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Bibliometric Analysis of Augmented Reality Research in Medicine

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ABSTRACT

This study aims to carry out a bibliometric analysis of the studies that have been carried out related to Augmented Reality (AR) in particular in the field of medicine. Augmented reality technology, which is becoming increasingly popular in the field of medicine, has the potential to improve medical diagnosis, treatment, and training. In this research, we perform bibliometric analysis of relevant scientific publications published in a particular period. Bibliometric analysis methodology gathers data on AR research in the field of medicine. This includes the title, author, journal where it was published, year of publication, and keyword used. The results of bibliometric analysis showed rapid progress in AR research in the field of medicine. In the last five years (2018-2023), as many as 250 publications were selected based on research criteria. This analysis reaches the conclusion that research on AR in the field of medicine is vital and increasingly recognized in the scientific community. The results of this analysis can help researchers and medical practitioners understand current trends with the use of AR in medical practice.

Keywords: *Augmented Reality, Bibliometrics, Medicine*

1. INTRODUCTION

Augmented Reality (AR) is a technology that is capable of collaborating real-world objects with virtual or digital worlds in real-time. AR itself was introduced by a researcher named Thomas Preston Caudell in 1992 at Boeing [1]. Augmented reality itself is a term that refers to a virtual interface, whether it's two- or three-dimensional, which is capable of enhancing what the user sees by inserting additional content, or digital information, into the real world. However, in this case, the user does not really plunge into the virtual world, because the user can still see the reality world around him [2].

In the last few years AR itself has become one of the technologies whose investment interest in research has increased rapidly. So it has also been a positive development related to its research findings while also reflecting how the potential and innovation of AR as a technology of interaction between humans and computers [3]. AR has also been widely discussed by people and has been used in various fields such as business, travel, entertainment, marketing, architecture, education and without exception in the world of medicine or health. In the world's use of AR home medicine today has undergone development and adaptation for every stage of medical training in its use as a tool for teaching anatomy, physiology, classroom learning aid, image training simulator, and clinical skill interaction simulator [4], [5].

With the emergence of many AR technologies, especially in this field of medicine, there is a need for a comprehensive literary study in this case to do bibliometric analysis. Bibliometrics is a process of analyzing information from a published book or journal along with related metadata in this case abstracts, keywords, and quotations to describe the relationship of a published work [6]. Bibliometry can be used in almost all scientific fields. In the field of health, bibliometrics may be used to analyze various fields such as medicine, health care, dental care, and others [7]. However, based on the search we have done in some sources of trusted journals, there are still few studies with

bibliometric analysis themes related to augmented reality research trends in medicine. So with this we created a study with the title "Bibliometric Analysis Of Augmented Reality Research In Medicine" with the aim that readers can understand or identify the latest trends related to the use of AR in medicine so that it can be useful in future research.

2. METHODS

Bibliometric analysis methods and bibliometric visualization are used in this research. A structural overview of a particular research subject is given through bibliometric visualization. For some reason, this study uses descriptive bibliometric analysis, that is to say, analysis that looks at literature from a description perspective. One reason for using bibliometrical analysis is to find new trends in articles and journals. In this study, the sample consisted of 250 publications corresponding to the keywords selected and accessed through the Google Scholar database. "Augmented Reality" and "Medicine" were the key words in this study. Of the 250 published publications, most came from articles or journals. The journals selected by the researchers are in the publication period between 2018 and 2023 using the VOSviewer application, which has three views: network visualization, overlay visualisation, and density visualisation. The indicator is determined by looking at the number of publications, number of quotes, and the strength of the link between objects displayed overall.

Researchers collected metadata on Augmented Reality in the Medical Field from 2018 to 2023 using the Google Scholar database. VOSviewer is a software for building and visualizing bibliometric maps and has a view that allows to examine bibliometrical maps thoroughly. Once downloaded in RIS form, the article is imported into the Mendeley program, which stores the reference information associated with the article. Next, the frequency of publication will be calculated on the basis of the keyword Augmented Reality in the medical field.

The following table shows the number of publications found in the Google Scholar database with the keyword Augmented Reality in the field of medicine from 2018 to 2023:

Table 1. Number and percentage of Augmented Reality publications in medicine (2018-2023)

No.	Year of Publication	Number of Publications	Percentage
1	2023	23	9.20%
2	2022	41	16.40%
3	2021	62	24.80%
4	2020	51	20.40%
5	2019	41	16.40%
6	2018	32	12.80%
Total		**250**	**100.00%**

The highest number of publications per year in 2021 was 62 publications, showing a rapid increase each year, as shown in table 1. Of the 250 publications most come from articles or journals.

3. RESULTS AND DISCUSSION

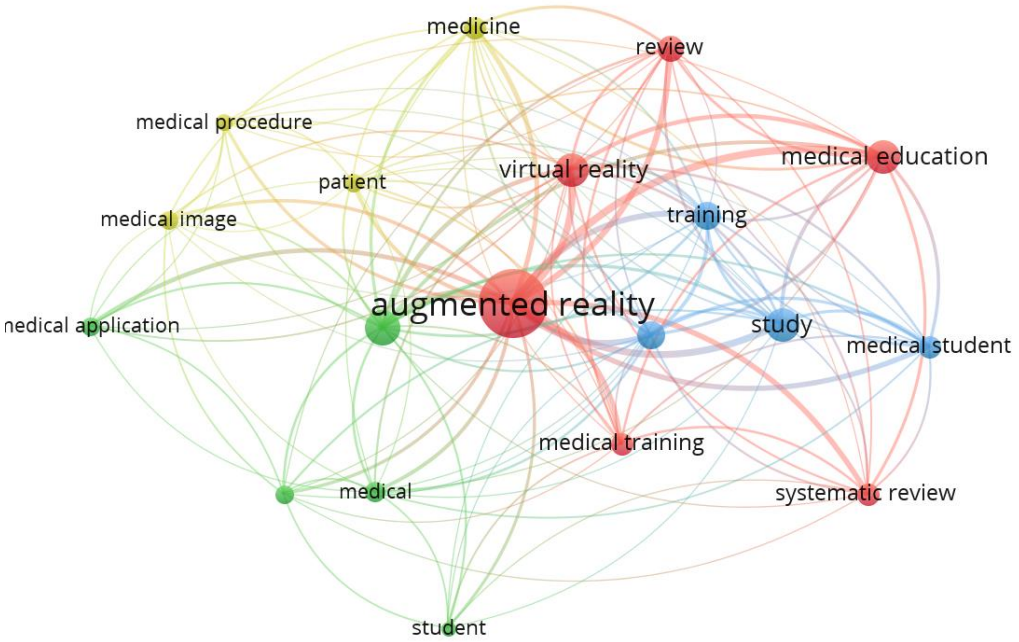

Figure 1. Network visualization map of keywords

The results of the study describe the main findings of the study. The presentations in the result Figure 1 above shows a number of colors, each showing a cluster. The red cluster is the largest because it consists of six keywords, and it can be seen that the Augmented Reality keyword has the largest circle compared to any other key word. This indicates that the focus of the research in this cluster was the study of augmented reality. In the second cluster, it consisted of five key words, with the largest Medical keyword. It shows that the research focus in this Cluster was Medical. In a third cluster the blue color consist of four keywords, and the Study keyword was the research focal point in this third Cluster. The last Cluster is yellow, from the above image it is seen that Medicine has a large circle diameter which means that the keyword is the focus on the research on this last cluster.

Table 2. Clusters and Keywords

Cluster	Keyword	Most Frequest Keyword	Total Item
1	Augmented Reality, Medical Education, Medical Training, Review, Systematic Review, Virtual Reality	Augmented Reality (181), Medical Education (44), Virtual Reality (42).	6
2	Augmented Reality Technology, Medical, Medical Application, Student	Medical (16), Medical Application (15).	4
3	Education, Medical Student, Study, Training	Study (41), Education (30), Training (30).	4
4	Medical Image, Medical Prosedure, Medicine, Patient	Medicine (20), Medical Image (13).	4

Table 2 above shows that the keyword Augmented Reality has the highest number of events, with 181 events associated with the study of Augmented Reality.

Table 3. Top 6 articles in augmented reality research in medicine

Cites	Authors and Years	Title
292	TK Huang, CH Yang, YH Hsieh, JC Wang, ... (2018)	Augmented reality (AR) and virtual reality (VR) applied in dentistry
279	B Muhsin, O Ahmed, MJE Kiani (2021)	Augmented reality system for displaying patient data
266	CQ Casas (2018)	Image-guided surgery with surface reconstruction and augmented reality visualization
204	M Eckert, JS Volmerg, CM Friedrich (2019)	Augmented reality in medicine: systematic and bibliographic review
190	J Sutherland, J Belec, A Sheikh, L Chepelev, ... (2019) J Sutherland, J Belec, A Sheikh, L Chepelev, ... (2019)	Applying modern virtual and augmented reality technologies to medical images and models
179	S Barteit, L Lanfermann, T Bärnighausen, ... (2021)	Augmented, mixed, and virtual reality-based head-mounted devices for medical education: systematic review

CONCLUSION

Based on the results we obtained from the above research, it can be concluded that "Augmented Reality" as the most dominant keyword, suggests that research on augmented reality is the most prominent in the dataset and is the event with the most number of keywords. This suggests that research on Augmented Reality is often associated with the approach of Medical Education. For further research, it is expected that readers or researchers will be able to do further exorcism regarding the relationship between "Study" and the use of augmented reality in the medical context in order to provide further insight into the benefits of this technology in research.

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