THE USE OF CHATBOT SYSTEMS IN ONLINE COUNSELING SERVICES: A BIBLIOMETRIC MAPPING

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Abstract

Along with the development of the study on artificial intelligence, the use of chatbot systems in various fields is increasingly prominent, including mental health services. Counselling services are still one of the grey areas in using chatbots due to ethical problems, technical constraints, and professionalism issues. Therefore, various relevant studies are still needed to examine further the use and development of chatbots in online counselling services. Bibliometric analysis can help highlight patterns and trends within a research area and determine further research direction. This study aims to figure out the scope of research on using chatbots in online counselling services through computational mapping using VOSviewer. The object of analysis is a file in the form of Research Information Systems (RIS), which contains 230 publication data drawn from the Google Scholar database for the last ten years (2012-2021). The study results show that despite various issues related to the use of chatbots in online counselling services, research on this subject has increased quite rapidly from 2016 to 2021. In addition, several future research opportunities have been identified to fill the research gaps in this field.

Keywords: Bibliometric analysis, Chatbot, Counselling service, Online counselling, VOSviewer.

1.Introduction

As a psychotherapeutic effort, counselling practice can take place in various contexts, such as in medical and healthcare, education, legal, and social contexts. Counselling, as an activity of assisting in the form of advice or suggestions from counsellors to clients, can be done in face-to-face and distance settings. Distance counselling can be done through e-counselling services (including counselling via telephone, email, and close-circuit television links). Along with the development of information technology and the internet, online counselling services are becoming prominent in the form of text chat, voice notes, and video conferences [1].

Technological development leads to increasingly affordable internet access supported by high bandwidth capacity, which also affects the counselling practice. Cyberspace is seen as an effective, affordable, and adequate means for counselling service delivery. Online counselling services were chosen due to several advantages such as cost-effectiveness, availability, time flexibility, accessibility, the possibility of anonymity for clients, and an easier record-keeping system [1-3].

During the COVID-19 outbreak, physical and social distancing policies were implemented and caused face-to-face counselling to be difficult or even impossible to conduct. Thus, online counselling services have become the most viable method chosen by both clients and counsellors [3-5]. As interest in online counselling increases, several online counselling service platforms use the virtual assistant feature to anticipate the gap between available counsellors and clients.

Virtual assistant features are developed based on Artificial Intelligence (AI) models and principles. Artificial Intelligence is a programming language mapping concept that can make a conclusion based on the mapping that has been done in programming. AI is added to machines (computers) to function like natural intelligence in humans or animals [6].

Some of the famous virtual assistant features include Apple Siri, Google Home, Amazon Alexa, and Samsung Bixby. Meanwhile, several chatbot systems developed to support online counselling services include MYLO, Woebot, VICA, CRECA, Dr. Joy, iHelpr, Wysa, Tess, Youper, and ReMind [7-11]. Hence, a virtual assistant also referred to as a predictive chatbot, is a computer program that mimics conversation with its user. In the system that is built by sentiment analysis-based, a chatbot consist of particular set of automated responses to the most frequent informative and transactional inquiries [12, 13].

The use of chatbot systems shows significant progress in the field of mental health support. Chatbot-assisted online counseling services can provide assistance for individuals who are facing a wide array of emotional challenges or psychological stress. Thus, the use of a chatbot system can increase the efficacy and accessibility of online counseling services conducted by the host site [11].

There are benefits of chatbot system utilization in online counselling services, including enhanced accessibility, reducing stigma (because of anonymity), continuous availability, personalized resources by AI, multilingual support, and open access to information and psychoeducation [11].

Along with its beneficial features, the emergence of online counselling also brings counsellors to a set of issues related to ethics, operational standards, counsellor professionalism, therapeutic relationships, crisis management, and

technical barriers [10-15], the use of chatbots in online counselling practices also triggers various problematic questions, especially around ethical problems, counsellor professionalism, and technical considerations [8, 10, 14, 15]. Therefore, further studies to improve the use of chatbots in the field of counselling are considered important and necessary.

Through such studies, researchers and practitioners in the counselling field can identify the components needed to develop chatbot model designs that are compliant with the principles and objectives of counselling; limitations and ethics related to the use of chatbots in online counselling services; evaluation of the use of chatbots that already exist today; and other research trends.

A review of research trends related to the use of chatbot systems in online counselling services through bibliometric analysis has never been published, especially in the last ten years. Similarly, computational mapping using VOSviewer software to various publications regarding the use of chatbot systems in online counselling services has never been done before.

Bibliometric analysis techniques can be used to show the research areas of publications and visualize the impact of research groups or areas of interest [15, 16]. It can also be used to identify potential collaboration between authors, research groups, or universities and track citation relationships through time to see how researchers work with one another [15-17].

In the last ten years, there have been several previous studies related to bibliometric analysis applied to track research trends in various fields. Table 1 shows current studies regarding bibliometric analysis. Bibliometric analysis is used to make decisions about continuing or stopping research in the future.

Among various software used for bibliometrics is VOSviewer, a software for performing computational mapping of publication meta-data [16, 17]. The results of computational mapping are visualized in detailed images to make them easier to observe and analyse.

This study was conducted to figure out the scope of research on the use of chatbots in online counselling services through computational mapping using VOSviewer. Using bibliometric mapping of relevant publications in the last ten years, the study results are expected to provide information on trends and research directions related to the use of chatbots in online counselling services for future researchers.

Table 1. Prior bibliometric analysis research.

No.	Topic Discussion	Ref.
1	VOSviewer is utilized in this study's Publish or Perish program to evaluate bibliometrics.	[17]
2	This study looks at how research has changed over the Covid-19 era using bibliometric methodology.	[18]
3	The literature review for this study discusses the benefits and drawbacks of using pure biodiesel on engine performance.	[19]
4	This study discusses the current state and future directions of bioenergy management research.	[20]
5	This study investigated the dissolution of empty palm oil fruit bunches using benzotriazole ionic salt solutions and VOSviewer, a tool for bibliometric analysis.	[21]
6	Information regarding decision-making is covered in this study.	[22]

No.	Topic Discussion	Ref.
7	This study covers the analysis of science and its integration. This paper also did mapping analysis using the VOSviewer application.	[23]
8	This study discusses the usage of VOSviewer in conjunction with mapping analysis.	[24]
9	The expansion of geotechnical engineering research was investigated in this work using VOSviewer and bibliometric distribution maps.	[25]
10	This study investigates the "Special Needs Education of Chemical Engineering" by combining mapping analysis and the VOSviewer tool.	[26]
11	The present directions in materials research are discussed in this paper.	[27]
12	This study uses data from Scopus-indexed article databases to investigate the evolution of bibliometric analysis research in the domains of science and Islam.	[28]
13	This study uses bibliometric analysis to examine how resin matrix composition affects brake pad performance.	[29]
14	This article examines the trends in briquette research during the COVID-19 epidemic.	[30]
15	This work presents the development of dental aerosol suction using VOSViewer and the dissemination of bibliometrics maps.	[31]
16	This paper explains the current nanotechnology on animal science.	[32]
17	This paper describes research on how particle technology involve in realistic life, including its impacts on computational fluid dynamics.	[33]
18	This paper describes how to improve students' understanding during practicum based on bibliometric analysis.	[34]
19	This paper describes how to improve students' understanding in engineering based on bibliometric analysis.	[35]
20	The research trends in techno-economic education are discussed in this paper.	[36]

2. Methods

This study was conducted using the literature research methods. The research data was collected using "Publish or Perish (PoP)" software. In this data collection process, several steps were taken in retrieving and classifying the data itself, namely:

(i) Set the keyword. In this step, the keywords "chatbot" and "online counselling" were set to undergo the search of publications in the academic citations database.

(ii) Set the database from which data was retrieved. Google Scholar was chosen as the database because of its open-source nature, allowing broader coverage of publication data.

(iii) Set the period years of publication data retrieval. The publications used were published between 2012 and 2021 (ten years).

(iv) Start the data retrieval process. Data retrieval results showed that 230 relevant publications were obtained. Then, the list was exported into two file formats: Research Information System (.RIS) and Comma Separated Value (.CSV).

(v) Data processing and classification. In this step, the list of 230 relevant publications from the Google Scholar database was processed using Microsoft Excel for bibliometric analysis. At this stage, data were sorted by year and number of citations.

After those steps were completed, another data analysis was conducted using "VOSviewer" software. VOSviewer is open-source software that is used to analyse and evaluate trends and patterns in a particular research field. In this data analysis

process, bibliometrics data from previous steps were analysed using a computational mapping analysis resulting in three types of bibliometric visualization mapping images namely: network visualization, density visualization, and overlay visualization.

The mapping process also generates citation-based clustering of publications by describing link strengths and occurrences. This clustering makes it easier for readers to identify gaps and directions of research topics in certain fields. Detailed figures depicted by the software were observed and analysed to determine among various online counselling service platforms (medical and healthcare, education, legal and social services), in which fields the chatbot systems are most widely applied.

When creating a bibliometric map, the keyword frequency is set to be found at least 10 times. Therefore, we get 13 items of terms. Several scientific articles explain the use of the VOS viewer for bibliometric research purposes in a detailed manner [37, 38].

3. Results and Discussion

3.1. Research developments on the use of chatbot systems in online counselling services

Publish or Perish search result shows 230 publications in the Google Scholar database relevant to the search keywords "chatbot" and "online counselling". The list of publications is presented in the form of metadata containing the author's name, title, year, journal name, publisher, number of citations, article links, and related URLs. The metadata is then sorted in terms of the number of citations to identify publications with popular topics. Thus, research developments regarding the use of chatbots in online counselling were identified through several publications each year during the 2012-2021 period.

Table 2 shows the list of publications with the highest citations. All publications in this study were cited 6743 times, with 674.3 citations per year and 29.32 citations per paper. The average number of authors in each paper was 3,43, the average h-index of all publications used in this study was 39, and the average g-index was 78 (hI-norm 22, hI annual 2,20, and hA-index 27).

Table 2. List of popular publications related to the use of chatbots in online counselling services on the Google Scholar database (2012-2021).

No.	Author	Title	Year	Journal	Citation
1	Wirtz et al.	Brave new world: service robots in the frontline	2018	Journal of Service Management Volume	906
2	Ho et al.	Psychological, relational, and emotional effects of self-disclosure after conversations with a chatbot	2018	The journal of communication	239
3	Huang et al.	Engaged with a robot? The role of AI in service	2021	Journal of Service Research Volume	239
4	Lattie et al.	Digital mental health interventions for depression, anxiety, and enhancement of psychological well-being among college students: systematic review	2019	Journal of Medical Internet Research	230

5	Hoermann et al.	Application of synchronous text-based dialogue systems in mental health interventions: a systematic review	2017	Journal of Medical Internet Research	170
6	Car et al.	Conversational agents in health care: scoping review and conceptual analysis	2020	Journal of Medical Internet Research	130
7	Morris et al.	Towards an artificially empathic conversational agent for mental health applications: system design and user perceptions	2018	Journal of Medical Internet Research	129
8	Ransing et al.	Mental health interventions during the COVID-19 pandemic: a conceptual framework by early career psychiatrists	2020	Asian Journal of Psychiatry	125
9	Pereira et al.	Using health chatbots for behavior change: a mapping study	2019	Journal of Medical Systems	119
10	Pachankis et al.	Sex, status, competition, and exclusion: Intraminority stress from within the gay community and gay and bisexual men's mental health.	2020	Journal of personality and social psychology	92

Meanwhile, Table 3 shows the development of research on the use of chatbots in online counselling services in the last decade (2012-2021). As displayed in Table 2, there were 230 publications on the use of chatbots in online counselling services from 2012 to 2021. In 2012 and 2013, the number of publications was recorded at a minimum number of only 1 publication each. In 2014, there was an increase to 5 publications, while in 2015 and 2016, the was only one publication each.

In 2017, there was another increase to 7 publications. Then from 2018 to 2021, there was a significant gradual increase. In 2018, there were 15 publications. In 2019 there was a twofold increase to 34 publications. In 2020, the increase in publications was more than doubled to 75 publications. Finally, in 2021 there were 90 publications on the use of chatbots in online counselling services.

Table 3. The development of research on the use of chatbots in online counselling services in the last decade (2012-2021)

Year of Publications	Number of Publications
2012	1
2013	1
2014	5
2015	1
2016	1
2017	7
2018	15
2019	34
2020	75
2021	90
Total	230
Average	23

Thus, if the data is visualized in graphic form, a unique pattern will be formed, as shown in Fig. 1. Figure 1 shows a low number of publications at the beginning of the decade and increasing towards the end of the decade. Two years with 1 publication, the following year increased, back to two years with 1 publication but the following years increased and continued to grow rapidly. The turning point of significant improvement occurred in 2019. Based on a review of relevant publications, it is known that the use of chatbots in various online counselling service platforms is dominated by the medical and healthcare fields (including mental health services).
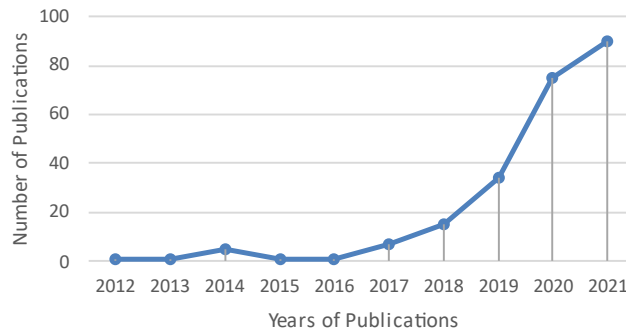

**Fig. 1. The development of research related to
the use of chatbots in online counselling services**

3.2. VOSviewer visualization of bibliometric data on chatbot and online counselling keyword

3.2.1. Citation-based clustering

VOSviewer was used in computational mapping which results in citation-based clustering of the analysed publications. The results of computational mapping found 13 terms. The terms related to chatbots, and counselling were then grouped into clusters as follows:

(i)   Cluster 1 (marked in red) consists of 5 items: *chatbot*, *counselling*, *covid*, *patient*, and *use.*
(ii) Cluster 2 (marked in green) consists of 4 items: *artificial intelligence*, *effect*, *review*, and *role*.
(iii) Cluster 3(marked in blue) consists of 3 items: *student*, *study*, and *systematic review*.
(iv) Cluster 4 (marked in yellow) consists of 1 item: *user*.

The relationship between terms is shown in each existing cluster. A label is assigned to each coloured circle term. The size of the circle for each term varies depending on the frequency of mention. The more frequently a term appears in the title and abstract of each publication, the larger the label size is. In this study, three types of mapping visualization were analysed: network visualization (see Fig. 2), overlay visualization (see Fig. 3), and density visualization (see Fig. 4).

3.2.2. Network visualization

In network visualization, the cluster size reflects the number of publications included. Larger clusters include a higher number of publications. The distance between the two clusters roughly indicates the relatedness of the clusters in terms of citations [16, 17].

Adjacent clusters tend to have a strong relationship in terms of citations, while clusters far apart from each other tend to have a weaker relationship. Curved lines between clusters indicate cluster relatedness, with line thickness representing the number of citations between two clusters. The horizontal and vertical axes have no special meaning [37].

As shown in Fig. 2, the relationships described in the network visualization are shown by lines connecting one term to another. Research on the use of chatbots in online counselling services is related to four clusters. Each term in each cluster has a different number of links, total link strength, and term appearance.

Figure 2 also shows the 4 terms with the most links, namely "chatbot", "counselling", "study" and "artificial intelligence". The term "chatbot" from cluster 1 has 12 links to other terms, 172 total link strength, and 132 occurrences. The term "counselling" from cluster 1 has 12 links to other terms, 122 total link strengths, and 79 occurrences. The term "study" from cluster 3 has 10 links to other terms, a total link strength of 61, and 45 occurrences. The term "artificial intelligence" from cluster 2 has 12 links to other terms, a total link strength of 49, and 28 occurrences.
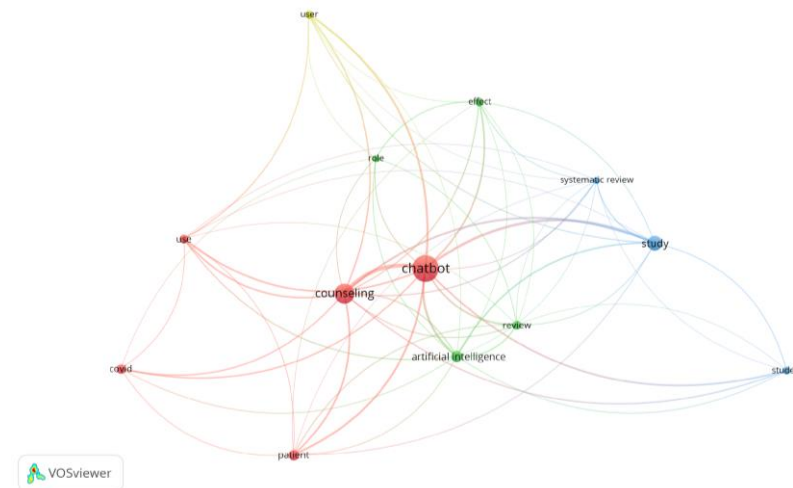

**Fig. 2. Network Visualization on research related
to the use of chatbots in online counselling services**

3.2.3. Overlay visualization

Figure 3 shows an overlay visualization of research on the use of chatbots in online counselling services, where the relationship between terms is followed by a research timeline to find out the terms in the latest research. As displayed in Fig. 3, the range of publication years depicted on the timeline in the lower right corner ranges from 2019 to 2020 because those years were when a significant increase occurred.

The recent or latest research is marked in bright yellow, while older research is marked in dark blue. "Covid", "role", "review" and "artificial intelligence" are

terms in the latest publications in the 2019-2020 timeline. The small number of circles with yellow colour implies that the opportunity to create or to find novelties in this topic area is still wide open.
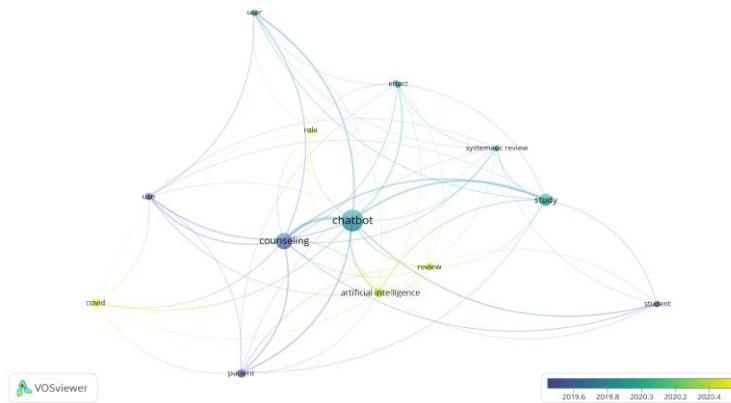

**Fig. 3. Overlay visualization on research related
to the use of chatbots in online counselling services**

3.2.4. Density visualization

Figure 4 shows the density visualization. This visualization is shown in a dark blue background area with lighter coloured circle areas appearing on it. These circles are coloured in bright yellow and darker colours and almost blend in with the dark blue background [37, 38]. The circle area's diameter and colour are affected by how often a term is found in the title and abstract of the publication. Thus, the larger and brighter the circle of a term, the more research on that term tends to increase.

Meanwhile, the fainter or darker the circle of a term, the research on that term tends to decline. Density views are particularly useful for getting an overview of the general structure of the map and for drawing attention to the most important areas on the map [38]. Figure 4 shows that research related to the terms "chatbot", "counselling", and "study" will tend to increase in the following years.
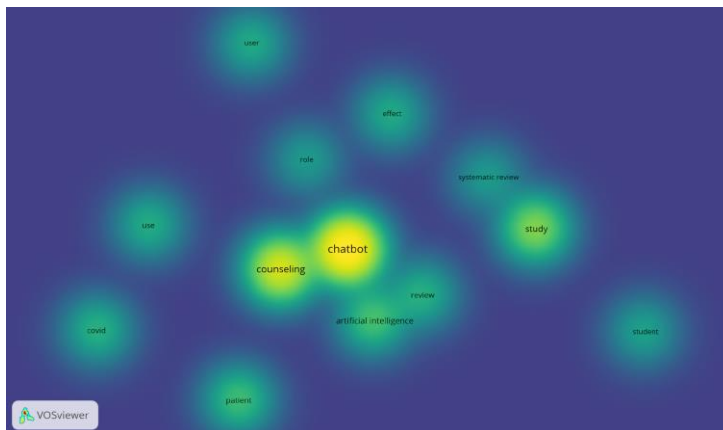

**Fig. 4. Density Visualization on research related
to the use of chatbots in online counselling services**

4. Conclusion

This study aims to figure out the scope of research on the use of chatbots in online counselling services through computational mapping using VOSviewer. The bibliometric data consisted of 230 research articles published in various Google Scholar-indexed journals from 2012 to 2021. Articles were collected using Publish or Perish software. The results show that research developments regarding the use of chatbots are increasing steadily from year to year. A significant increase occurred from 2019 to 2020. So far, the use of chatbots in online counselling services is dominated by the medical and healthcare fields (including mental health services). This indicates vast opportunities for research around the development of chatbot systems for use on various online counselling service platforms, both in the medical and healthcare fields as well as other fields such as education, legal, and social services.

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