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# Bibliometric Computational Mapping Analysis of Trend Augmented Reality in Education Using VOSviewer

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**ABSTRACT**
This study aims to present a bibliometric analysis of the topic of trend augmented reality in education published in the Google Scholar database. The data used in this study totaled 993 published articles from 2013 to 2023. This study used reference management software, namely Publish or Perish for data collection, Microsoft Excel for data analysis, and VOS viewer for data visualization. International journal of augmented reality in education are journal that publishes many publications on keywords. It is hoped that the findings of this study can become a reference and provide direction for future researches with similar themes, for example, the link between augmented reality in education. This study shows how important bibliometric analysis is to obtain information about this phenomenon. This study is prospective to assist and become a reference for scientists and researchers in conducting and deciding on research topics, mainly related to augmented reality in education.

***Keywords:*** *Augmented reality, Education.*

## 1. INTRODUCTION

Augmented reality is a combination of the real and the virtual and contains more than virtual [1]. Augmented reality refers to a situation in which users utilize a large amount of information and physical materials from the real world and have access to relatively little virtual information [2]. Augmented reality could provide users technology mediated immersive experiences in which real and virtual worlds are blended. Augmented reality permits the user to perceive the real world through a virtual overlay [3]. Virtual objects used in augmented reality system may include text, image, video clips, sounds, 3D models and animations. Ideally, these virtual objects will be perceived as coexisting within a real-world environment [4].

Augmented reality can be used for educational purposes because it's potential and affordances extended when an augmented reality system is designed by connecting multiple types of technologies [5][6]. The educational values of augmented reality are not solely based on the use of technologies but closely related to how augmented reality is designed, implemented and integrated into formal and informal learning settings. For educators and designers, defining augmented reality in a broad sense would be more productive because such a definition suggest that augmented reality could be created and implemented by varied technologies.

In an integrated sense, the Augmented Reality technology allows educators to create a scenario, provide location-specific information based upon GPS position, inject scripted or non-Player characters into the learning experience and embed data (via image or object triggers) seamlessly within the real-world context [7]. The role of the educator as designer and facilitator appears to be a critical factor. In their use of augmented reality to track objects and graph vertical and horizontal velocity and displacement. Users are able to achieve greater focus without the risk of cognitive overload caused by excessive information or exhausting allocated time by shifting between operating instructions.

This study aims to determine the augmented reality in education trend through a literature review and bibliometric analysis. We also describe the image of the metaverse and digital transformation. We use VOSviewer mapping to analyze the data. Keywords were obtained from the relationship augmented reality in education" to find data from 2013 to 2023. The novelty of this research is the augmented reality in education

topic. This shows the importance of bibliometric analysis of augmented reality in education with the hope that it can help and become a reference for determining research topics.

## 2. METHOD

Bibliometric is the application of the mathematical and statistical analysis to pattern contained in the publication and use of document in the form textbooks, journals, articles, student dissertation, or the other sources. Bibliometric methods are increasingly being used by science mapping to measure research performance of institutions and researchers. The article literature data is used in this study is based on searched from journal publication on Google Scholar. We chose Google Scholar because Google Scholar is an open source of data. A reference application is used to collect research data namely Publish or Perish. Publish or Perish software was used to conduct a literature review on our chosen topic.

The search for article data in Publish or Perish is used to filter publications to use the keyword "virtual reality" AND "education" based on the need for publication titles. The research was published between 2013-2023. All datas were collected in May 2023 and 986 articles were found indexed by Google Scholar. The articles that had been collected and matched for studying analysis were the converted into two data types: research information system (*.ris) and comma separated value format (*.csv). The *.ris format is used as the format for data mapping in the VOSviewer application, while the *.csv is used as the format for data analysis in Ms. Excel.

Microsoft Excel is used to analyze development data every year and sort articles based on the highest number of citation. VOSviewer is used to visualize and evaluate trends using blibiometric maps. The article data from the source database is mapped. VOSviewer is used to generate three variations of mapping publications, namely network visualization, density visualization, and overlay visualization based on the relationship between items.

The research was conducted through several stages:

(i) Collection of publication data using the Publish or Perish application

(ii) Process bibliometric data for articles that have been collected by using Microsoft Excel application

(iii) Analysis of computational mapping of bibliometric published data using VOSviewer application

(iv) Analysis of computational mapping results

## 3. RESULT AND DISCUSSION

We use the VOSviewer application to map article data that is relevant. There are three variations of mapping publications, namely network visualization, density visualization, and overlay visualization based on the relationship between items [8-15]. Nine cluster were identified that grouped related keywords, forming groups that were heterogeneous with each other and internally homogeneous. The most common keyword leading to the main cluster is: "augmented reality".

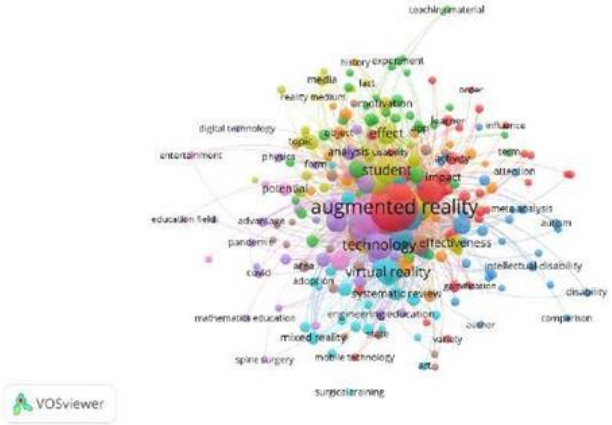


**Figure 1** Network visualization.

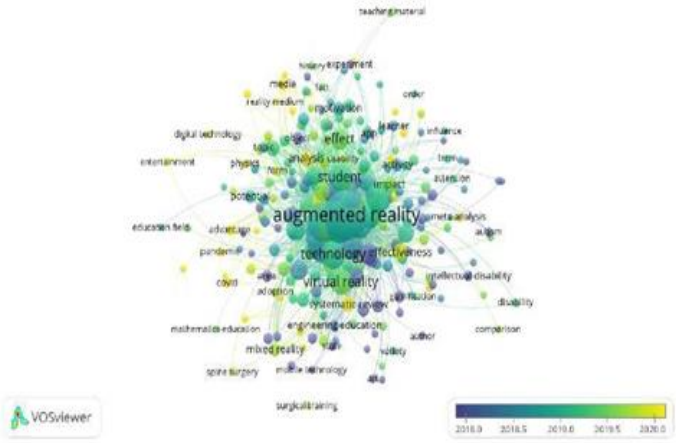


**Figure 2** Overlay visualization.

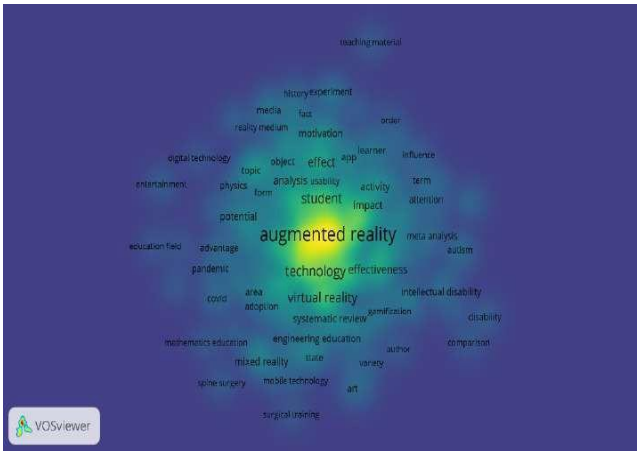


**Figure 3** Density visualization.

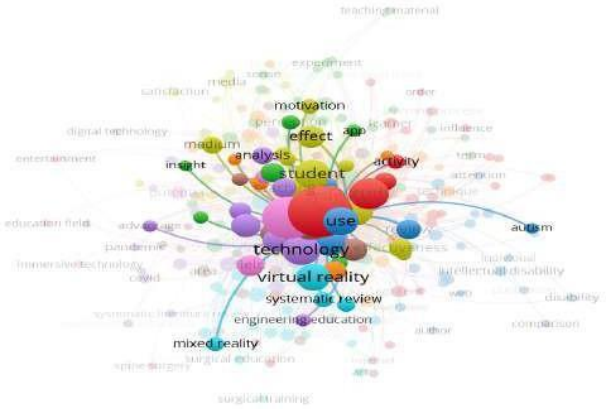


**Figure 4** Network visualization of the term augmented reality in education (cluster 1).

Figure 4 shows term related to the topic, namely augmented reality education, Activity, approach, augmented reality, augmented reality, augmented reality book, augmented reality sandbox, benefit, cognitive load, content, educational application, educational potential, educational purpose, educational setting, educator, elementary school student, feature, gamification, gap, impact, influence, learner, learning process, limitation, metaverse, mobile application, mobile technology, order, performance, perspective, practice, science, science learning, study, system, topographic map, usability, variety.

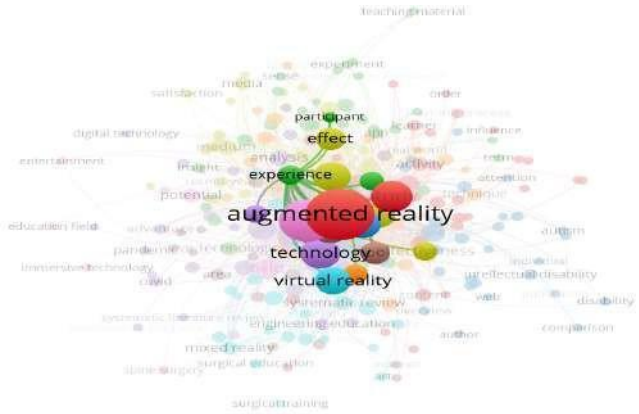


**Figure 5** Network visualization of the term augmented reality in education (cluster 2).

Figure 5 shows term related to the topic, namely augmented reality education, App, ar technology, aspect, augmented reality experience, augmented reality mobile application, augmented reality use, book, case, case study, context, data, device, display, educational activity, efficacy, environment, experience, experiment, importance, insight, interaction, keyword, library, literature, participant, perception, project, role, search, sense, survey, teaching material, term, tourism, type, university.

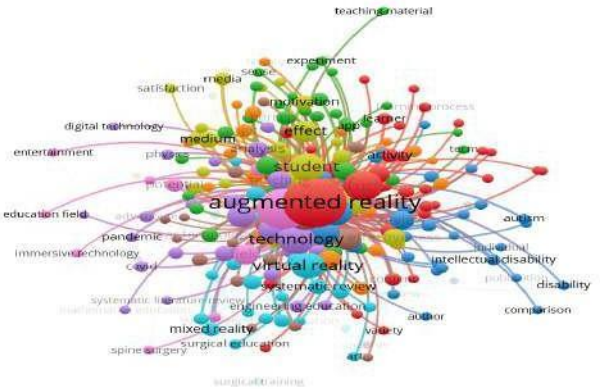


**Figure 6** Network visualization of the term augmented reality in education (cluster 3).

Figure 6 shows term related to the topic, namely augmented reality education, Affordance, application, attention, augmented reality environment, augmented reality game, author, autism, autism spectrum disorder, classroom, comparison, dental education, disability, educational content, educational game, educational technology, educational tool, framework, improvement, individual, intellectual disability, journal, language learning, location, meta analysis, mobile learning, need, overview, problem, publication, review, special education, use, web

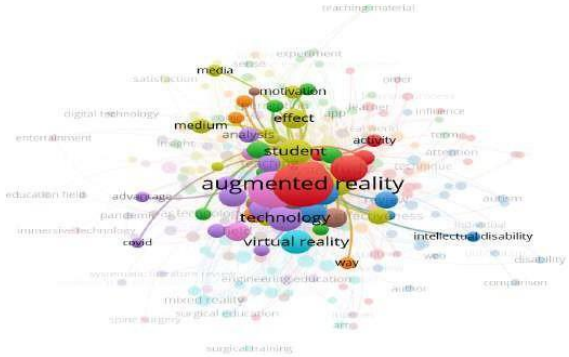


**Figure 7** Network visualization of the term augmented reality in education (cluster 4).

Figure 7 shows term related to the topic, namely augmented reality education, Achievement, android, attitude, augmented reality app, augmented reality application, augmented reality medium, chemical education, concept, effect, effectiveness, fact, instruction, interest, investigation, mathematics, media, medium, mobile, motivation, quality, reality medium, mobile, motivation, quality, reality medium, recent year, research, satisfaction, science education, strategy, student, student achievement, topic

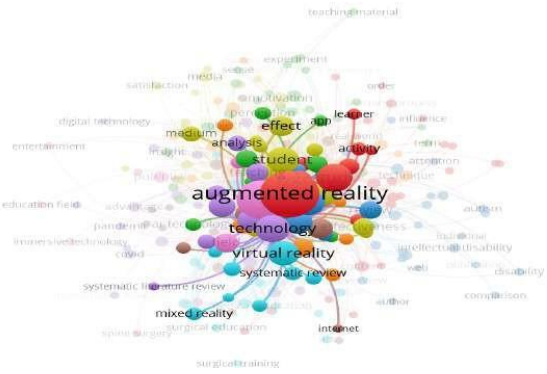


**Figure 8** Network visualization of the term augmented reality in education (cluster 5).

Figure 8 shows term related to the topic, namely augmented reality education, Advantage, analysis, augmented reality technology, challenge, computer, covid, development, digital technology, early childhood education, educational environment, educational field, engineering education, form, http, implementation, integration, learning, mathematics education, mobile augmented reality, mobile augmented reality application, opportunity, pandemic, physics, positive impact, systematic literature review, teaching, technology, work

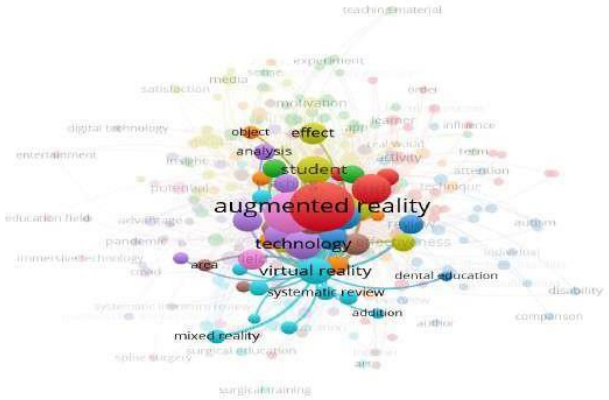


**Figure 9** Network visualization of the term augmented reality in education (cluster 6).

Figure 9 shows term related to the topic, namely augmented reality education, Addition, adoption, ar application, art, article, augmented reality system, change, construction, country, education system, educational material, factor, medical education, mixed reality, new technology, reality technology, simulation, surgery, surgical education, surgical training, systematic review, value, view, virtual reality, vocational education, year.

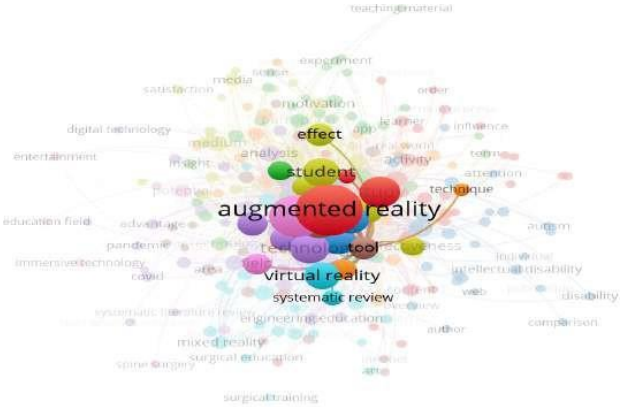


**Figure 10** Network visualization of the term augmented reality in education (cluster 7).

Figure 10 shows term related to the topic, namely augmented reality education, Abstract, chemistry, distance education, educational institution, educational process, higher education, history, industry, information, level, marker, model, object, paper, possibility, process, real world, teacher, technique, virtual reality technology, visualization, way, world

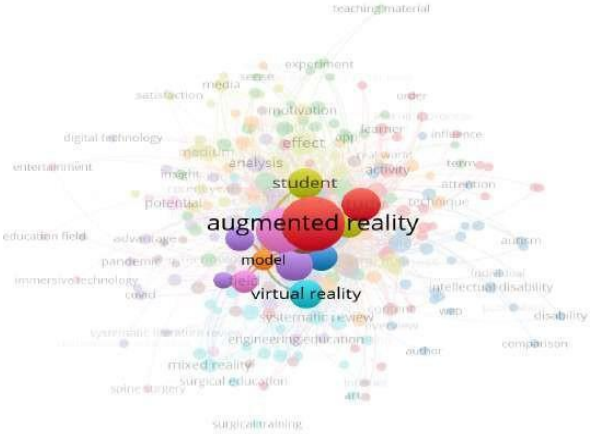


**Figure 11** Network visualization of the term augmented reality in education (cluster 8).

Figure 11 shows term related to the topic, namely augmented reality education, 3d printing, ability, area, chemistry education, evaluation, expert, future, incorporation, internet, knowledge, mobile device, production, reality, reality application, researcher, state, tool, training, usage, user, virtual, virtual environment

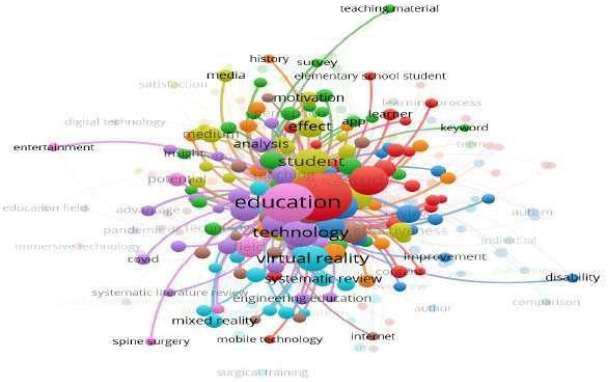


**Figure 12** Network visualization of the term augmented reality in education (cluster 9).

Figure 12 shows term related to the topic, namely augmented reality education, Combination, course, education, education field, entertainment, field, immersive technology, potential, spine surgery, university student

Figure 4 and 6 shows term related to the topic, namely augmented reality education. Based on figure 4, the term of augmented reality is in cluster 1. “Augmented reality” is connected to 243 other terms with a total link strength of 4432 and an accurancy of 770. While based on figure 6, the term of education is in cluster 3. “Education” is connected to 108 other terms with a total link strength 356 and an accurancy of 56.

## 4. CONCLUSION

This study provides the results of a bibliometric analysis of the topic of augmented reality in education published in the Google Scholar database. The articles data taken were data from articles published in 2013-2023.

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