A Bibliographic Mapping Study: Concepts and Their Relationships in Information Literacy before and after COVID 19 Pandemic

Buket Akkoyunlu[1] and Nihal Menzi Çetin[2(✉)]

[1] Çankaya University, Ankara, Turkey
buket@cankaya.edu.tr
[2] Adana Alparslan Türkeş Science and Technology University, Adana, Turkey
ncetin@atu.edu.tr

Abstract. The aim of the study was to reveal the Information Literacy (IL) concept and relationship between the concept of IL before and after the pandemic. Also, common keywords were examined. The period between 2016-11-01 and 2019-12-31 was considered as pre-pandemic, and between 2020-01-01 – 2022-11-26 as post-pandemic, in both groups. Trend analysis on the information literacy pre- and post-pandemic period was performed by VOSviewer software and in-app algorithms thereby visualizing Web of Science database on the related concept. The co-occurrence analysis of the keywords of articles conducted to reveal common concepts and the most associated concepts. After the bibliographic analysis of common keywords of the sample articles, 25 most common concepts before and after the pandemic were obtained and visualized. Some distinctive concepts before the pandemic were library instruction, collaboration, and students, while fake news, misinformation, and social media were observed in the post-pandemic period. Occurrences of the concepts in both periods were discussed within the scope of the related literature.

Keywords: Covid-19 pandemic · bibliographic mapping study · information literacy

1 Introduction

The American Library Association defines Information Literacy (IL) as "…a set of abilities requiring individuals to 'recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" [1]. The Association of College and Research Libraries (ACRL) [2] expanded upon this definition by indicating that "information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning". Information literacy is more important than ever. As of March 12, 2020, the Covid-19 pandemic, which was declared as a pandemic after spreading all over the world, has shown its impact with lost human lives, economic repercussions and

S. Kurbanoğlu et al. (Eds.): ECIL 2023, CCIS 2043, pp. 83–91, 2024.
https://doi.org/10.1007/978-3-031-52998-6_7

increasing poverty. [3]. This event, which has had an impact on every aspect of life, has also been reflected in scientific research. The outbreak of COVID-19 poses new challenges to concepts of information literacy. Studies showed the increasing importance of IL especially in the pandemic era. According to a study of Chinese academic libraries, IL education during the pandemic had several characteristics, such as rapid response to information needs, recommending reliable information resources to users, developing and gathering current information on COVID-19 cases, and resisting misinformation and false information [4]. Research studies emphasize the enhancing of individual immunity against science-related misinformation; this is also named as "infodemic" induced by the pandemic [5–7]. With the pandemic, research in the field of information literacy has changed direction; IL's focus has changed and this is reflected in publishing patterns in databases as well. Just before the pandemic, Stopar and Bartol [8], conducted research on Web of Science (WoS) and Scopus based publishing patterns and trends in relation to IL related competencies that is, digital competences, computer skills, and related abilities in different settings. A bibliometric analysis from 2001 to 2020 on IL showed that "information literacy and library" is the top-researched topic and considerable increase in publications over a number of years was observed in this area [9]. Onyancha [10] examined the evolution of IL research over a 43-year period by mapping the Scopus database. The researchers revealed that within the specified time frame, the focus of the studies on IL moved out of the library and librarianship, spread to a wide variety of fields in a multidisciplinary structure, and was studied in 27 different disciplines besides the social sciences.

Research trends studies have emerged in Information Literacy (IL) to determine research methods and changes before and after COVID-19. Focusing on the concept of information literacy in higher education, Chen, et al. [11] captured related keywords, that is, IL, college students, higher education and academic libraries as a result of the bibliographic analyzes within the 2011–2020 period. Pinto et al. [12] analysed the evolution of research activity during an extensive period (1974–2011) and scientific productivity about IL. The researchers observed exponential growth in the research on the concept within the areas of information and documentation, communication, education, management, and health sciences.

Research conducted around the Covid-19 pandemic exposed that the pandemic has created a gap between community and the science in the context of IL and related literacies and competencies. The reflection of this situation on scientific research can be observed with the help of bibliometric analyzes. The current study attempted to comparatively analyze the impact of the pandemic on the scientific production and reveal new challenges undertaken.

2 Method

2.1 Selecting Articles

The data set was extracted from WoS databases with keywords related to "Information Literacy". The keyword was searched in the database as "information literacy" in double quotes in order to limit the search. Selection criteria was the publication period between specified dates. The period between 2016-11-01 and 2019–12-31 was considered as

pre-pandemic, and between 2020-01-01 and 2022–11-26 as post-pandemic. Selected publications were then refined by Document Type (article or proceeding paper or book chapters). A total of 3141 articles published between 2016 and 2022 were analyzed. While 1701 of the articles were from pre-Covid 19, 1440 articles were from post-Covid 19.

2.2 Analysis

In order to reveal the co-occurrence of IL and related concepts we utilized bibliographic mapping analysis with the help of the VOSviewer tool to analyze keywords and visualize them. Trend analysis on the information literacy pre- and post-pandemic period was performed by VOSviewer software and in-app algorithms thereby visualizing WoS database on the related concept [13]. In order to examine the most common concepts, we selected top 25 keywords and the threshold value for determining the frequency of keywords is set to 5. At the same time, most associated pairs were analyzed according to the frequency of co-occurrence of keywords with IL. Using the described method, we pursued two research questions listed below:

- What are the common concepts on maps before and after Covid-19?
- What are the most associated concepts with IL on maps?

3 Findings

3.1 Most Common Concepts Before Pandemic

The map of the concepts belongs to pre-pandemic period is presented at Fig. 1:

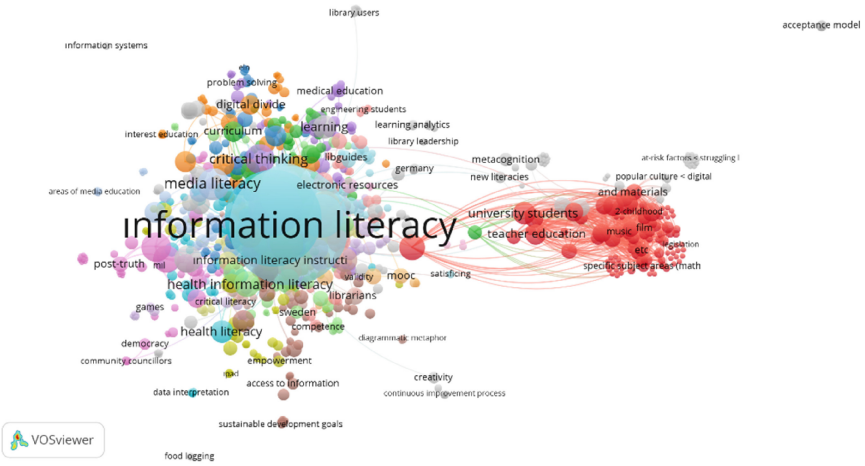

Fig. 1. The map of pre-pandemic concepts and their relationships

Figure 1 shows the relationship and linkage map of the concepts studied with IL. The quantitative values of the links on the map are given in the Table 1.

Table 1. Most common concepts on the map before pandemic.

Concept	Occurrence	Total link strength
Academic libraries	93	342
Higher education	86	288
Library instruction	55	191
Digital literacy	50	165
Assessment	42	138
Collaboration	32	113
Media literacy	29	111
Education	29	87
Students	27	85
Critical thinking	26	66
Fake news	25	86
E-learning	24	66
Libraries	21	75
Social media	21	73
ACRL framework	20	67
Internet	19	136
Health information literacy	19	36
Research	17	58
Digital competence	17	51
Learning	16	42
University students	15	155
University libraries	15	65
Graduate students	15	47
Health literacy	15	46
Plagiarism	15	36

Table 1 shows the frequency of occurrences of the top 25 keywords which appeared with IL. The five most common concepts revealed with information literacy were academic libraries, higher education, library instruction, digital literacy and assessment. The second five common concepts are collaboration, media literacy, education, students and critical thinking.

3.2 Most Common Concepts After Pandemic

After the pandemic, new concepts were observed occurring with IL. Figure 2 showed the common concepts in the second period:

Also, Table 2 shows the occurrences and total link strength of the post-pandemic concepts from the map. According to Table 2, after the pandemic, the 5 most common concepts associated with IL are higher education, academic libraries, assessment, digital literacy and fake news. The second five are media literacy, misinformation, Covid-19, social media and education. As shown in the Table 1 and 2, it is observed that there are

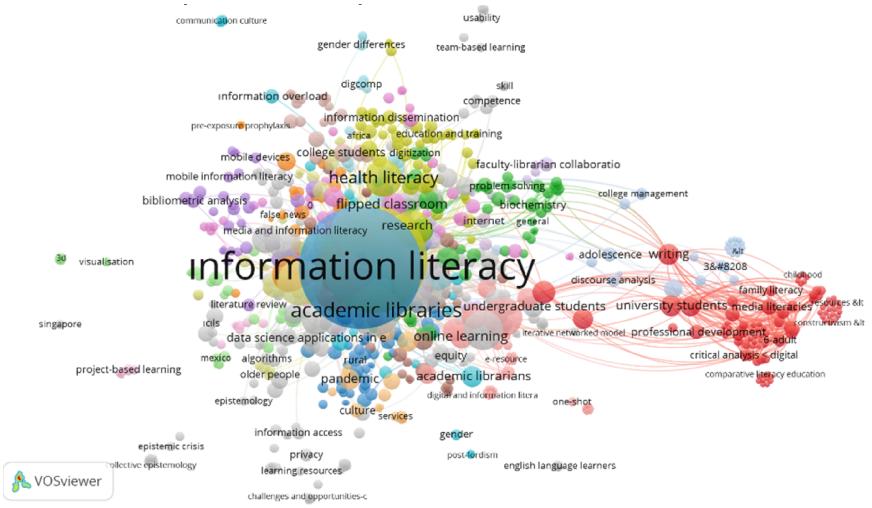

Fig. 2. The map of post-pandemic concepts and their relationships

Table 2. Most common concepts on the map after pandemic.

Concept	Occurrence	Total link strength
Higher education	76	311
Academic libraries	61	242
Assessment	35	227
Digital literacy	56	202
Fake news	46	178
Media literacy	48	178
Misinformation	43	167
Covid-19	46	155
Social media	36	144
Education	34	142
Students	34	142
Library instruction	37	141
Critical thinking	36	126
Health literacy	33	103
Disinformation	29	110
Media and IL	26	96
Libraries	22	116
Digital divide	15	89
Internet	12	105
University students	11	121

(*continued*)

Table 2. (*continued*)

Concept	Occurrence	Total link strength
Writing	11	174
Critical analysis	3	89
Comprehension	3	89
Family literacy	3	108

changes in the concepts mentioned together with IL in the pre- and post-pandemic period. The occurrences of the top 5 keywords were changed; fake news was also prominent after the pandemic. Misinformation, Covid-19, disinformation and family literacy were observed just after the pandemic.

In terms of the concepts of fake news, social media, critical thinking and health literacy, an increase is observed after the pandemic. Total link strengths indicate the total links of given keywords with IL. When we compared with the pre-pandemic data, there was also notable increase in the mentioned concepts.

4 Discussion

Results of this bibliographic mapping study revealed that there was a change before and after Covid-19 pandemic in terms of research concerned with IL. Although there were common terms both in the maps such as academic libraries, higher education and library instruction, new concepts emerged just after the pandemic. When we examined the common concepts with IL on the maps, misinformation, covid-19, disinformation and family literacy were observed on the second period. This showed that the covid-19 pandemic changed the face of the scientific research related to the subject of IL. Baber, et al. [14] reached the similar results with digital literacy. They reported concepts associated with digital literacy were fake news, competence, educational technology, health literacy, self-efficacy, and covid-19. Nadi-Ravandi and Batooli [15] also put forth the occurrence map of the scientific products of the library subject area and the Covid-19 pandemic, they extracted four clusters: libraries and librarians, use of media and social networks and information and communication technologies, online library services, and information and news. They reported the most frequently used keywords associated with the library were misinformation, fake news, IL and crisis management.

Another salient finding of this study is the changes in the total link strengths of the common concepts in both periods. After the pandemic, there were remarkable increases in the occurrences of terms, that is, fake news, social media, critical thinking and health literacy. Fake news is one of the important topics covered in IL literature, especially in the covid-19 process. It is discussed together with the concept of critical thinking in the examination of exposure to information that spreads rapidly on social media during the pandemic period [16–20]. IL and related literacies such as media, news, digital and scientific, have protective effect on people against harmful effects of misleading information [21–24]. Igbinovia et al. [25] revealed that, IL competency had a significant effect on curtailing the spread of COVID-19 fake news among undergraduates in Nigeria.

They are educationally positioned to acquire IL competency which is crucial to their identification of fake news and helps to curtail its spread. In this study, the increase in the link strength of the related concept, especially in the post-pandemic period, shows that as it has been studied more with IL its importance has increased.

Social media has been considered together with IL and an increase in the tie strength has been observed. Because it has a pivotal role in disseminating information, the importance of the term come into prominence during the pandemic. Bajwa et al. [26] put forward that the behavior of young people changed after getting exposed to the disseminated information regarding COVID-19 in social media; also the effect of social media in creating literacy among masses helps people to use precautionary measure against COVID-19. As the spread of misinformation about COVID-19 increases, the importance of IL and related literacy such as media literacy is increasing to avoid confusion and uncertainty [27]. Raising the awareness of the masses against the effect of the information disseminated in social media shows itself especially in research on media and information literacy. Investigating the negative impact of misinformation/disinformation on media and IL is still seen as insufficient and limited within academic spheres only [6]. The digital divide also plays a key role in terms of the mentioned literacies, and it is indicated as having been the most significant impediment to the success of digital, media and IL initiatives [6, 28].

Health literacy was another concept with an increased occurrence of IL after the pandemic so its total link strength was considerably increased. It played a vital role in saving lives during the pandemic. In this period when accurate information is of critical importance, relying on low-quality information sources could create and reinforce people's misperception, combined with socioeconomic vulnerabilities, this also leads to low compliance with Covid-19-related public health measures, poor health outcomes and low anxiety levels regarding Covid-19 [29–31]. Li et al., [32] showed that health literacy was positively associated with Covid-19-specific precautionary behaviors and conventional health behaviors helps college students adopt these behaviors and also reduces the risk of infection among them.

Covid-19 showed its effect on scientific research trends in the field of IL, as it does in all areas of life. This study makes a comparison of the concepts related to IL, which have increased in importance or come to the fore during the pandemic period. However, the time periods included in the analysis cover a period of approximately three years before the pandemic and a period of two years afterward. In order to observe visible changes in research trends, it would be useful to conduct a study over a larger time period. Another limitation of this study is that it is limited to the visualization and mapping of the concepts. Thus, this study revealed the impact of the pandemic on IL research, and discussed possible reasons. In future studies, comparative analyses can be conducted for both periods in terms of different refinement criteria such as research categories or regions. Nonetheless, the economic effects that have emerged as a result of the pandemic, and the diminishing effect of it since 2023, could cause research to focus on new and different concepts.

References

1. American Library Association. Presidential Committee on Information Literacy: Final Report (July 24, 2006) (1989). http://www.ala.org/acrl/publications/whitepapers/presidential. Accessed 4 Dec 2022
2. American Library Association (ALA), Association for College and Research Libraries (ACRL). (2000). Information Literacy Competency Standards for Higher Education, http://hdl.handle.net/10150/105645 (Accessed December 4, 2022)
3. Ciotti, M., Ciccozzi, M., Terrinoni, A., Jiang, W.C., Wang, C.B., Bernardini, S.: The COVID-19 pandemic. Crit. Rev. Clin. Lab. Sci. **57**(6), 365–388 (2020). https://doi.org/10.1080/10408363.2020.1783198
4. Guo, J., Huang, J.: Information literacy education during the pandemic: the cases of academic libraries in Chinese top universities. J. Acad. Libr. **47**(4), 102363 (2021). https://doi.org/10.1016/j.acalib.2021.102363
5. Gisondi, M.A., et al.: A deadly ınfodemic: social media and the power of Covid-19 misinformation. J. Med. Internet Res. **24**(2), 1–7 (2022). https://pubmed.ncbi.nlm.nih.gov/35007204/
6. Singh, N., Banga, G.: Media and information literacy for developing resistance to 'infodemic': lessons to be learnt from the binge of misinformation during COVID-19 pandemic. Media Cult. Soc. **44**(1), 161–171 (2022). https://doi.org/10.1177/01634437211060201
7. Bin Naeem, S., Boulos, M.N.K.: Covid-19 misinformation online and health literacy: a brief overview. Int. J. Environ. Res. Public Health **18**(5), 1–12 (2021). https://doi.org/10.3390/ijerph18158091
8. Stopar, K., Bartol, T.: Digital competences, computer skills and information literacy in secondary education: mapping and visualization of trends and concepts. Scientometrics **118**(2), 479–498 (2019). https://doi.org/10.1007/s11192-018-2990-5
9. Ali, N., Shoaib, M., Abdullah, F.: Information literacy and research support services in academic libraries: a bibliometric analysis from 2001 to 2020. J. Inf. Sci. (2022). https://doi.org/10.1177/01655515211068169
10. Onyancha, O.B.: Knowledge visualization and mapping of information literacy, 1975–2018. IFLA J. **46**(2), 107–123 (2020). https://doi.org/10.1177/0340035220906536
11. Chen, C.C., Wang, N.C., Tu, Y.F., Lin, H.J.: Research trends from a decade (2011–2020) for ınformation literacy in higher education: content and bibliometric mapping analysis. In: Proceedings of the Association for Information Science and Technology, vol. 58, no. 1, pp. 48–59, (2021), https://doi.org/10.1002/pra2.435
12. Pinto, M., Escalona-Fernández, M.I., Pulgarín, A.: Information literacy in social sciences and health sciences: a bibliometric study (1974–2011). Scientometrics **95**, 1071–1094 (2013). https://doi.org/10.1007/s11192-012-0899-y
13. Van Eck, N., Waltman, L.: Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics **84**(2), 523–538 (2010). https://doi.org/10.1007/s11192-009-0146-3
14. Baber, H., Fanea-Ivanovici, M., Lee, Y.T., Tinmaz, H.: A bibliometric analysis of digital literacy research and emerging themes pre-during COVID-19 pandemic. Inf. Learn. Sci. **123**(3/4), 214–232 (2022). https://doi.org/10.1108/ILS-10-2021-0090
15. Nadi-Ravandi, S., Batooli, Z.: Libraries respond to the COVID-19 pandemic: drawing a science map of published articles. Library Hi Tech **41**(1), 42–58 (2023). https://doi.org/10.1108/LHT-04-2022-0209
16. Kruijt, J., Meppelink, C.S., Vandeberg, L.: Stop and Think! exploring the role of news truth discernment, ınformation literacy, and ımpulsivity in the effect of critical thinking recommendations on trust in Fake COVID-19 news. Eur. J. Health Commun. **3**(2), 40–63 (2022). https://doi.org/10.47368/ejhc.2022.203

17. Montagni, I., Ouazzani-Touhami, K., Mebarki, A., Texier, N., Schuck, S., Tzourio, C.: Acceptance of a Covid-19 vaccine is associated with ability to detect fake news and health literacy. J. of Public Health **43**(4), 695–702 (2021). https://doi.org/10.1093/pubmed/fdab028
18. Usman, B., Msughter, A.E, Ridwanullah, A.O: Social media literacy: fake news consumption and perception of Covid-19 in Nigeria. Cogent Arts Hum. **9**(1), 1–14 (2022). https://doi.org/10.1080/23311983.2022.2138011
19. Haigh, M., Haigh, T., Dorosh, M., Matychak, T.: Beyond fake news: learning from ınformation literacy programs in Ukraine. In: Taylor, N.G., Kettnich, K., Gorham, U., Jaeger, P.T. (eds.) Libraries and the Global Retreat of Democracy. Advances in Librarianship, vol. 50, pp. 163–182. Emerald Group Publishing, England (2022), https://doi.org/10.1108/S0065-283020210000050007
20. Moscadelli, A., et al.: Fake news and Covid-19 in Italy: results of a quantitative observational study. Int. J. Environ. Res. Public Health, **17**(16), 1–13 (2020), https://doi.org/10.3390/ijerph17165850
21. Jones-Jang, S.M., Mortensen, T., Liu, J.: Does media literacy help identification of fake news? Information literacy helps, but other literacies don't. Am. Behav. Sci. **65**(2), 371–388 (2021). https://doi.org/10.1177/0002764219869406
22. Xiao, X., Borah, P., Su, Y.: The dangers of blind trust: examining the interplay among social media news use, misinformation identification, and news trust on conspiracy beliefs. Public Underst. Sci. **30**(8), 977–992 (2021). https://doi.org/10.1177/0963662521998025
23. Musi, E., Aloumpi, M., Carmi, E., Yates, S., O'Halloran, K.: Developing fake news immunity: fallacies as misinformation triggers during the pandemic. Online J. Comput. Media Technol. **12**(3), 1–18 (2022). https://doi.org/10.30935/ojcmt/12083
24. Archila, P.A., Danies, G., Molina, J., de Mejia, A.M.T., Restrepo, S.: Towards Covid-19 literacy. Invest. Lit. Levels Univ. Stud. Colombia **30**(4), 785–808 (2021). https://doi.org/10.1007/s11191-021-00222-1
25. Igbinovia, M.O., Okuonghae, O., Adebayo, J.O.: Information literacy competence in curtailing fake news about the COVID-19 pandemic among undergraduates in Nigeria. Ref. Serv. Rev. **49**(1), 3–18 (2021). https://doi.org/10.1108/RSR-06-2020-0037
26. Bajwa, S., Khan, M.A., Waheed, S.: Role of social media in perspective of media ınformation literacy during pandemic Covid-19. Int. J. Media Inf. Liter. **7**(2), 305–314 (2022). https://doi.org/10.13187/ijmil.2022.2.305
27. Bonnet, J.L., Sellers, S.: The COVID-19 misinformation challenge: an asynchronous approach to information literacy. Internet Ref. Serv. Q. **24**(1–2), 1–8 (2020). https://doi.org/10.1080/10875301.2020.1861161
28. Barrientos-Baez, A., Garcia, A.P., Caldevilla-Dominguez, D.: Technological digital literacy: volunteer training. Investigaciones Sobre Lectura **15**, 95–129 (2021). https://doi.org/10.24310/isl.vi15.12560
29. Chen, X., et al.: Trust in and Use of COVID-19 ınformation sources differs by health literacy among college students. Healthcare **11**(6), 831 (2023). https://doi.org/10.3390/healthcare11060831
30. Ruedin, D., Probst, J., Wanner, P., Efionayi-Maeder, D., Bodenmann, P.: Covid-19 related health literacy of socioeconomically vulnerable migrant groups. Int. J. of Public Health **67**, 1–8 (2022). https://doi.org/10.3389/ijph.2022.1604664
31. Ugras, S., Sagin, A.E., Karabulut, O., Ozen, G.: The relationship between college athletes' health literacy and Covid-19 anxiety levels. Phys. Educ. Stud. **25**(1), 36–42 (2021). https://doi.org/10.15561/20755279.2021.0105
32. Li, S., Cui, G., Kaminga, A.C., Cheng, S., Xu, H.: Associations between health literacy, ehealth literacy, and Covid-19–related health behaviors among Chinese college students: cross-sectional online study. J. Med. Internet Res. **23**(5), e25600 (2021). https://doi.org/10.2196/25600