of the document, namely "Article Title". In order to find the suitable resources, the suitable keyword should applied when discover the literature,

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furthermore, the keyword in this study was ("Experience Museum or User Experience Museum or User Experience Case Study or User Museum or Museum Augmented Reality or Museum Virtual Reality or Experience Virtual Museum or Museum Cultural Heritage or Effect Museum").

4. RESULTS AND DISCUSSIONS

The data analysed in this study were elaborated by document and source type, year of publication, language of document, subject area, country. Tables, graphs, pie charts and other illustration forms were also used to illustrate these parts of the data. The results were presented as frequency and percentage until 16 March 2024. The results were discussed in the next section

A. Document and Source Type

This study analysed all the data collected to identify their categorisation. The first part of the analysis was on document types. Document types include articles , conference papers, review and book chapters

Table 1 shows that there are seven (7) types of documents which have been published based on user experience museum. The types of documents are namely conference papers, articles, conference review, book chapters, review, erratum, book and Retrated. Table 1 also illustrates that most publications are conference papers (51.23%), articles (36.83 %), conference review (6.58%), book chapter (2.28 %) and review (1.85%). The other types of documents were less than 1 % such as books (0.21 %), Erratum (0.21 %), and Retracted (0.21 %).

Table 1 – Document Type

Document Type	Frequency	Percentage(%)
Conference Paper	249	51.23
Article	179	36.83
Conference Review	32	6.58
Book Chapter	14	2.88
Review	9	1.85
Book	1	0.21
Erratum	1	0.21
Retracted	1	0.21
Total	486	100

Figure 1 shows the top seven of document types. The findings showed that the authors prefer to publish their research papers in conference papers rather than in journals. This pattern shows document types such as book, editorial and Retracted has not anymore become the favourite types among the academia to publish their research. Academics prefer to publish their research papers in the form of articles and conference papers because these are more familiar than the other document types.

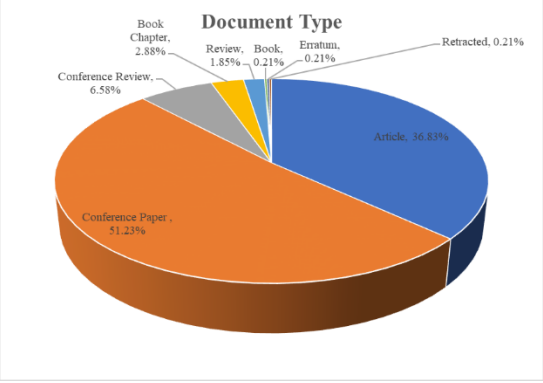

Fig. 1. Document Type

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Table 2 presents 5 source types that show the highest percentage: journals (39.71 %), conference proceedings (30.04 %), followed by book series (28.60 %) and book (1.65 %). Main source types is jounals and book is the smallest source of publication.

Table 2 – Source Type

Source Type	Frequency	Percentage(%)
Journal	193	39.71
Conference Proceeding	146	30.04
Book series	139	28.60
Book	8	1.65
Total	486	100

Based on figure 2, it is clear that journal is the priority source for researchers because it is the paper presented in a conference, and it is easier to understand. Meanwhile, books and trade publications seem less popular by scholars as a source for reference.

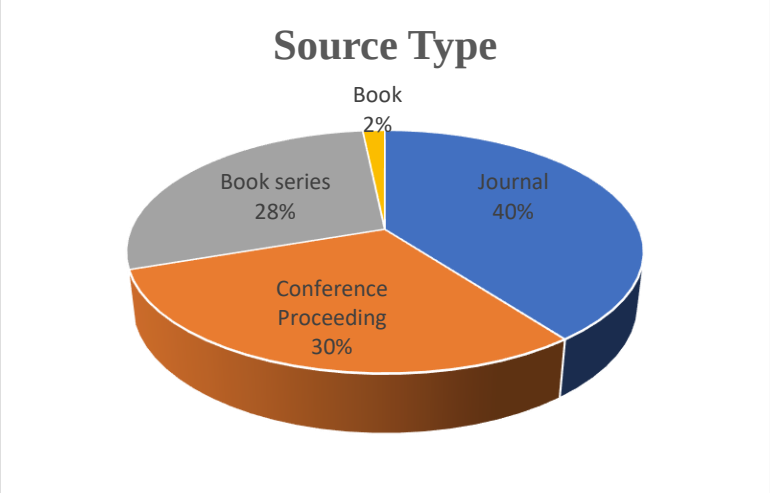

Fig. 2. Source Type

B. Year of Publications

Table 3 shows that there are six (6) year of publications which have been published based on user experience museum. The years publications years 2018 until 2024. Table 2 also illustrates that most publications are year 2019 (69), 2020 (84), 2021(67), 2022(73), 2023 (98) and 2024 (95).

Table 3 – Total Number of Publications by year

Year	Total Number of Publication
2019	69
2020	84
2021	67
2022	73
2023	98
2024	95
Total	486

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Figure 3 shows the top six of years publications year 2019 until 2024. It can be seen that there has been a significant increase from 2019 to 2024.

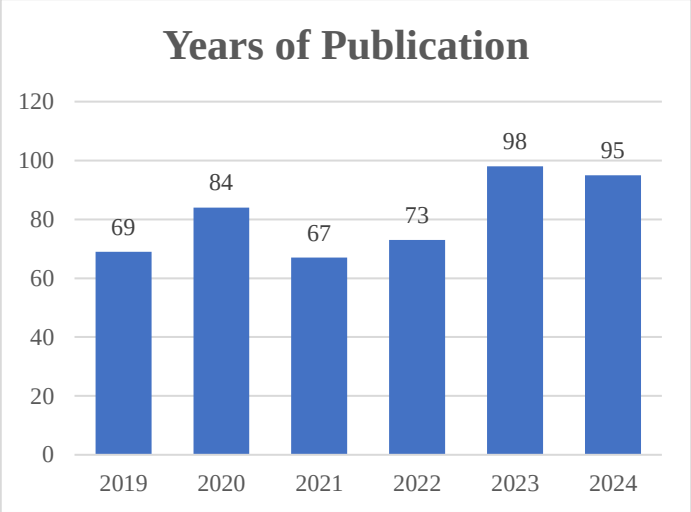

Fig. 3. Year of Publications

C. Language of Documents

Table 4 shows that most of the documents were published in English (96.52 %). There were a few in followed by Chinese (1.43%), Portuguese (0.82%), Korean (0.41 %), Estonian (0.20%), Italian (0.20%), Polish (0.20%) and Thai (0.20%). Based on Table 4 also shows that the popular language for the papers studied is English. Analysis reveals that the frequency of publications in other languages such as Portuguese, Korean, Estonian, Italian, Polish and Thai could not even reach 1% (based on 486 papers collected).

Table 4 – Languages

Language	Frequency	Percentage %
English	471	96.52
Chinese	7	1.43
Portuguese	4	0.82
Korean	2	0.41
Estonian	1	0.20
Italian	1	0.20
Polish	1	0.20
Thai	1	0.20
Total	486	100

Figure 4 shows the top eight of languages publications English, Chinese, Portuguese, Korean, Estonian, Italian, Polish and Thai. This is because many of today's academic references are using English as the main language as it is more accepted and understood by researchers around the world.

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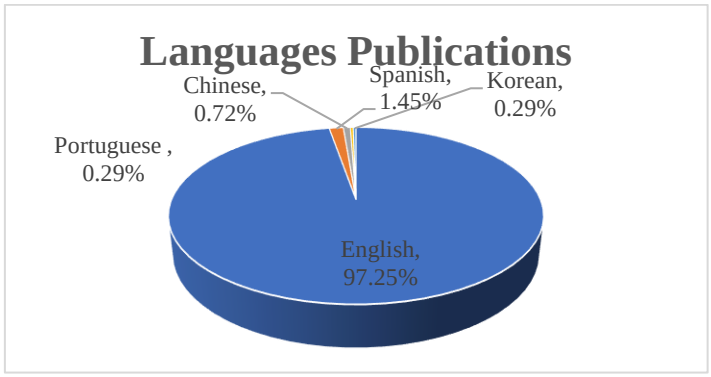

Fig. 4. Languages

D. Subject Areas

This study also analysed the published documents based on their subject areas. 10 Most of the studies on User Experience or UX in museum were in the area of Computer Science, which holds 41.38 % of the total documents followed by Engineering (15.45 %), Mathematics (14.018 %), Social Science (7.94 %), Arts and Humanities (7.30%), Material Science (4.23%), Pyysics and Astronomy (3.39%), Decision Sciences (2.43 %), Bussiness, Management and Accounting (2.01%) and Chemical Engineering (1.69%).

Table 5 – Subject areas

Rank	Subject Area	Frequency	Percentage(%)
1	Computer Science	391	41.38
2	Engineering	146	15.45
3	Mathematics	134	14.18
4	Social Science	75	7.94
5	Arts and Humanities	69	7.30
6	Material Science	40	4.23
7	Physics and Astronomy	32	3.39
8	Decision Sciences	23	2.43
9	Bussiness, Management and Accounting	19	2.01
10	Chemical Engineering	16	1.69

Figure 5 shows the top ten of subject area and other subject areas, which applied less than 1% UX in museum Energy, Psychology, Medicine, Environmental Science and Neuroscience.

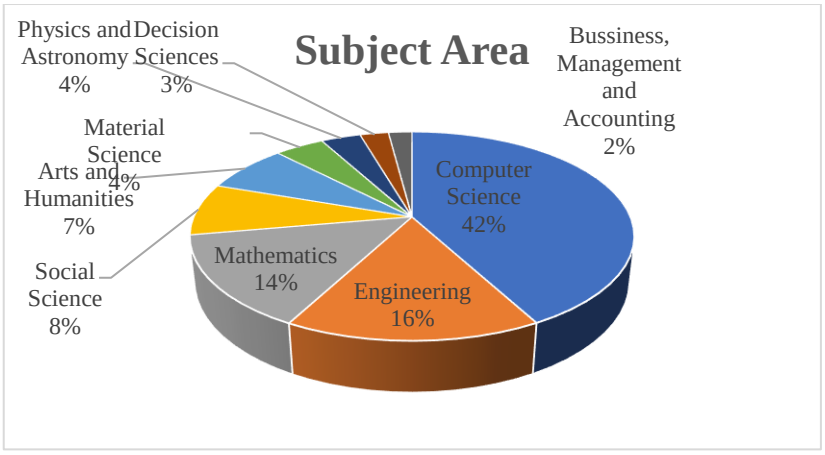

Fig. 5. Subject Areas

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E. Keywords

This study also analysed the published documents based on their 10 top keywords . Most of the studies on User Experience in museum, which User Experience/ User Experiences (29.20%), Museum/ Museums (19.17%), Cultural Heritage/ Cultural Heritages (11.43%), Virtual Reality (11.08%), (12.19%), User Interfaces (7.30%), Augmented Reality (6.24%), (6.10%), (6.00%), Human Computer Interactions (5.10%), Exhibitions (4.13%0, Virtual Museum (4.05%) and Mixed Reality (2.29%).

Table 6 – Keywords

Rank	Subject Area	Frequency	Percentage(%)
1	User Experience/ User Experiences	332	29.20
2	Museum/ Museums	218	19.17
3	Cultural Heritage/ Cultural Heritages	130	11.43
4	Virtual Reality	126	11.08
5	User Interfaces	83	7.30
6	Augmented Reality	71	6.24
7	Human Computer Interactions	58	5.10
8	Exhibitions	47	4.13
9	Virtual Museum	46	4.05
10	Mixed Reality	26	2.29

Figure 6 also presents the top 10 keywords that substantially applied User Experience in museum fields in their study. Other keywords, which applied less than 2% which Behavioral Research, Gamification, Imersive, Surveys and E-Learning.

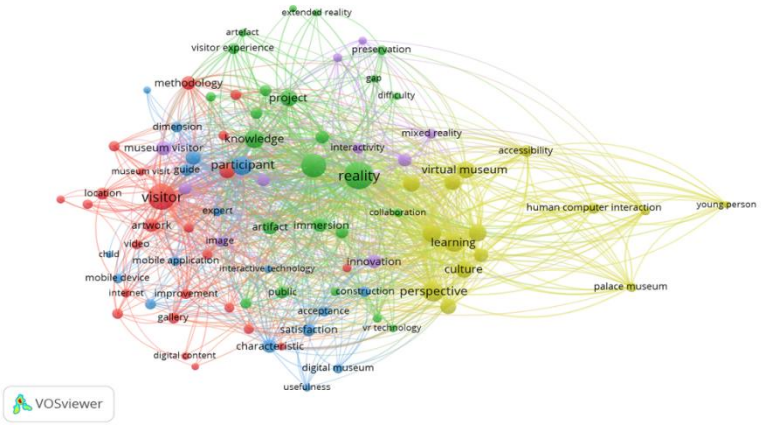

Fig. 6. Keywords

F. Country Distributions

The study found that there are 45 countries that contributed to the research publications. According to Figure 7, these countries partake in the distribution of published documents. The 10 countries with the absolute highest number of publications are the China, Italy, United Kingdom (UK), United States (US), Greece, South Korea, Germany, Portugal,

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Australia and France.. The study also analysed the total publications in different countries (based on the collected 486 papers), as shown in Table 7.

Table 7 – Country Distributions

Rank	Country	Frequency	Percentage %
1	China	115	28.89
2	Italy	57	14.32
3	United Kingdom	45	11.31
4	United States	37	9.30
5	Greece	34	8.54
6	South Korea	33	8.29
7	Germany	33	8.29
8	Portugal	19	477
9	Australia	13	3.27
10	France	12	3.02

Figure 7 shows a network visualisation of country of the same colour, for example, have been commonly listed. Figure 7 also presents the top 10 country that substantially applied User Experience in museum fields in their study. Other keyword, which applied less than 3% which Japan, India, Malaysia, Canada and Finland.

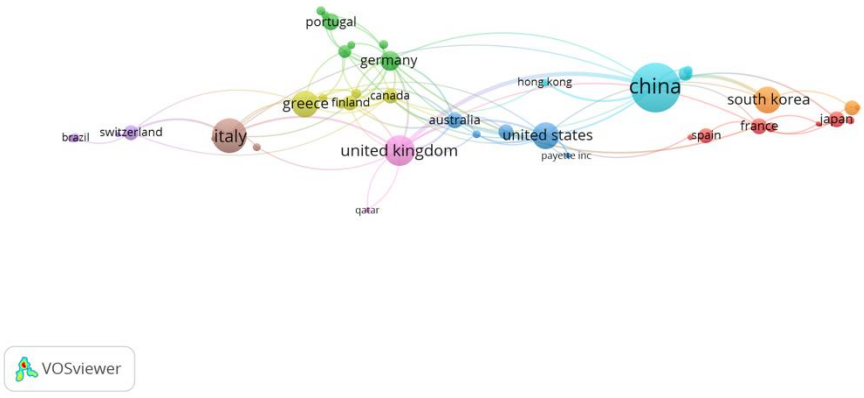

Fig. 7. Country Distributions

G. Author Name

The number of authors per document is indicated in Table 8. A total of 486 publications records have been are multi-authored. There was no information on the authors' background on certain documents obtained from the database in Scopus. Author have top 10 in publications which Koutsabsis (8), P, Hakkila, J (6), Nikolakopoulou (6), V, Paananen (6), S, Vosinakis (6), Bordegoni (5), M, Carulli, M (5), Li, Y (5), Chatzigrigorigorious, P (4), Harrington, M.C.R (4).

. Table 8 – Author

Rank	Author	Total of Publication
1	Koutsabsis, P	8
2	Hakkila, J	6
3	Nikolakopoulou, V	6
4	Paananen, S	6
5	Vosinakis	6
6	Bordegoni, M	5
7	Carulli, M	5

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8	Li, Y	5
9	Chatzigrigorigorious, P	4
10	Harrington, M.C.R	4

Based on Figure 8, the authors most frequently prefer to conduct research with partners with 486 publications. VOSviewer, the software instrument for creating and viewing bibliometric networks, has been utilised to map authors.

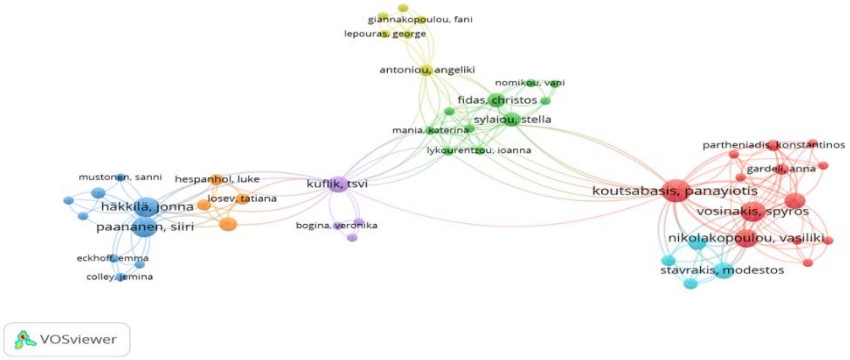

Fig. 8. Author Name

5. CONCLUSION

This study reveals the areas that are mostly covered in the UX Museum research are based on the keywords used by authors. Based on the analysis in this study, most of the document types are followed by conference papers (249), articles (179), Conference Review (32), book chapters (14), reviews (9), books (1), Erratum (1) and and Retracted (1). 4 top source type are Journal (193), Coference Proceeding (146), Book Series (139) and Book (8). The research on this topic was started in 2019 and has increased annually since then, as shown in the number of publications in 2019 (69), 2020 (84), 2021 (67), 2022 (73), 2023(98) and 2024 (95). Top 10 languages publications are English dominant, then Chineese (7), Portuguese (4), Korean (2), Estonian (1), Italian (1), Polish (1) and Thai (1).

Top 10 subject area are computer science (391), Engineering (146), Mathematic (134), Social Science (75), Arts and Humanities (69), Material Science (40), Pyhsics and Astronomy (32), Decision Sciences (23), Business (19) and (Chemical Engineering(16). Top 10 keywords are User Expereince (208), Museums (156), Virtual Reality (126), User Experiences (124), User Interfaces (83), Augmented Reality (71), Cultural Heritages (68), Museum (62), Cultural Heritage (61) and Human Computer Interactions (58). The global distribution of the literature reveals that the China has the most publications and has influences on the Italy, United Kingdom, United States, Greece and other countries. Author have top 10 in publications which Koutsabsis (8), P, Hakkila, J (6), Nikolakopoulou (6), V, Paananen (6), S, Vosinakis (6), Bordegoni (5), M, Carulli, M (5), Li, Y (5), Chatzigrigorigorious, P (4), Harrington, M.C.R (4).

In this study, Bibliometric statistics of literature in UX museum revealed that publications were dominated by multi-authored publications. In addition, this study focused only on the UX museum subject, which also included UX based on the documents' titles. Literature which is relevant to UX museum but not included in the title specifically was omitted. It is imperative to note that no search results are completely correct. In this study, the analysis is based on Scopus. Despite these constraints, this study is one of the first to analyse the bibliometric information of the literature about UX museum and the analysis may be used by other researchers to get the overview of the UX area.

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