Sibatik Journal
Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, dan Pendidikan
E-ISSN: 2809-8544

LITERATURE REVIEW OF RESEARCH TRENDS ON AUGMENTED REALITY AS A MEDIA ART THERAPHY FOR PEOPLE WITH DISABILITIES

Astri Noviani[1], Anne Nurfarina[2]
Universitas Multimedia Nusantara, Indonesia
Email: astri.noviani@lecturer.umn.ac.id[1], anne.nurfarina@umn.ac.id[2]

Abstract

Research related to Art Therapy on an international scale increases every year. Several studies identified its development through a bibliometric approach referring to various scientific areas. Research generally describes things that are contextual with visual arts-based scientific products as artistic therapies. On the other hand, this development is supported by technological advances, including Augmented Reality (AR). AR is a technology that allows users to gain additional insight into reality from a situation needed. The correlation between art therapy and AR is a fundamental research platform for research teams in developing learning media for people with disabilities. So that literacy analysis is needed related to the two objects of study. This study will review the literacy characteristics of previous research with the aim of gaining objective insight into AR media for learning for people with disabilities. The method used is a literature study with a Bibliometric Analysis approach adopting the five-stage method from Denyer and Tranfield (2009). Research output in the form of data recommendations and concepts that are of novelty value according to user needs.

Keywords: *Art therapy, Augmented Reality, Literacy Studies, Bibliometrics, Disability*

INTRODUCTION

Art Theraphy is a type of mental health therapy that uses the creative process of art to foster the process of personal development, psychology, affective, cognitive and social relationships of individuals (Donnari et al., 2019). The purpose of this method is to increase or calm self-awareness, social relationships, or conditions with emotional disorders and mental distress. Art Theraphy consists of many types of methods and technologies, one of which is Augmented Reality. Bridges et al. (2020) in their research stated that AR can improve daily skills and independence among students with special needs. In addition, McMahon (2015) in his research also showed AR technology can improve learning among students with special needs. This can happen because Augmented Reality allows combining traditional learning methods of material and visualization in the process (Sugiura et al., 2019).

In recent years, technological advancements, particularly Augmented Reality (AR), have brought a new dimension to art therapy. AR is a technology that combines multimedia facilities, 3d-Modelling, Real time tracking and registration, interaction intelligence, sensing and other assistance to be able to bring a virtual world to the real world. In principle, augmented reality makes use of data generated by computers to simulate into the real world. In this way, the two types of information will complement each other so as to achieve improvement in the real world (Chen et al., 2019). The application of AR in art therapy opens up new opportunities to develop more interactive, inclusive, and effective interventions for individuals with different types of disabilities.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

Based on the data that the research team collected, the trend of AR use in Indonesia has not developed progressively like in developed countries in Asia or Europe. From the research index with the keywords disability and AR, America occupies the highest position. For this reason, AR has the opportunity to become an effective technology to help handle disability through Art Theraphy in Indonesia. In this case, the research team is interested in further exploring the benefits of AR, especially as an Art Theraphy technology with case studies from various regions of Indonesia.

This research is the initial stage of a research roadmap that aims to conduct a review of previous research literacy, within the scope of using AR as an art therapy technology for disability cases. Through these literacy studies, the research team needs to understand the advancements, trends and potential uses of AR as an art therapy technology. The objectivity of research related to AR and art therapy is useful for improving cognitive, psychological and social relations abilities of people with disabilities.

In the context of a literature study on the use of AR technology and art therapy for individuals with disabilities, previous research has revealed several research gaps that need attention. Most of these literature studies have a limited scope in reviewing different types of disabilities, so there needs to be a more comprehensive literature review of how AR has been used in art therapy for different types of disabilities. In addition, some research focuses on the use of AR in art therapy in specific regions or in specific cultural contexts, so it is important to consider geographic and cultural diversity in this literature review. Evaluation of the effectiveness of AR use in art therapy is also not yet in-depth, so it is necessary to review the literature that examines more in-depth studies of therapeutic outcomes and long-term development that occurs.

However, this literature review also brought novelty elements in the use of AR in art therapy. The new literature study could bring elements of novelty by identifying current trends in the use of AR in art therapy, including the use of the latest AR hardware or software that hasn't been explored much in previous research. In addition, this literature review can highlight the development of new concepts of the use of AR as art therapy, such as the potential for developing AR applications that are more specifically in accordance with the needs of individuals with disabilities from Indonesian socio-cultural backgrounds. In addition, synthesis of recent findings from multiple research sources can help connect data dots not seen before, while comparisons of methods used in past research can provide valuable insights. Finally, this literature review can identify practical implications of previous research into the use of AR as an art-based therapeutic medium, helping interested practitioners and researchers to better understand how this technology can be better used in everyday practice.

Asia is a geographical region that has social, cultural and psychographic similarities with Indonesia, so the research team focused on the literacy index of previous research from the Asian region. This is to identify research opportunities and media design that have novelty value and benefit value in accordance with the characteristics of the research subject. Asia is one of the regions with significant contributions to the study, with many countries

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

such as South Korea, India, Malaysia, Singapore, Indonesia, Japan, Saudi Arabia, Iran, and China, producing a total of 161 articles.

METHOD

This study uses bibliometric analysis based on two methods, namely systematic review and explicit (Garza-Reyes, 2015) or mind mapping that emphasizes the limits of knowledge (Denyer & Tranfield, 2009). Systematic review is a specific method of searching for existing data, selecting and evaluating the contribution of a study, analyzing and synthesizing data, and then reporting evidence of new findings that can explain the extent of existing knowledge and what can be added. This study adopted a five-stage method (Denyer & Tranfield, 2009; Setyaningsih et al., 2018) which consists of:

Figure 1. Stages Of The Bibliometric Method

1. Defining keywords
   In the first stage, to be able to search for literature relevant to the research, the research team determines keywords as the focus of the study. A good systematic review is one that has a directed formulation of research questions so that researchers can easily determine data search strategies to identify the relevance of sources, and which data needs to be taken from various studies found (Counsell, 1997). This study focused on the keywords "Augmented Reality for Disability", and "Art Theraphy for Disability."

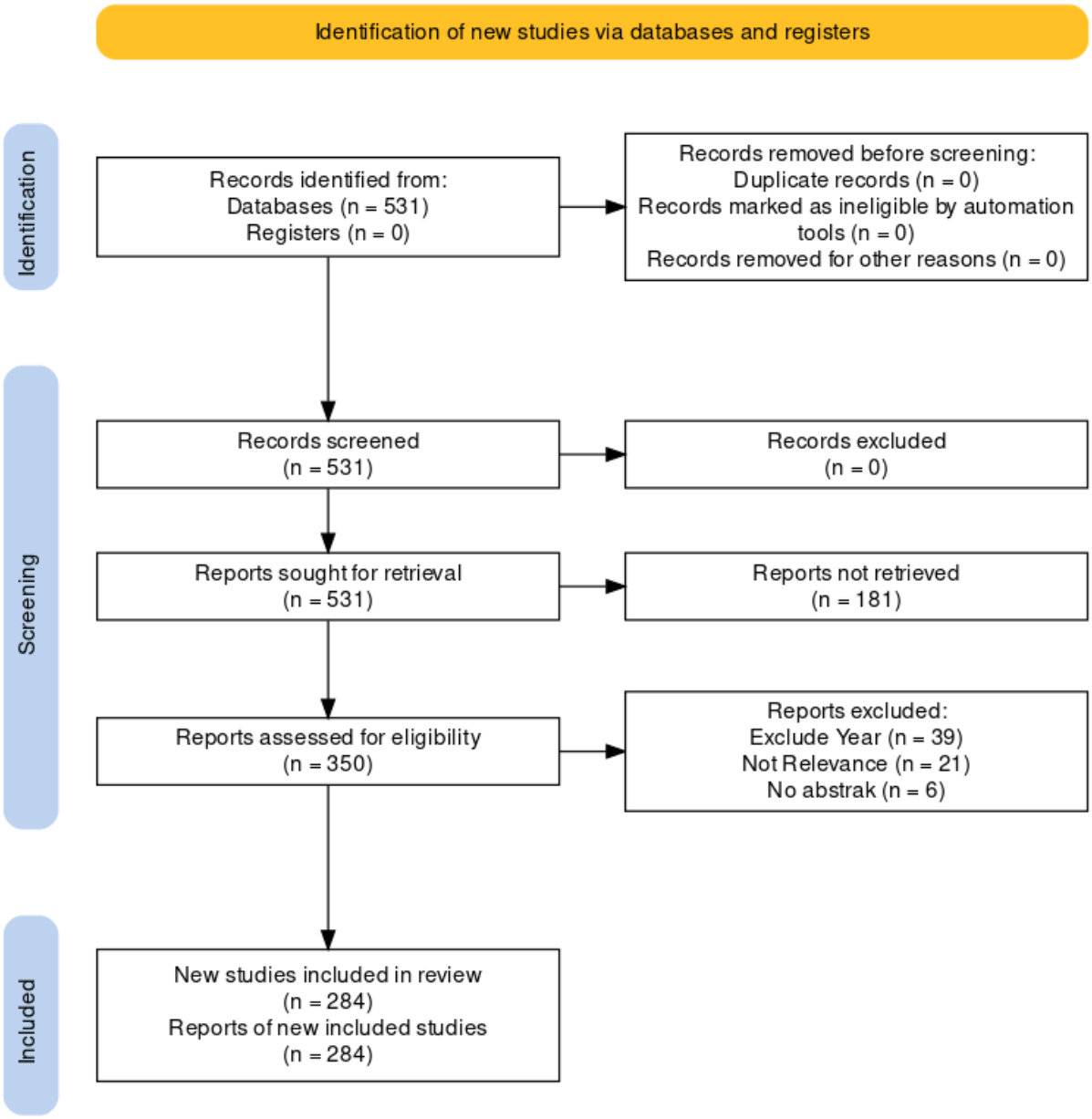
2. Data searching process
   After determining the research keywords, related literacy data was searched by sourcing from the Scopus journal. The literature obtained is focused on journals produced in the range of 2020 to 2023. There are 531 research journals obtained from predetermined keywords.

3. Data refinement process
   The journals obtained were then re-selected based on its relevance to research keywords to produce 284 journals that were relevant to research keywords. Journals are selected based on the year of publication, relevance of content, and abstract of research

4. Compiling statistical data
   The data obtained is then compiled and collected into a data set for later processing by VosViewer

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

5. Data analysis and visualization
   The data that has been compiled is then analyzed using the help of VosViewer to map the relevance of existing literature to the research conducted, what trends are related, and what other new keywords can be related to the research



RESULT AND DISCUSSION

Data Matrix Analysis

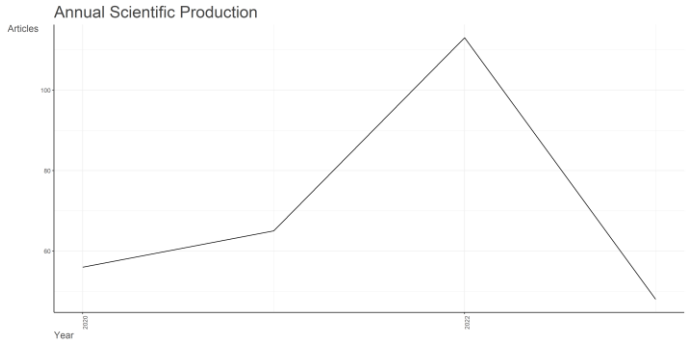
The following are the results of matrix analysis related to the data that has been collected.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

Tabel 1. Main Information About Data

Description	Results
Timespan	2020:2023
Sources (Journals, Books, etc)	177
Documents	284
Annual Growth Rate %	-5,01
Document Average Age	1,46
Average citations per doc	3,287
References	1

In the results of the data matrix analysis that has been collected from Scopus sources for the period 2020 to 2023, there are 284 scientific papers that have been published. The papers have received a total of 938 citations from other studies, with an average citation of 328.7 per year, or about 3.20 citations per paper. Although there was a slightly negative annual growth of -5.01%, the average age of documents was 1.46 years, indicating that this content is relatively new.



In addition, the authors involved in these papers have an h-index of 15, indicating the significant impact of their scientific work in the scientific community. In addition, the g index (g-index) reached 21, while the hc-index and hI-index were 24 and 3.57 respectively. This shows that the research conducted has contributed substantially to the scientific literature in the field. In terms of coverage, h_coverage reached 40.07%, while g_coverage at 49.06%, indicating a wide spread of citations from such studies. In addition, there are 12 researchers involved in writing these papers, with an average of 0.193055556 papers per author. It should be noted that in 2023, there are 10 papers that have been produced, showing growth in research productivity from year to year. In addition, the AWCR (Adjusted Weighted Citation Ratio) index was 527.67, while AW_index reached 0.984027778. In terms of citation accuracy, there are 135 citations that have an accuracy level of 1 (acc1), 89 citations with an accuracy level of 2 (acc2), and 35 citations with an accuracy level of 5 (acc5). However, no citation has an accuracy rate of 20 (acc20). The E-index number is 12.53, while the hm-index is 08.16. From these data, it can be concluded that the research

conducted has a positive impact in the scientific literature, with varying levels of citation accuracy.

DOCUMENT CONTENTS	
Keywords Plus (ID)	1902
Author's Keywords (DE)	766
AUTHORS	
Authors	1025
Authors of single-authored docs	14
AUTHORS COLLABORATION	
Single-authored docs	34
Co-Authors per Doc	4,2
International co-authorships %	22,34

In addition, there are 1902 Keywords Plus (ID), which is an additional keyword term used in these documents. This reflects the diversity of topics covered in this study and efforts to facilitate the search and indexation of documents. In addition, there are 766 Author's Keywords (DE), which are keywords chosen by authors to detail the topic and content of their research. This number shows the variety of research focuses covered in these documents. Then, in terms of author collaboration, there were a total of 1025 authors involved in writing documents in this period. This reflects the existence of various contributors participating in the study, who may come from different institutions and academic backgrounds. However, there are also 14 documents written by one author only, without collaboration with other authors, as well as 34 documents that have only one author but may collaborate with other authors on other documents. This shows variation in author preferences related to collaboration.

On average, each document had 4.2 authors collaborating on the writing, suggesting that research in this period tended to involve collaboration between multiple authors. What's more, more than 22% of the authors' collaborations were international, indicating that there was cooperation between authors from different countries in the study. This can result in research that is more diverse and international in its views and approaches.

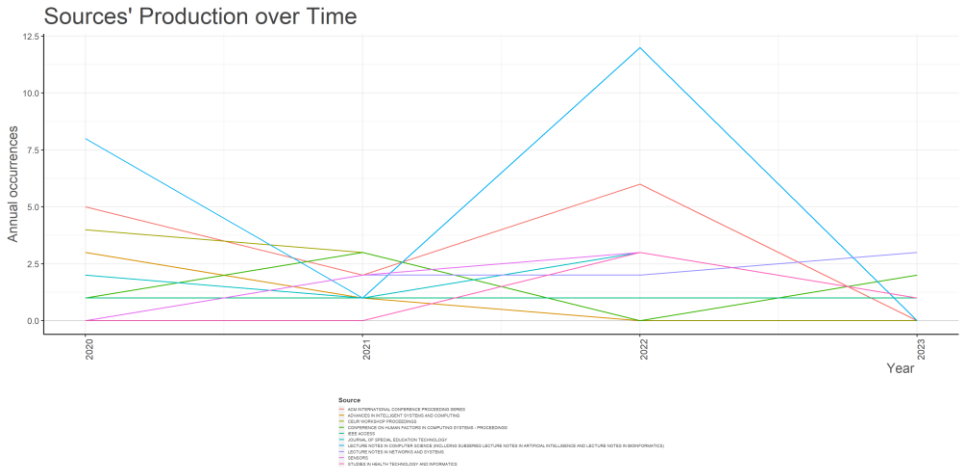
The Development of Journal Engagement

In the course of analysis, we identified the following journals as the most active in producing articles related to the use of augmented reality in art therapy for individuals with disabilities:

1. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): This journal is the most active in producing articles related to this topic, with a total of 21 articles.
2. ACM International Conference Proceedings Series: This journal also has significant contributions, with 13 related articles having been produced.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

3. CEUR Workshop Proceedings: This journal contributed 7 related articles.
4. Journal of Special Education Technology: This journal also has 7 related articles on this topic.
5. Lecture Notes in Networks and Systems: This journal has also produced 7 related articles.
6. Conference on Human Factors in Computing Systems - Proceedings: This journal has 6 articles related to this topic.
7. Sensors: This journal contributed 6 related articles.
8. Advances in Intelligent Systems and Computing: This journal has 4 related articles.
9. IEEE Access: This journal has also produced 4 related articles.
10. Studies in Health Technology and Informatics: This journal has produced 4 related articles.



In addition to analyzing the number of articles produced by journals related to the use of augmented reality in art therapy for individuals with disabilities, it is also important to consider the impact or influence that these journals have on the scientific community. The following is an analysis of journals that have the greatest impact based on several metrics such as h-index, g-index, m-index, total citations (TC), and number of publications (NP).

JOURNAL IMPACT	h_index	g_index	m_index	TC	NP
JOURNAL OF SPECIAL EDUCATION TECHNOLOGY	6	7	1.500	86	7
LECTURE NOTES IN COMPUTER SCIENCE (INCLUDING SUBSERIES LECTURE NOTES IN ARTIFICIAL INTELLIGENCE AND LECTURE NOTES IN BIOINFORMATICS)	4	4	1.000	31	21
ACM INTERNATIONAL CONFERENCE PROCEEDING SERIES	3	4	0,520833333	21	13

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS - PROCEEDINGS	3	3	0,520833333	13	6
INTERNATIONAL JOURNAL OF HUMAN COMPUTER STUDIES	3	3	0,520833333	55	3
SENSORS	3	6	1.000	38	6
BMC MUSCULOSKELETAL DISORDERS	2	2	0,463194444	10	2
EUROPEAN JOURNAL OF SPECIAL NEEDS EDUCATION	2	2	0,347222222	40	2
IEEE ACCESS	2	4	0,347222222	25	4

It can be concluded that several journals have a significant impact in research related to the use of augmented reality in art therapy for individuals with disabilities. The "Journal Of Special Education Technology" has a high h-index, indicating a strong influence in the scientific community. In addition, several other journals such as "Lecture Notes In Computer Science, Acm International Conference Proceedings Series", and "SENSORS" also have a significant impact. This analysis can assist researchers and practitioners in selecting appropriate resources and influential journals to keep abreast of the latest developments in the use of augmented reality in art therapy for individuals with disabilities.

Related Author Development

In the author's developmental analysis related to the use of augmented reality in art therapy for individuals with disabilities, it was seen that "Na Na" was the most prolific author with 21 articles that have been produced. However, it is important to note that several other authors such as "Kaimara P" and "Lim Jy" also have significant contributions with high Fractionalized Articles, suggesting that they were instrumental in the study. In addition, several other authors such as "HWANG JH," "CHEN BB," and "MORRIS JR" have also contributed to this research with several articles. This analysis helps identify authors who have special expertise and interests in this field, and may also encourage collaboration among authors for further research into the use of augmented reality in art therapy for individuals with disabilities.

The author of "NA NA" had a significant number of articles from 2020 to 2022, with each year having 9, 2, and 6 articles. Despite this, they have not received citations (TC) in this period.

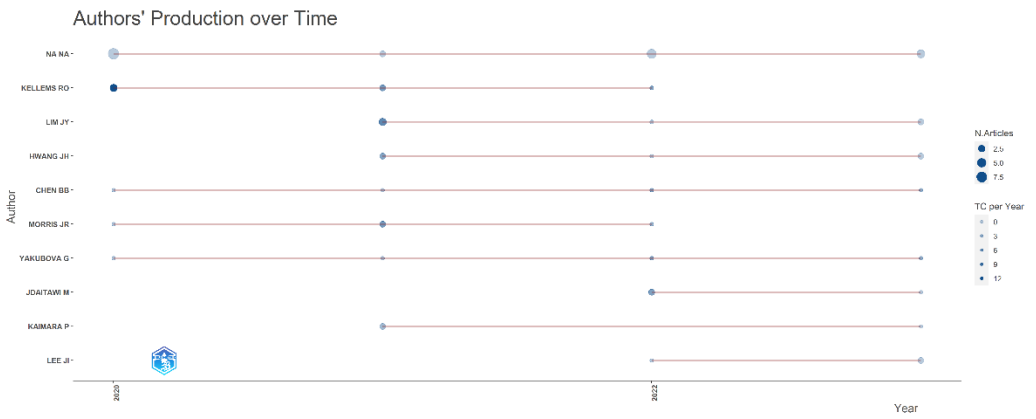
The author of "KELLEMS RO" has contributed significantly in 2020 with 3 articles and obtained a total of 48 citations in that year, which resulted in a TCpY (Total citations per year) of 12. However, his contribution declined in the following years.

The author of "LIM JY" also had a significant contribution in 2021 with 3 articles and a TC of 19, resulting in a TCpY of 6,333. However, in 2022 and 2023, its contribution decreased.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

The author of "HWANG JH" had a contribution in 2021 with 2 articles and a TC of 11, resulting in a TCpY of 3,667. However, his contribution declined in the following years. Other authors such as "CHEN BB," "MORRIS JR," "YAKUBOVA G," "JDAITAWI M," "KAIMARA P," and "LEE JI" have also contributed in recent years with varied TCs.

This analysis shows that some authors have significant contributions in certain years, but it is worth noting that some of them also experience a decrease in contributions from year to year. This reflects the dynamics of research in the field of using augmented reality in art therapy for individuals with disabilities.



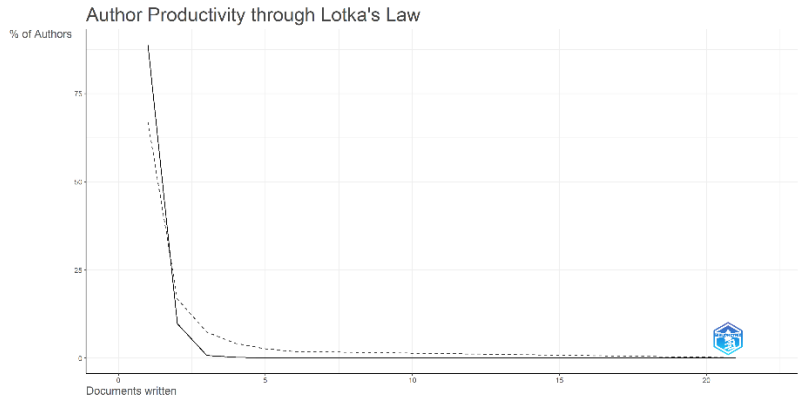
The analysis based on Lotka's Law provides insight into the spread of the number of documents written by a number of authors in research on the use of augmented reality in art therapy for individuals with disabilities. Based on the data provided, we can see that most of the authors (0.616666667 or about 61.67%) wrote only one document in this study.

About 9.8% of authors write two documents, which is a lower percentage, and this includes 100 authors. Then, only a small number of authors (0.008 or about 0.8%) wrote three documents, and even fewer (0.003 or about 0.3%) wrote four documents. Only one author wrote five documents (0.001 or about 0.1%), and two authors wrote six documents (0.002 or about 0.2%).

In addition, it is interesting to note that there was one author who wrote 21 documents (0.001 or about 0.1%). This is a small number of authors who have had a very significant contribution to the study.

This analysis reflects the pattern of distribution of authors in the study, with most authors contributing only one article, while only a few authors had greater contributions by writing multiple articles. It is a common characteristic in many areas of scientific research, where a small number of authors have a significant contribution in the production of research.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558



From the available data, it can be seen that some authors have a high impact based on several metrics such as h-index, g-index, m-index, total citations (TC), number of publications (NP), and initial year of publication (PY_start). Here are some high-impact writers:

Element	h_index	g_index	m_index	TC	NP	PY_start
KELLEMS RO	4	6	1.000	70	6	2020
CHEN BB	3	4	0,520833333	18	4	2020
LIM JY	3	4	1.000	20	6	2021
LIU Y	3	3	1.500	10	3	2022
MORRIS JR	3	4	0,520833333	22	4	2020
YAKUBOVA G	3	4	0,520833333	18	4	2020
AFLATOONY L	2	2	0,347222222	9	2	2020
AL-SAMARRAIE H	2	2	0,347222222	48	2	2020
ALIFIROVA VM	2	2	0,347222222	18	2	2020
ANCAU M	2	2	1.000	6	2	2022

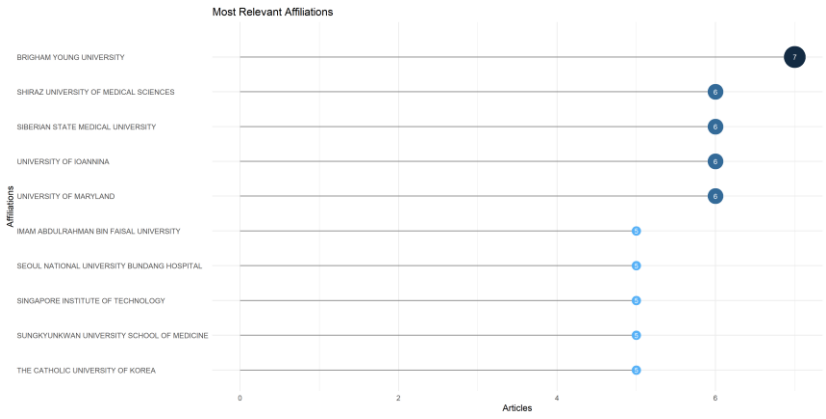
These authors have an h-index and g-index that reflect a significant impact in their research. They have produced a number of citation-intensive articles, which demonstrate meaningful contributions in the field of using augmented reality in art therapy for individuals with disabilities.

Related Affiliate Development

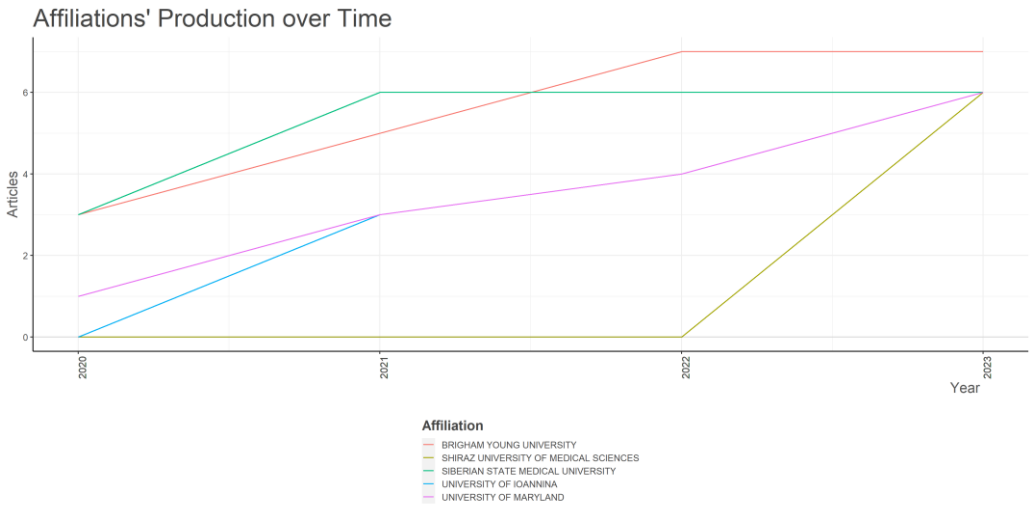
In the analysis of affiliates involved in the study on the use of augmented reality in art therapy for individuals with disabilities, a total of 436 affiliates participated in the study. Of the number of affiliates involved, ten of them stand out based on the number of articles they produce. Brigham Young University led the list with significant contributions, resulting in seven articles in the study. It was followed by several other affiliates such as Shiraz University of Medical Sciences, Siberian State Medical University, University of Ioannina, and University of Maryland, which each produced six articles. Imamat Abdulrahman bin Faisal University, Seoul National University Bundang Hospital, Singapore Institute of Technology, Sungkyunkwan University School of Medicine, and The Catholic University

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

of Korea also made considerable contributions with five articles each. The involvement of these various affiliations reflects the diversity of academic and medical institutions involved in the study, and suggests that the use of augmented reality in art therapy for individuals with disabilities is a topic of interest and collaboration across institutions.



Based on the highest production data of affiliates in recent years, it is seen that several affiliates have made significant contributions in research on the use of augmented reality in art therapy for individuals with disabilities. Here are some of the affiliates that stand out based on article production in recent years:



BRIGHAM YOUNG UNIVERSITY:

- In 2020, they produced 3 articles.
- In 2021, their contributions increased to 5 articles.
- In 2022, they produced 7 articles.
- In 2023, they also produced 7 articles.

SIBERIAN STATE MEDICAL UNIVERSITY:

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

- In 2020, they produced 3 articles.
- In 2021, their contributions increased to 6 articles.
- In 2022, they also produced 6 articles.
- In 2023, they still produce 6 articles.

UNIVERSITY OF MARYLAND:

- In 2020, they produced 1 article.
- In 2021, their contributions increased to 3 articles.
- In 2022, they produced 4 articles.
- In 2023, they also produced 6 articles.

UNIVERSITY OF IOANNINA:

- As of 2020, they are not producing articles.
- In 2021, they produced 3 articles.
- In 2022, they produced 4 articles.
- In 2023, they still produce 6 articles.

SHIRAZ UNIVERSITY OF MEDICAL SCIENCES:

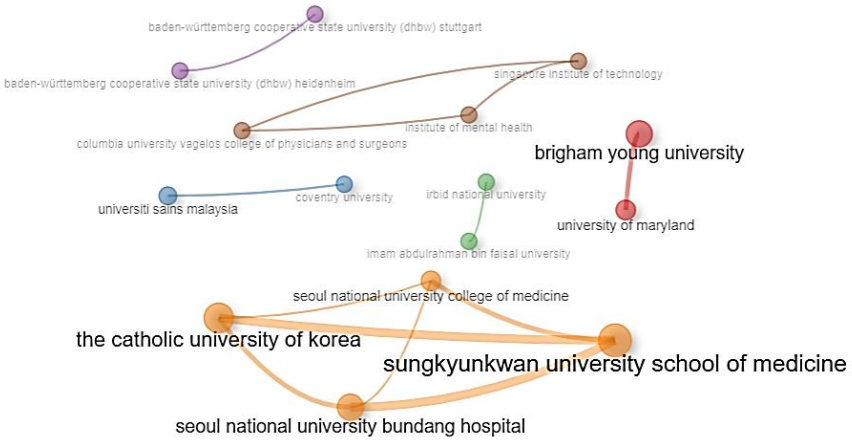
- As of 2020, they are not producing articles.
- In 2021, they didn't produce any articles either.
- In 2022, they didn't produce any articles either.
- However, in 2023, they produced 6 articles.

With the consistent and increasing contributions of some of these affiliates in recent years, it can be concluded that they have an important role to play in the development of knowledge in the field of using augmented reality in art therapy for individuals with disabilities.

Affiliation Connectedness

In addition, the relationship between related Affiliates has also been analyzed, the results can be seen in the figure below. This data illustrates the connectedness between affiliates in the form of clusters based on several metrics such as betweenness, closeness, and PageRank. These clusters can provide insight into how affiliates are connected in research on the use of augmented reality in art therapy for individuals with disabilities.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558



Cluster 1: Consists of "Brigham Young University" and "University of Maryland." This cluster has the same betweenness and closeness values, indicating that these two affiliates have a strong relationship within this cluster. Their PageRank is also quite high, indicating a significant influence in the connectedness of this cluster.

Cluster 2: Consists of "imam abdulrahman bin faisal university" and "irbid national university." This cluster has the same betweenness, closeness, and PageRank values, indicating the close connection between these two affiliates in this cluster.

Cluster 3: Consists of several affiliates, including "Seoul National University Bundang Hospital," "Sungkyunkwan University School of Medicine," "The Catholic University of Korea," and "Seoul National University College of Medicine." This cluster has the same closeness value for all its members, indicating high connectedness within the cluster. Their PageRank is also quite high, indicating an influence in the connectedness of this cluster.

Cluster 4: Consists of several affiliates, such as "Singapore Institute of Technology," "Columbia University Vagelos College of Physicians and Surgeons," and "Institute of Mental Health." This cluster has the same closeness value for all its members, indicating high connectedness within the cluster. Their PageRank is also quite high.

Cluster 5: Consists of "Universiti Sains Malaysia" and "Coventry University." This cluster has the same betweenness and closeness values, indicating a strong connection between these two affiliates in this cluster. Their PageRank is also quite high.

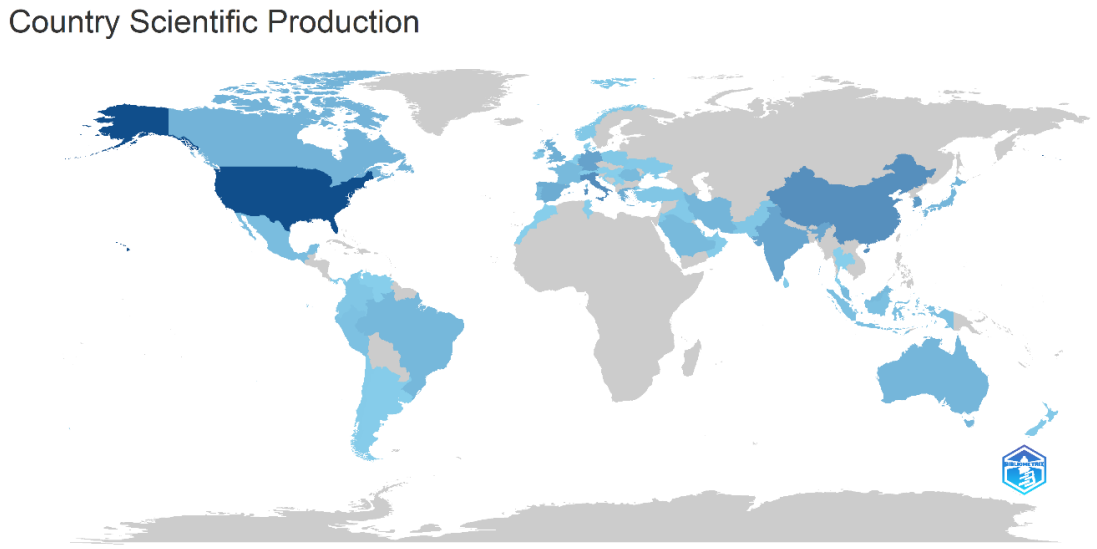
Cluster 6: Consists of two affiliates, namely "Baden-Württemberg Cooperative State University (DHBW) Heidenheim" and "Baden-Württemberg Cooperative State University (DHBW) Stuttgart." This cluster has the same betweenness and closeness values, indicating a strong connection between these two affiliates in this cluster. Their PageRank is also quite high.

This cluster analysis helps us understand how affiliates are connected in this study, and how they contribute to forming a closely connected group in the field of using augmented reality in art therapy for individuals with disabilities.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

Development of Contributions by Relevant Country

Global participation in research on the use of augmented reality in art therapy for individuals with disabilities reflects a broad interest in the development of knowledge in this area.



Regions Involved:

1. North America (USA and Canada): The United States (USA) and Canada (Canada) together contributed the highest number of articles in the study, with a total of 106 articles.
2. Europe (Italy, Germany, Greece, Spain, UK, Romania, Portugal, France, Norway, Netherlands, Switzerland, Ukraine, Denmark, Belgium, Croatia, Cyprus, Austria, Hungary, Montenegro): Europe was also a major contributor to the study, with many countries such as Italy, Germany, Greece, Spain, the United Kingdom, Romania, Portugal, France, and others, producing a total of 207 articles.
3. Asia (South Korea, India, Malaysia, Singapore, Indonesia, Japan, Saudi Arabia, Iran, China): Asia is one of the regions with significant contributions in the study, with many countries such as South Korea, India, Malaysia, Singapore, Indonesia, Japan, Saudi Arabia, Iran, and China, generating a total of 161 articles.
4. South America (Brazil, Peru, Colombia, Ecuador): South America also participated in the study, with countries such as Brazil (Brazil), Peru, Colombia (Colombia), and Ecuador (Ecuador) producing a total of 38 articles.
5. Australia and Oceania (Australia, New Zealand): Australia and New Zealand also contributed to the study, with a total of 20 articles.
6. Africa (South Africa, Tunisia, Morocco): Africa also participated in the study, with countries such as South Africa, Tunisia, and Morocco producing a total of 7 articles.

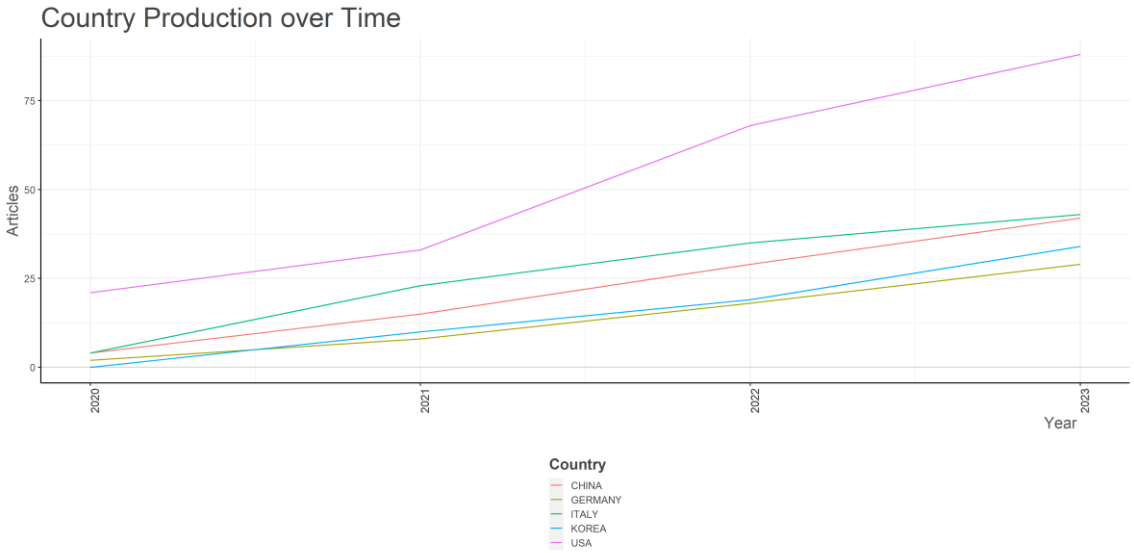
Indonesia's active participation in this study with the contribution of 10 articles confirms the country's important role in developing knowledge on the use of augmented reality in art therapy for individuals with disabilities. This indicates a strong interest and

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

commitment in exploring the potential of this technology to improve the quality of life of individuals with disabilities in Indonesia.

More broadly, Asia also plays a significant role in the development of this knowledge. With a total contribution of 161 articles, Asia shows that various countries in the region, including South Korea, India, Malaysia, Singapore, Indonesia, Japan, Saudi Arabia, Iran, and China, have a high interest in incorporating augmented reality in the context of art therapy. This reflects the diversity of cultures and approaches in understanding and leveraging these technologies to support individuals with disabilities in Asia.

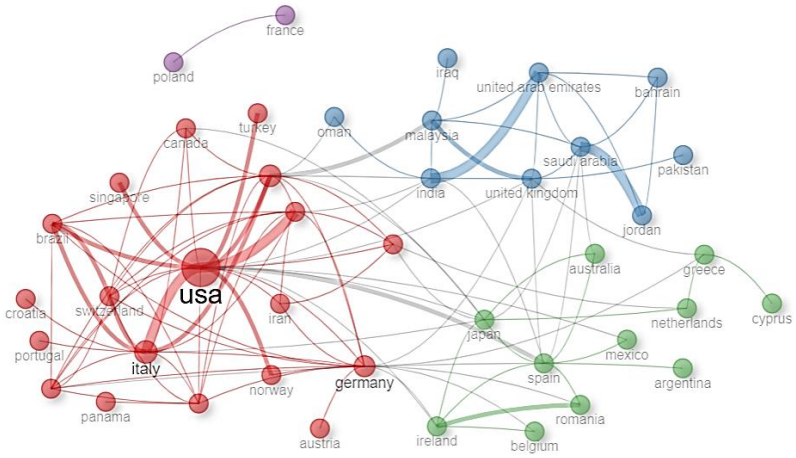
When viewed from production per country it can be seen in this figure the countries that have the highest production involvement:



It is known that the United States remains the leader in the production of this study, with 88 articles. It demonstrates the central role of the United States in the development of global knowledge regarding the use of augmented reality in art therapy. Thus, this research shows that collaboration and knowledge sharing between countries and regions are key in delivering innovative solutions to support individuals with disabilities around the world.

In addition, collaboration data between countries involved in this study provide an idea of the extent to which these countries interact and contribute to the development of knowledge regarding the use of augmented reality in art therapy for individuals with disabilities.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558



Analysis by clusters in international collaborations in this study provides further understanding of how countries are organized in specific collaboration groups:

Cluster 1: North America and Europe

It consists of the United States (USA), Italy, China, South Korea, Germany, Canada, Iran, Brazil, Portugal, Colombia, Ecuador, Turkey, Norway, New Zealand, Switzerland, Croatia, Panama, Austria.

It is seen that this cluster includes most of the countries of North America and Europe. The United States has a central role in this cluster, followed by Italy and China. The cluster represents a strong collaboration between countries on both continents.

Cluster 2: Asia and the Middle East

It consists of India, United Kingdom, Malaysia, Saudi Arabia, Pakistan, United Arab Emirates, Iraq, Jordan, Oman, Bahrain.

The cluster includes countries from Asia and the Middle East. India and the UK play a central role in this cluster, which shows the collaboration between countries in the Asian and Middle Eastern regions in the study.

Cluster 3: Europe and Spain

It consists of Greece, Spain, Australia, Japan, Romania, Mexico, Ireland, Netherlands, Argentina, Belgium, Cyprus.

The cluster includes most European countries and Spain. Greece played a central role in this cluster, reflecting the close collaboration between European countries on the study.

Cluster 4: France and Poland

It consists of France and Poland.

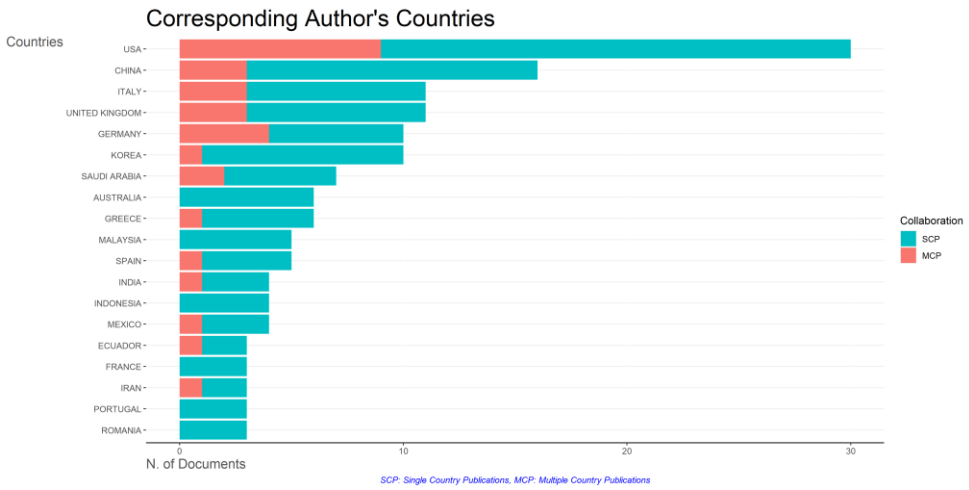
The cluster is smaller and consists of only two countries, namely France and Poland. This shows the special collaboration between these two countries in this study.

International collaboration in the study is based on such clusters, reflecting the close relationship between countries within a particular group. This cross-border cooperation

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

enables a better exchange of knowledge and resources in the development of augmented reality solutions for art therapy for individuals with disabilities.

In addition, it was found that coresponding authors based on the countries involved revealed the main contributions of several countries in the role of correspondent authors in this study. The United States leads with the greatest contribution, demonstrating its central role in the development of knowledge about augmented reality in art therapy for individuals with disabilities. China also has a significant contribution, reflecting its important role in this field. Italy, the United Kingdom, and Germany also played a role in this study with a fairly high number of articles. South Korea also participates actively, while Saudi Arabia has significant contributions, especially in the role of lead correspondent writer. Australia, Greece, and Malaysia also made important contributions to the development of this knowledge. The diversity of international collaborations in roles as correspondent writers reflects a shared interest in developing better solutions in support of individuals with disabilities around the world.



Trend Topics

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

This word cloud provides an overview of the key words that appear most frequently in research related to the use of augmented reality in art therapy for individuals with disabilities. Some of the most dominant keywords in the study included "reality," "augmented," "learning," "technology," "disabilities," and "study."

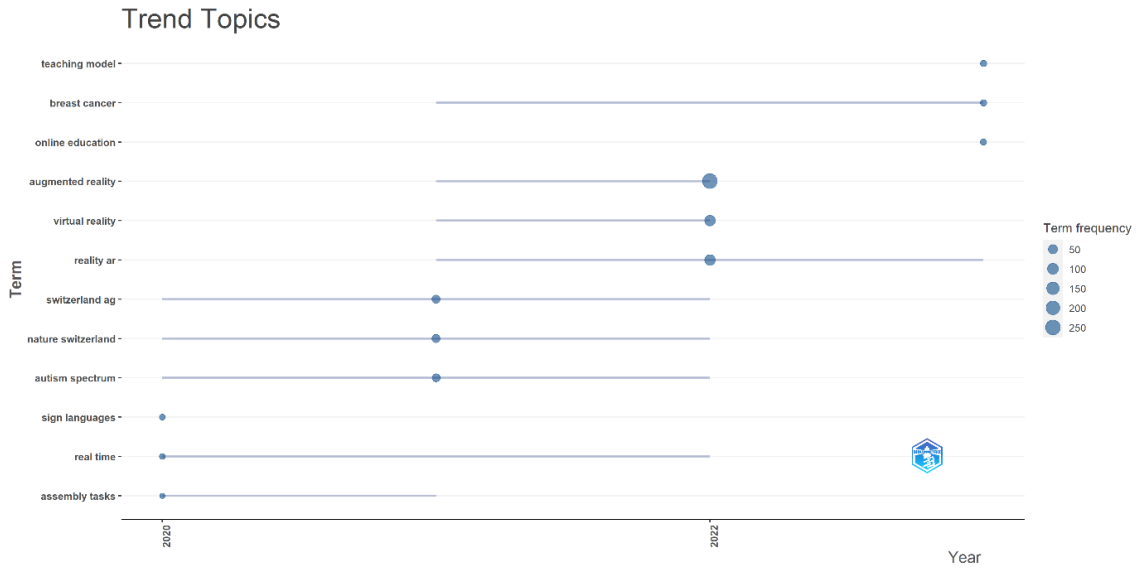
There is a strong focus on developing augmented reality (AR) applications and technologies for education, especially in the context of children with disabilities. Keywords such as "education," "students," and "learning" suggest that the study seeks to improve the learning and educational experience for individuals with disabilities through AR.

In addition, the keywords "rehabilitation" and "physical" indicate that AR is used in the context of physical rehabilitation, which can provide valuable support for patients with physical disabilities.

The keywords "cognitive" and "skills" highlight research focused on developing the cognitive skills of individuals with disabilities through AR technology.

In addition, the keywords "research," "results," and "review" indicate that the study also has a strong analysis and evaluation component to the use of AR in art therapy for individuals with disabilities.

Overall, this word cloud illustrates the diversity of topics involved in the study, from AR technology development to education, physical rehabilitation, and cognitive skill enhancement. This reflects the complexity and significance of the use of AR in the context of art therapy for individuals with disabilities.



Analysis of the direction of development of topics in research on the use of augmented reality (AR) in art therapy for individuals with disabilities shows interesting trends from year to year:

2020: The year 2020 saw the beginning of interest in this research, with topics such as "Switzerland AG," "Nature Switzerland," "Autism Spectrum," "Sign Languages," and "Real Time." This year's research seems to focus more on topics that are general in AR use and not yet in-depth on specific applications in art therapy.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

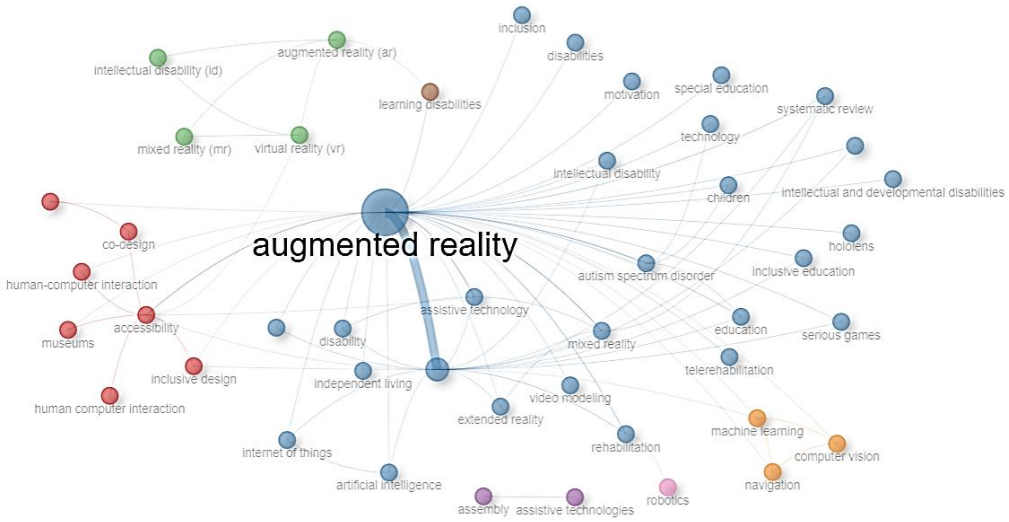
2021: The year 2021 witnessed a significant increase in AR-related research with a high frequency for the topics of "Augmented Reality" and "Virtual Reality." This shows that this year, research is getting more in-depth on the use of AR technology in a variety of contexts, including art therapy and wellness.

2022: The year 2022 remains strong in AR-related research, demonstrating continued interest in the topic. Topics such as "Reality AR" and "Assembly Tasks" are emerging, showing an increased focus on the use of AR in real tasks and specialized applications.

2023: The year 2023 is showing exciting developments with increased interest in the topics of "Teaching Model," "Breast Cancer," and "Online Education." This reflects the expansion of AR use into various fields, including education and health, as well as the development of teaching models involving AR technology.

Overall, the development of research related to the use of AR in art therapy and related fields shows a positive trend. There is an expansion of interest from general applications of AR to specialized applications in a variety of contexts. The development of AR technology has also enabled wider implementation in education and healthcare.

In the analysis of network co-occurrence data seen in the figure below we have several nodes that have different clusters as well as several nodes with the same cluster. To evaluate the connectedness of these nodes, we can use the Betweenness, Closeness, and PageRank metrics. In addition, we can also identify the number of clusters that appear in this network and which nodes still have small clusters.



In this analysis of co-occurrence network data, there are 46 nodes involved in each connection. In this network, we can identify at least 7 identifiable clusters, namely Cluster 1 (Red), Cluster 2 (Blue), Cluster 3 (Green), Cluster 4 (Purple), Cluster 5 (Orange), Cluster 6 (Pink), and Cluster 7 (Brown). Each of these clusters represents a group of nodes with a closer interrelationship between them. Further analysis can be done to understand the roles and relationships between the nodes in each of these clusters.

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

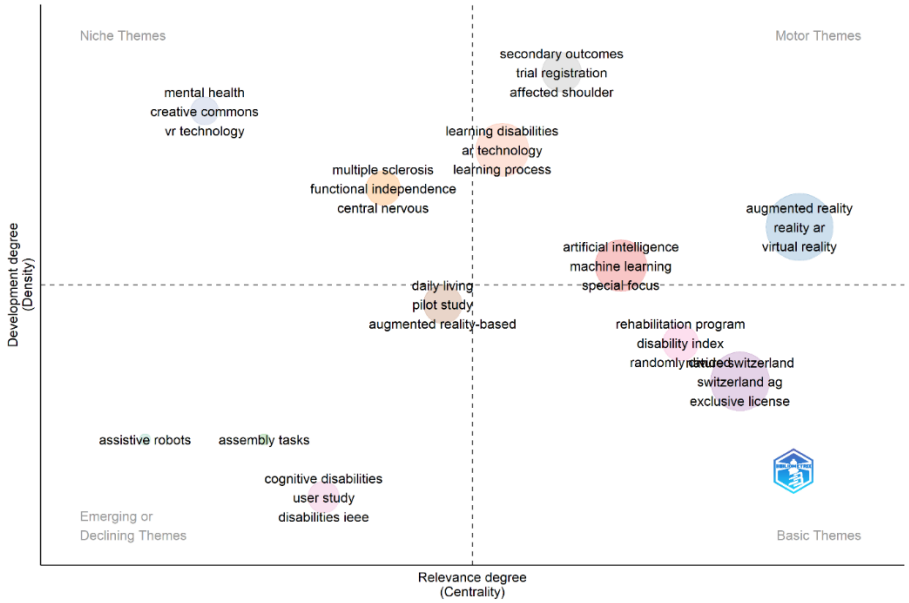
An interesting finding in this analysis of co-occurrence network data illustrates the minimal relationship between various nodes covering topics related to learning disabilities and technology.

Overall, Learning Disabilities (LD) appears in Cluster 7 with a very high Betweenness score, suggesting that this topic has a central role in networking. This indicates that LD is often the focus or main topic in contexts related to technology and education. In addition, a relatively high closeness value indicates that LD has close relationships with various other nodes in the network.

On the other hand, LD's PageRank is ranked lower compared to some other nodes in the network. This indicates that LD may not have received enough attention among other topics in this context. Therefore, to increase understanding and awareness of learning disorders, further efforts need to be made in integrating LD with other more dominant topics.

In future developments, it is important to continue to monitor and improve the connectedness of LDs with related topics. This can be done by promoting further research on LD in the context of technology, establishing collaborations between researchers in different fields, and increasing publications that include LD. By doing so, we can strengthen understanding of these learning disorders and improve the quality of support and technological solutions available to individuals with LD.

Division of Research Themes



In this dataset, there are several clusters of research themes that can be identified based on metrics such as Callon Centrality, Callon Density, Rank Centrality, Rank Density, and Cluster Frequency. There is an analysis of several clusters of prominent research themes:

1. The "Artificial Intelligence" cluster has a high Callon Centrality, which is around 5,341,104,249,248,870, and a fairly high Callon Density of around

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558

4,735,777,809,399,360. This shows that research themes related to artificial intelligence have a strong relationship in this research network. Although it has a fairly high Rank Centrality (rank 9), its Rank Density is higher (rank 7), which shows that this theme has a fairly quality relationship in the network. This cluster also has a frequency of occurrence of 175. This theme has a high Callon Centrality and a high Callon Density. This suggests that artificial intelligence is one of the important research themes in this network. In the context of this research, there may be many studies related to the development and application of artificial intelligence.

2. The "Augmented Reality" cluster has a fairly high Callon Centrality, about 1,352,226,813,304,130, and a high Callon Density of about 4,884,581,059,839,560. This shows that virtual reality-related research themes have a strong relationship in research networks. Despite having a fairly high Rank Centrality (rank 12), its Rank Density is also high (rank 8), indicating that this theme has quality relationships within the network. This cluster has a frequency of occurrence of 727. This cluster also has high Callon Centrality and high Callon Density. This indicates that virtual reality is a significant research theme in this network. Augmented reality-related research may involve developing virtual reality technologies or virtual reality applications in a variety of domains.
3. The "Learning Disabilities" cluster has a high Callon Centrality, about 488,734,087,291,455, and a high Callon Density of about 6,034,359,719,901,190. This suggests that learning distraction-related research themes also have a strong relationship in research networks. This cluster has a fairly high Rank Centrality (rank 7) and a high Rank Density (rank 10). This cluster has a frequency of occurrence of 197. This theme has a high Callon Centrality and a high Callon Density. This suggests that research on learning disorders is one of the main focuses in this network. This research may include identification of learning disorders, interventions, and educational approaches.
4. The "Cognitive Disabilities" cluster has a fairly high Callon Centrality, about 0.6444516594516595, and a high Callon Density of about 2,246,428,571,428,570. This suggests that cognitive impairment-related research themes also have a strong relationship in the research network. This cluster has a fairly high Rank Centrality (rank 4) and a high Rank Density (rank 1). This cluster has a frequency of occurrence of 26. This cluster also has high Callon Centrality and high Callon Density. This suggests that research on cognitive impairment is also important in this network. This research may be related to understanding cognitive impairment, treatments, or technologies that help individuals with cognitive impairment.

As such, these clusters represent a significant research theme in this research network, with a strong degree of connectedness and high quality in the relevant research context.

CONCLUSION

In conclusion, the results of data analysis that has been carried out on various aspects of research related to the use of augmented reality in art therapy for individuals with disabilities revealed several important findings:

1. Publication Data: There are 284 scientific papers published in the period 2020 to 2023, with a total of 938 citations from other studies. Although the growth in the number of papers is slightly negative, the content presented is still relatively new with an average document age of about 1.46 years.
2. Author Contributions: The authors involved in these various papers have a significant impact in the scientific literature with an index of AR technology for art therapy related to social, cultural and psychographic aspects in each research area. This shows their substantial contribution in advancing knowledge in this area.
3. Diversity of Research Topics: Keyword analysis shows the diversity of research topics, including the development of AR technology in education, physical rehabilitation, cognitive skills development, and analysis and evaluation of research results.
4. Linkages Between Affiliations: Analysis of affiliations involved in the study revealed the diversity of contributing academic and medical institutions. Some affiliates stand out with the highest contributions in the number of articles they produce, and there are indications of increased research productivity.
5. Global Participation: The research involves affiliates from different countries, creating significant international cooperation in the development of knowledge in this field.
6. Dominant Journals: Several journals, such as "Lecture Notes in Computer Science" and "Journal of Special Education Technology," lead in the number of related articles, and the journal "Journal of Special Education Technology" has a strong influence in the scientific community.
7. Citation Accuracy: There are variations in citation accuracy, with some citations having a high degree of accuracy.
8. Global Impact: This research reflects global interest in developing augmented reality-based solutions to improve the quality of life of individuals with disabilities.

These conclusions provide valuable guidance for the research team on this topic, assisting in selecting appropriate resources and influential journals to access relevant and high-quality knowledge in the field of using augmented reality in art therapy for individuals with disabilities. In particular, looking at the social, cultural and psychographic aspects of the research subject so that it is consistent with the solutions offered.

REFERENCES

Bridges, S. A., Robinson, O. P., Stewart, E. W., Kwon, D., & Mutua, K. (2020). Augmented Reality: Teaching Daily Living Skills to Adults With Intellectual Disabilities. *Journal of Special Education Technology*, *35*(1), 3–14. https://doi.org/10.1177/0162643419836411

Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019). An overview of augmented reality technology. *Journal of Physics: Conference Series*, *1237*(2), 022082. https://doi.org/10.1088/1742-6596/1237/2/022082

Counsell, C. (1997). Formulating Questions and Locating Primary Studies for Inclusion in Systematic Reviews. *Annals of Internal Medicine*, *127*(5), 380. https://doi.org/10.7326/0003-4819-127-5-199709010-00008

Denyer, D., & Tranfield, D. (2009). Producing a Systematic Review. In *The SAGE Handbook of Organizational Research Methods* (pp. 671–689).

Donnari, S., Valentina, C. ., Giovanni, F., Chiara, B., Moren, M., & Sandro, E. (2019). New Technologies For Art Therapy Interventions Tailored To Severe Disabilities. *Psychiatria Danubina*, *31*, 462–466.

Garza-Reyes, J. A. (2015). Lean and green – a systematic review of the state of the art literature. *Journal of Cleaner Production*, *102*, 18–29. https://doi.org/10.1016/j.jclepro.2015.04.064

McMahon, D., Cihak, D. F., & Wright, R. (2015). Augmented Reality as a Navigation Tool to Employment Opportunities for Postsecondary Education Students With Intellectual Disabilities and Autism. *Journal of Research on Technology in Education*, *47*(3), 157–172. https://doi.org/10.1080/15391523.2015.1047698

Setyaningsih, I., Indarti, N., & Jie, F. (2018). Bibliometric analysis of the term'green manufacturing'. *International Journal of* …. https://doi.org/10.1504/IJMCP.2018.093500

Sugiura, A., Kitama, T., Toyoura, M., & Mao, X. (2019). The Use of Augmented Reality Technology in Medical Specimen Museum Tours. *Anatomical Sciences Education*, *12*(5), 561–571. https://doi.org/10.1002/ase.1822

Astri Noviani[1], Anne Nurfarina[2]
DOI: https://doi.org/10.54443/sibatik.v2i12.1558