

Digital Literacy

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Digital Literacy Research: A Scientometric Mapping over the Past 22 Years

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Abstract—Digital literacy as a necessity for the industrial revolution 4.0 is a new challenge for teachers and students to prepare themselves to use digital resources to learn and digital benefits based on entrepreneurial spirit. It has been research yet the notion about digital literacy review which showed the big picture using data from all countries. This research aims to study the status of international digital literacy research that is indexed by Scopus using scientometric mapping. The study has carried out scientometric methods and analyzed research data using the analyze search results service from Scopus and the VOSviewer application. The research data of 2,749 documents published from 1997 to 2019 were obtained from the Scopus database. The results showed an increasing trend in the number of digital literacy publications at the international level each year. Most countries, affiliation, and authors in digital literacy research were the United States, Monash University, and Marsh, J. The most intensive subject areas and sources of publications in digital literacy research are computer science and the ACM international conference proceeding series. There were two collaborative researchers' patterns in digital literacy research. This research proposes a convergence axis classification consisting of digital literacy research to characterize the body of knowledge generated from two decades of research: Learning, Information communication, Technology, Human, and Education, abbreviated as LITHE themes.

Keywords—digital literacy, scopus, scientometric, vosviewer

I. INTRODUCTION

The development of information and communication technology, as well as the 4.0 industrial revolution, requires digital literacy expertise. The 4.0 industrial revolution that developed at an exponential pace is currently characterized by several new technologies, such as robots, artificial intelligence, and the Internet of Things (IoT) [1]. The development of these technologies is one of the important roles to meet the needs of students in getting information, distance communication, and facilitating interaction in the learning process [2]. The development of technology is seen by the presence of multimedia learning as a learning medium that involves information technology in the form of computers or android [3]. In several other modalities, such as sound, images, video, or a mixture of these, modern

information and knowledge are very often funneled and communicated than in historically successful text mode [4]. Knowledge and skills in the use of information and communication technology are important parts of modern life [5]. Some research institutions report the problem of education literacy that students' ability in literacy, reading, and science is very low. The presence of digital technology such as computers and smartphones has become a part of students' daily lives. The problem of education in the modern era and the industrial era 4.0 is how changes in thinking patterns, ways of learning, and creative innovation actions make students competitive in the global market [6]. Digital literacy refers to the ability to understand and use information described via a computer or electronic device, in different sources and formats [7]. Thus, the education sector throughout the world began to integrate digital literacy into the curriculum [9].

Digital literacy is a new challenge for teachers and students to prepare themselves to use digital resources for digital benefits. Digital literacy requires the attitude, awareness, and ability of individuals to use digital equipment and facilities appropriately. So, the community can identify, manage, access, integrate, analyze, evaluate, and synthesize digital resources. That's all to build new knowledge, make media expressions, communicate with others in the context of certain life situations, enable constructive social activities, and reflect on this process [7], [8]. Digital literacy as a contemporary way for educators and students to interact with text and technology [10]. People who have digital literacy capabilities can read digital information and analyze the truth of information from digital sources. People need digital literacy to participate and benefit from digital opportunities in the community and to reduce exposure to risks and threats in the ever-changing digital environment associated with device protection, personal data and privacy protection, and health and well-being [11]. Students need to get digital literacy advocacy from teachers to support meaningful literature studies according to current needs. This is a challenge for teachers who are accustomed to using print media-based learning approaches [12]. The implementation of digital literacy in the education sector and society can be developed with the spirit and principles of entrepreneurship.

New literacy research in the 21st century called digital literacy is experiencing rapid growth. Digital literacy includes the skills, strategies, and dispositions needed to adapt to technological changes that affect all aspects of life [13]. Someone who understands digital literacy means being able to understand the learning and social interactions that occur in digital contexts, both inside and outside the educational setting [14]. Generally, previous studies related to digital literacy research were limited to one subject [15] or one country [16]. It has been research yet the notion about digital literacy review which showed the big picture using data from all countries. Also, it has been research yet the notion that specifically stated about the relationship between authors, affiliations, keywords, and the impact of their research. Therefore, this research aims to study the status of international digital literacy research that is indexed by Scopus using scientometric mapping.

II. RESEARCH METHODS

This study has mapped the status of digital literacy research visually at the international level indexed by Scopus for the past 22 years. This research has obtained data using the document search service feature on Scopus in April 2020 [17]. This survey has identified keywords related to digital literacy to search for and identify related articles in the Scopus database for 2,749 academic documents published from 1997 to 2019 at the global level. The query command that has been applied when mining data on Scopus is TITLE-ABS-KEY ("digital literacy") AND (PUBYEAR <2020)). The study limited data collection to 2019 without looking at 2020 (exclude 2020) so that the annual data obtained illustrates the condition of research publications in one full year from January to December.

Studies have conducted scientometric methods and analyzed research data using the VOSviewer application and the Scopus analyze search results service [18]–[20]. The study analyzed co-authorship with units of analysis of authors and full counting methods using VOSViewer to get the author's collaboration network. The study carried out an analysis of co-occurrence with analysis of keywords and a full calculation method using VOSViewer to obtain a theme map.

III. RESULT AND DISCUSSION

This section explains about increasing data results based on affiliation, country, subject area, document type, documents per year from sources, documents per year from fields and document cited, theme map, and author networks in digital literacy research.

A. Document-based on the Research Institute Affiliation of Digital Literacy Research

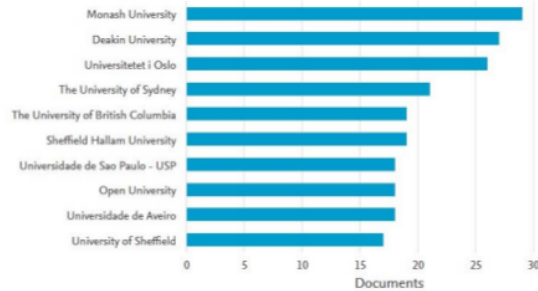


Fig. 1. Number of Documents based on Affiliations Research Institute of Digital Literacy Research

The affiliated research institute that has the largest contribution in digital literacy research shown in Fig. 1 is Monash University with 29 documents. Followed by Deakin University with 27 documents, the University of Oslo with 26 documents, The University of Sydney with 21 documents, The University of British Columbia with 19 documents, Sheffield Hallam University with 19 documents, Universidade de Sao Paulo - USP with 18 documents, Open University with 18 documents, Universidade de Aveiro with 18 documents, and the University of Sheffield with 17 documents.

B. Document-based on the Most Common Authors of Digital Literacy Research

The author with the most publications on digital literacy research is Marsh, J. with 11 documents, Meurant, R.C. with 10 documents, Subramaniam, M. with 10 documents, Burnett, C. with 9 documents, Erstad, O. with 9 documents, Reynolds, R. with 9 documents, Smith, B.E. with 9 documents, Kiili, C. with 8 documents, Eshet-Alkalai, Y. with 7 documents, Frydenberg, M. with 7 documents and Norton, B. with 7 documents.

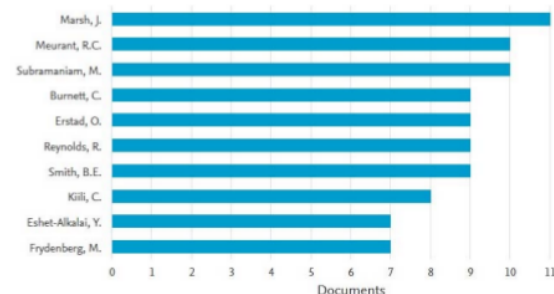


Fig. 2. Number of Documents based on Authors from Digital Literacy Research

C. Documents based on the Most Common Countries of Digital Literacy Research

The country that has the largest contribution to digital literacy research shown in Fig. 3 is the United States with 735 documents. Followed by the United Kingdom with 329 documents, Australia with 245 documents, Spain with 210

documents, Canada with 136 documents, India with 77 documents, Brazil with 70 documents, Portugal with 66 documents, Norway with 65 documents, and Germany with 55 documents.

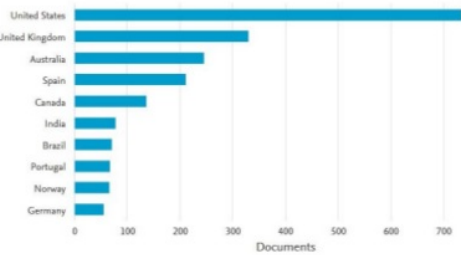


Fig. 3. Number of Documents based on the Most Common Countries of Digital Literacy Research

D. Document-based on Sponsoring Funding of Digital Literacy Research

The most supporting sponsor funding in digital literacy research at the international level is the National Science Foundation with 17 documents. Followed by the Social Sciences and Humanities Research Council of Canada with 15 documents, European Commission with 13 documents, Australian Research Council with 11 documents, Economic and Social Research Council with 11 documents, Academy of Finland with 7 documents, National Institutes of Health with 7 documents and the Engineering and Physical Sciences Research Council with 6 documents.

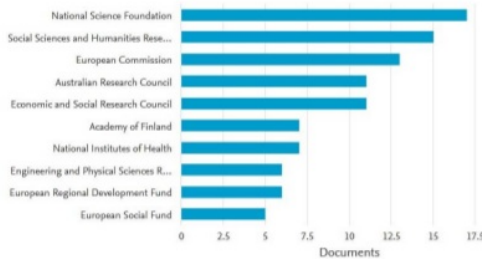


Fig. 4. Number of Documents based on Sponsoring Funding from Digital Literacy Research

E. Documents based on Subject Areas of Digital Literacy Research

The most subject area in digital literacy research at the international level is social sciences with 1958 documents (42.4%). Followed by computer science with 1129 documents (24.5%), arts and humanities with 426 documents (9.2%), engineering with 262 documents (5.7%), medicine with 145 documents (3.1%), mathematics with 137 documents (3.0%), psychology with 125 documents (2.7%) and business, management and accounting with 91 documents (2.0%).

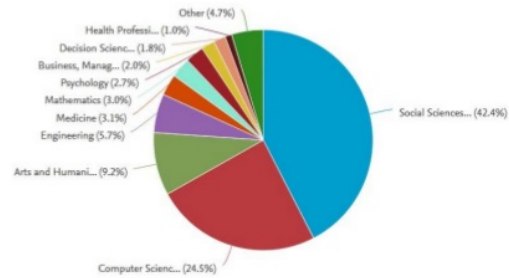


Fig. 5. Number of Documents based on Subject area of Digital Literacy Research

F. Documents based on Types of Digital Literacy Research

The most common document type in digital literacy research is articles with 1585 documents (57.7%). Followed by conference paper with 652 documents (23.7%), book chapter with 259 documents (69.4%), review with 122 documents (4.4%), and books with 51 documents (1.9%).

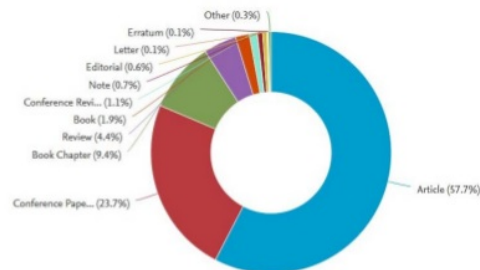


Fig. 6. Number of Documents based on the Most Common Types of Digital Literacy Research

G. Documents Per Year based on Sources from Digital Literacy Research

The highest number of sources in digital literacy research is the "ACM international conference proceeding series" with 65 documents. Followed by "communications in computer and information science" with 60 documents, "lecture notes in computer science including subseries lecture notes in artificial intelligence and lecture notes in bioinformatics" with 54 documents, computers, and composition with 39 documents, "journal of adolescent and adult literacy" with 39 documents and "Nordic Journal of Digital Literacy" with 33 documents.

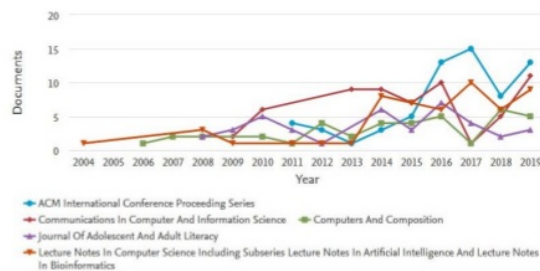


Fig. 7. Number of Documents Per Year Based on Sources from Digital Literacy Research

H. Documents Per Year of Digital Literacy Research

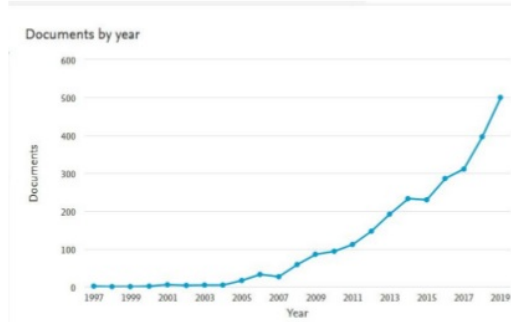


Fig. 8. Number of Documents Per Year of Digital Literacy Research

The number of digital literacy studies published internationally has shown an increasing trend every year. This can be seen in Fig. 8, the highest publication peak in 2019 with 500 documents. Digital literacy publications have been started since 1997. The number of documents per year in digital literacy research in 2019 was 500 documents, in 2018 there were 396 documents, in 2017 there were 311 documents, in 2016 there were 286 documents and in 2015 there were 230 documents.

I. The document cited of Digital Literacy Research

The most cited international level of digital literacy publication as a form of academic impact is Bawden, D., Robinson, L. in 2009 entitled "The dark side of information: Overload, anxiety and other paradoxes and pathologies" in the "Journal of Information Science" cited by 392 documents.

J. Map of Research Theme

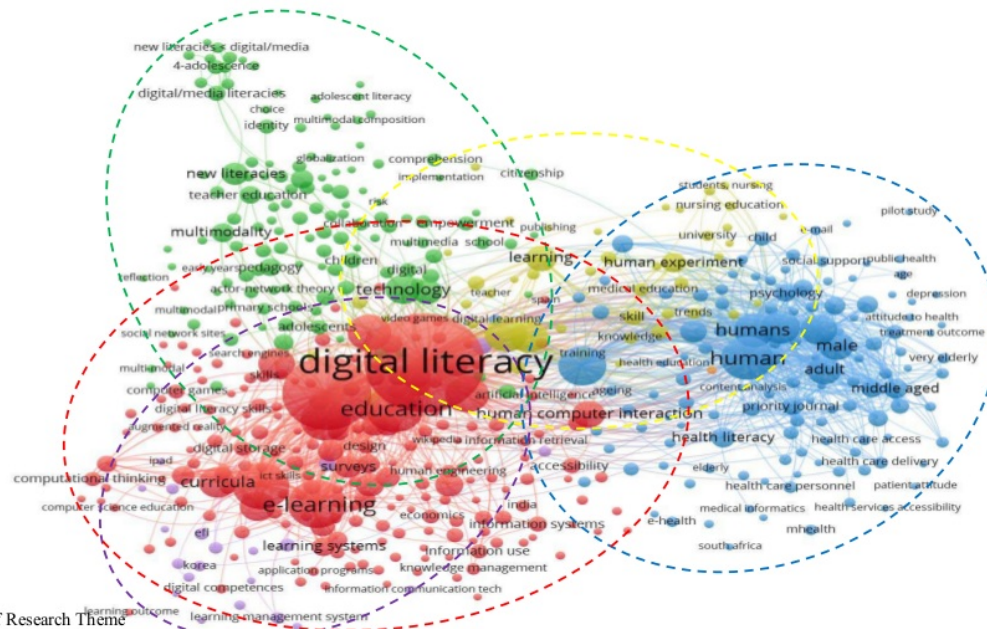
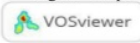


Fig. 9. Map of Research Theme



Construction on the digital literacy keyword network for the research theme map was built with the VOSviewer application. The criterion for a minimum number of documents related to keywords is five repetitions. So, from 6,896 keywords there are only 534 keywords that meet the thresholds.

Fig. 9. shows that there were five groups of research themes based on research keywords related to digital literacy research, abbreviated as LITHE themes.

1. Learning cluster (yellow). This cluster dominated by keyword training, skill, knowledge, publishing, and human experience.
2. Information communication cluster (purple). This cluster dominated by the keywords learning management system, efl, and ipad. Most of these keywords relate to information communication themes.
3. Technology cluster (green). In this cluster dominated by the keywords digital, collaboration, empowerment, social network sites, globalization, media literacies, and multimedia
4. Human cluster (blue). In this cluster, we can find human themes. This cluster was related by the keywords age, psychology, health literacy, health education, social support, attitude to health, and patient attitude.
5. Education cluster (red). This cluster dominated by the keywords learning system, skills, e-learning, human computer interaction, information use, digital competences, learning outcome, computer science education. Most of these keywords relate to education themes.

K. Author Network

Fig. 10 shows that there were two groups of construction patterns in the author's collaboration network in digital literacy research compiled with the VOSViewer application.

The criteria for the minimum number of documents per author were five documents. Thus, from 5,347 writers, 47 authors were found who met the thresholds. There were two groups of collaboration patterns between researchers in digital literacy studies as shown in Figure 10. Author Collaboration Network.

1. The red cluster consists of Mastin Prinsloo, Jennifer Rowsell, and Jackie Marsh. Mastin Prinsloo is an Emeritus Professor at the University of Cape Town, South Africa. Jennifer Rowsell is a Professor of Literacies and Social Innovation at the University of Bristol, Inggris. Jackie Marsh is a Professor of Education at the University of Sheffield, Inggris. These authors have collaboration in digital literacy research.
2. The green cluster consists of Guy Merchant and Cora Burnett. Guy Merchant is Professor of Literacy Education, Sheffield Hallam University, Inggris. Cora Burnett is Research Professor, Department of Sport and Movement Studies, University of Johannesburg, South Africa. These authors have collaboration in digital literacy research.



Fig. 10. Author Network

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IV. CONCLUSION

The results of this study indicate the status of the map and the increasing trend of the number of digital literacy research at the international level. The most productive countries, research institutions, and individual researchers in digital literacy research are the United States with 735 documents, Monash University with 29 documents, and Marsh, J. with 11 documents. The most funding sponsor for supporting digital literacy research is the National Science Foundation with 17 documents. The most intensive subject area in digital literacy research in social sciences with 1,958 documents (42.4%). The largest source of publications in digital literacy research is the "ACM international conference proceeding series" with 65 documents. The highest international publication in digital literacy research was achieved in 2019 with 500 documents. There were five authors' collaboration groups on research related to the field of digital literacy.

In terms of contributing implications to knowledge, this research proposes a convergence axis classification consisting of digital literacy research to characterize the body of knowledge generated from two decades of research: Learning, Information communication, Technology, Human, and Education, abbreviated as LITHE themes. As implications for practical, identifying key themes in the digital literacy sector leads to understanding the development of studies to understand common topics and contexts, as well as the research gaps. With all of this, new studies can be led to address a lack of study and advance knowledge in the areas. The themes most researched also demonstrate the digital literacy contribution to education and technology.

Future research that can be done is to analyze the contribution and impact of digital literacy research by measuring quotations based on a combination of Scopus and Web of Science data.

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