What’s up in WhatsApp research: a comprehensive analysis of 12,947 papers indexed in Dimensions.ai

Manoj Kumar Verma
Department of Library and Information Science, Mizoram University, Aizawl, India, and
Mayank Yuvaraj
Rajarshi Janak Central Library, Central University of South Bihar, Gaya, India

Abstract

Purpose – In recent years, instant messaging platforms like WhatsApp have gained substantial popularity in both academic and practical domains. However, despite this growth, there is a lack of a comprehensive overview of the literature in this field. The primary purpose of this study is to bridge this gap by analyzing a substantial dataset of 12,947 articles retrieved from the Dimensions.ai database spanning from 2011 to March 2023.

Design/methodology/approach – To achieve the authors’ objective, the authors employ bibliometric analysis techniques. The authors delve into various bibliometric networks, including citation networks, co-citation networks, collaboration networks, keywords and bibliographic couplings. These methods allow for the uncovering of the social and conceptual structures within the academic discourse surrounding WhatsApp.

Findings – The authors’ analysis reveals several significant findings. Firstly, the authors observe a remarkable and continuous growth in the number of academic studies dedicated to WhatsApp over time. Notably, two prevalent themes emerge: the impact of coronavirus disease 2019 (COVID-19) and the role of WhatsApp in the realm of social media. Furthermore, the authors’ study highlights diverse applications of WhatsApp, including its utilization in education and learning, as a communication tool, in medical education, cyberpsychology, security, psychology and behavioral learning.

Originality/value – This paper contributes to the field by offering a comprehensive overview of the scholarly research landscape related to WhatsApp. The findings not only illuminate the burgeoning interest in WhatsApp among researchers but also provide insights into the diverse domains where WhatsApp is making an impact. The analysis of bibliometric networks offers a unique perspective on the social and conceptual structures within this field, shedding light on emerging trends and influential research. This study thus serves as a valuable resource for scholars, practitioners and policymakers seeking to navigate the evolving landscape of WhatsApp research. The study will also be useful for researchers interested in conducting bibliometric analysis using Dimensions.ai, a free database.

Keywords WhatsApp, Instant messaging platform, Bibliometrics, Dimensions.ai, Performance analysis, Science mapping, Cluster analysis

1. Introduction

In an era characterized by the rapid transmission of communication and information, the world has experienced a remarkable compression of geographical and temporal boundaries. The advent of the Internet and the pervasive influence of social media have wrought significant transformations in global communication and interaction dynamics (Yuan and Bi, 2023; Vogiatzis et al., 2022). These changes are especially exemplified by the rise of instant messaging platforms, ushering in a new era of real-time, cross-border communication. Users of these platforms seamlessly exchange text messages, voice recordings, images, videos and documents, breaking down traditional geographical barriers with unprecedented ease. This transformative shift has been made possible by the widespread adoption of smartphones and the emergence of mobile applications, rendering traditional operator-based text messaging obsolete. Cost-effective or even free alternatives such as WhatsApp, Facebook Messenger, WeChat, Snapchat and Telegram (Montag et al., 2015) have become the new norm.
The popularity of instant messaging platforms has experienced steady growth over the years, driven by continuous innovation and the introduction of new features. These innovations encompass video calling, file sharing and group chat functionalities (Mars et al., 2019). WhatsApp, in particular, has garnered significant attention, boasting approximately two billion monthly active users globally, securing its position as the third-largest social platform worldwide, trailing only behind Facebook and YouTube (Statista, 2023).

The global impact of WhatsApp is vividly illustrated by its geographic distribution. India leads the pack with a staggering 487.5 million users accessing their WhatsApp accounts at least once a month, with projections indicating an increase to 795.67 million users by 2025 (Statista, 2021). Other significant user bases include Brazil, with 118.5 million users; Indonesia, with 84.8 million users and the United States of America, with 79.6 million users. This widespread adoption underscores WhatsApp’s reach across diverse populations and cultures. One pivotal moment in WhatsApp’s trajectory was the introduction of end-to-end encryption in April 2016, a feature highlighted by Pang and Woo (2020). This enhancement further solidified the platform’s appeal, providing users with robust security and privacy measures and contributing to its increasing popularity among individuals and organizations.

Research on WhatsApp has emerged from various disciplines, examining it as a socio-technical, multi-stakeholder phenomenon (Rejeb et al., 2022; Kapoor et al., 2018). Three primary research directions dominate the scholarly work on WhatsApp. The first group of studies explores how WhatsApp is utilized in diverse fields, including education (Alamer et al., 2023; Durgungoz and Durgungoz, 2022), health sciences (Choudhury et al., 2022; Bartolo and Ferrari, 2018; Kamel Boulos et al., 2016), politics (Cheng et al., 2022; Chagas et al., 2022), sociology (Costa et al., 2022) and more. Secondly, researchers have examined WhatsApp as a service platform, covering communication services (Mrad et al., 2022), healthcare services (Yadav et al., 2022), laboratory management (Dorwal et al., 2016), library reference services (Guo et al., 2022) and customer service through chatbots (Balatamoghna and Nagajayanthi, 2022; Cordero et al., 2022). The third category of studies delves into topics such as fake news, psychological behavior, surveillance and security in the context of WhatsApp (Nobre et al., 2022; Kligler-Vilenchik, 2022; Latina et al., 2023; Ortiz-Peregrina et al., 2020; Moyano Dávila et al., 2023; Van Steden and Mehlbaum, 2022; McDonald et al., 2022).

However, despite this extensive body of research, there exists a noticeable gap in comprehensive WhatsApp reviews, especially those utilizing bibliometric analysis, which can encompass a substantial corpus of articles and unveil otherwise concealed knowledge structures. The summarization and analysis of WhatsApp research, employing quantitative literature review methodologies such as bibliometric analysis (Dekkers et al., 2022; Cardoso Ermel et al., 2021), a widely recognized research tool for systematically examining publications (Dong et al., 2022), have the potential to provide a comprehensive portrait of the knowledge structure. This approach facilitates the identification of pivotal topics, the analysis of current trends and future perspectives and the delineation of diverse research foci and paradigms (Moresi et al., 2022). Notably, bibliometric analysis combines quantitative techniques with metadata from the literature, making it a versatile and multidisciplinary tool applicable across a spectrum of disciplines. While traditional systematic literature reviews tend to adopt qualitative methods and meta-analyses lean toward quantitative approaches, a quantitative method grounded in bibliometrics, as introduced by Zupic and Cater (2015), has given rise to a third approach known as “science mapping” for delineating scientific disciplines and fields. In bibliometric analysis, two principal avenues for exploring a research field emerge: “performance analysis” and “science mapping” (Donthu et al., 2021; Van Raan, 2004; Noyons et al., 1999). The former scrutinizes scientific production through citation-based measures, whereas the latter focuses on how scientific production is conceptually structured using science maps, visually elucidating the interrelationships among scientific entities (Zhang et al., 2020).
This study represents the first attempt to analyze WhatsApp research from a bibliometric perspective. Thus, applying this quantitative approach to WhatsApp research aims to fill a significant gap. Our study seeks to explore the entire domain of WhatsApp research, identifying essential paradigms, influential researchers, leading journals, institutions, countries and the networks that link them. Furthermore, we employ keyword analysis methods to enhance our understanding of WhatsApp research and its frontiers. In doing so, our study provides a comprehensive overview of a rapidly growing body of research on WhatsApp, shedding light on the connections between various foci and laying the groundwork for future investigations. As part of our research process, we address the following research questions:

RQ1. What is the current research trend and scientific productivity of WhatsApp?

RQ2. What is the status of contribution in different fields?

RQ3. Which are the most influential journals on WhatsApp, and what is their influence and impact? How are co-citation networks formed between journals?

RQ4. Who are the most prolific researchers in WhatsApp, and how do they influence and impact the research community? What type of collaboration occurs between scholars?

RQ5. Which countries contribute the most to WhatsApp research impact?

RQ6. What are the most influential papers in the domain?

RQ7. Which keywords (research focal points) are prominent in the published works, and how do they relate?

RQ8. What are the thematic patterns and conceptual structures in the published works?

RQ9. How is the bibliographic coupling network formed in WhatsApp research?

2. Literature review

As a popular mode of communication for personal and professional purposes, WhatsApp has over two billion users worldwide. The application’s popularity has led scholars and researchers to research it in various areas extensively. In recent years, there have been an increasing number of research studies investigating WhatsApp usage. WhatsApp research has been conducted across various disciplines, including communication studies, psychology, marketing and education. Among the various topics investigated are the social and psychological impacts of using WhatsApp, the impact of WhatsApp on intercultural communication, the influence of WhatsApp on political participation and the role of WhatsApp in education. In addition, researchers have examined how individuals and organizations use WhatsApp for communication, collaboration and marketing purposes.

One of the key themes that emerge from the literature is the social and psychological impacts of using WhatsApp. Several studies have investigated the impact of WhatsApp on social relationships and found that the application can facilitate communication and strengthen social bonds (Lee et al., 2023; Gazit et al., 2019). However, other studies have found that excessive use of WhatsApp can lead to addiction, which can have negative effects on mental health and well-being (Sha et al., 2019). Additionally, researchers have also explored the relationship between WhatsApp usage and emotional intelligence, with some studies suggesting that WhatsApp usage can improve emotional intelligence (Völker and Mannheim, 2021), while others have found no significant relationship (Albasi and Alghamdi, 2019). Another significant theme in WhatsApp research is the application’s role in intercultural communication. Studies have shown that WhatsApp can facilitate cross-cultural communication and reduce communication barriers (García-Gómez, 2022). However, other
studies have highlighted the potential for misunderstandings and conflicts to arise due to
cultural differences in the interpretation of messages (Lim and Urakami, 2019).

Furthermore, researchers have also examined the role of WhatsApp in political
participation. Studies have shown that WhatsApp can be an effective tool for political
mobilization, especially in countries where traditional media are tightly controlled (Chagas
et al., 2022). However, other studies have highlighted the potential for WhatsApp to be used
for spreading false information and propaganda (Gil De Zúñiga et al., 2021). Finally,
researchers have also investigated how individuals and organizations use WhatsApp for
communication, collaboration and marketing purposes. Studies have shown that WhatsApp
can be an effective tool for group collaboration and project management (Conde et al., 2021;
Jailobaev et al., 2021). In addition, businesses have started to utilize WhatsApp for marketing
purposes, with some studies showing that WhatsApp can be an effective tool for building
customer relationships and increasing sales (Agrawal, 2021; Agrawal and Mittal, 2019).

However, few literature reviews focus on overarching WhatsApp, and these are scattered
across a limited range of fields, as presented in Table 1.

Literature reviews on WhatsApp are limited to health sciences, education and language
and must present a comprehensive overview of the core knowledge. Overall, these studies
present a partial outlook but indicate that WhatsApp has potential as a research, clinical
practice, medical Education and language learning tool. However, guidelines and ethics must
be taken into account.

Advancing knowledge in a specific research domain necessitates thoroughly synthesizing
scientific literature. In various academic fields, bibliometrics has gained widespread recognition as
an invaluable quantitative methodology for systematically reviewing scientific literature. By
applying quantitative assessments to various domains and their current status, bibliometrics
allows researchers to address fundamental questions in a structured manner, aligning with the
quality criteria advocated by Boote and Beile (2005). These inquiries encompass: (1) Key
researchers of a domain, (2) Where they are from (types of institutions, locations of author
institutions, etc.), (3) When the research was conducted, (4) What are dominant publication venues,
indicating which disciplines were involved in the research, (5) Key patterns and research trends.

Notably, while bibliometric analyses have been applied to platforms such as Facebook
(Obreja, 2022; Shiau et al., 2018), Instagram (Rejeb et al., 2022), YouTube (Mostafa et al., 2023),
Telegram (Herrero-Solana and Castro-Castro, 2022) and WeChat (Cong et al., 2022), we have
not identified any prior studies utilizing bibliometrics to investigate WhatsApp. The
advantages of conducting a bibliometric study are multifaceted, such as (1) identification of
promising research endeavors within a specific domain; (2) disclosure of research gaps that
necessitate further exploration; (3) provision of a comprehensive overview of a field,
particularly beneficial to emerging researchers (Mostafa et al., 2023). Furthermore,
bibliometrics has the potential to unearth implicit knowledge within the literature by
pinpointing research hotspots and forecasting future trends in a given field.

In this study, we have integrated bibliometric parameters as identified by Gutiérrez-Salcedo
et al. (2018) with scholarly research on WhatsApp to address a significant research void.
Specifically, we aimed to bridge both the knowledge and empirical gaps, as no previous study
has undertaken a comprehensive bibliometric analysis of published works on WhatsApp. To
achieve this, we harnessed bibliographic metadata sourced from Dimensions.ai, a freely
accessible database deemed on par with Scopus, thus resolving a crucial methodological gap.

Müller-Bloch and Kranz (2015) underscore the necessity of adapting research methods to
unearth fresh insights and prevent skewed results, serving as the impetus for selecting the
Dimensions database as our research tool. Notably, the high costs associated with accessing
databases like Web of Science and Scopus can pose a barrier for many researchers wishing to
conduct bibliometric inquiries (Petersen, 2022). This limitation creates a practical knowledge gap
within the field.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Title</th>
<th>Author/s</th>
<th>Type of review</th>
<th>Data source</th>
<th>Domain</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using WhatsApp to Support English Language Learning: a systematic review</td>
<td>Syairofi et al. (2023)</td>
<td>Systematic review</td>
<td>Scopus</td>
<td>Language</td>
<td>Highlights WhatsApp as a means to support English language learning</td>
</tr>
<tr>
<td>2</td>
<td>Using WhatsApp messenger for health systems research: a scoping review of available literature</td>
<td>Manji et al. (2021)</td>
<td>Systematic review</td>
<td>Scopus, PubMed, SAGE Journals Online, ScienceDirect and JSTOR</td>
<td>Health Sciences</td>
<td>Highlights the potential of WhatsApp in e-health research</td>
</tr>
<tr>
<td>3</td>
<td>WhatsApp in Clinical Practice—The Challenges of Record Keeping and Storage. A Scoping Review</td>
<td>Morris et al. (2021)</td>
<td>Systematic review</td>
<td>PubMed, Scopus, Science Direct, EbscoHost, CINAHL, Health Source Nursing/ academic edition, Index to legal periodicals, PsycARTICLES, PsycINFO, MEDLINE.</td>
<td>Health Sciences</td>
<td>Found that WhatsApp is being used in clinical practices for keeping medical records</td>
</tr>
</tbody>
</table>

Table 1. Review papers on WhatsApp research (continued)
Our study not only addresses this practical knowledge gap but also offers a comprehensive and replicable methodology that can serve as a valuable reference for future researchers seeking to conduct bibliometric studies utilizing the Dimensions database. Additionally, we have employed supplementary visualization tools, such as rawgraphs.io and mapcharts.net, to enhance the presentation and interpretation of our findings.
3. Methodology
3.1 Database selection
Selecting the right database is crucial for bibliometric analysis (Nguyen et al., 2021). In our study, we opted for Dimensions.ai due to several compelling reasons supported by Banshal et al. (2022), Petersen (2022), Duffy (2021), Herzog et al. (2020) and Hook et al. (2018).

1. Extensive Data: Dimensions.ai offers access to over 150 million research outputs from a wide range of sources, including journals, books and conference proceedings, aligning perfectly with our study’s goals.

2. Data Accuracy: The database maintains data accuracy through rigorous curation, including author affiliation verification; duplicate record resolution and the assignment of DOIs for uniqueness.

3. Search and Filtering Tools: Dimensions.ai provides advanced search and filtering options, enabling complex bibliometric analyses based on criteria like authors, institutions, publication dates and research topics.

4. Integration: Seamless integration with various tools and services makes data export, sharing and collaboration easy and efficient.

5. User-Friendly: Its user-friendly interface accommodates users with varying levels of experience in bibliometric analysis.

In addition to complementing databases like Web of Science and Scopus, Dimensions.ai offers valuable altmetric attention scores (AASs) for gauging online research attention. This choice ensures a robust foundation for our bibliometric analysis.

3.2 Search strategy
Following the recommendation by Lim et al. (2021) to search for broad and generic review domains with a single keyword, we conducted a search for “WhatsApp” in the title and abstract fields of the Dimensions.ai database. To ensure the comprehensiveness of our study, we did not restrict the search to a specific field of research. Given that WhatsApp was launched in 2010 (Kamel Boulos et al., 2016), we initially set the study period as 2010 to March 2023. However, as we found no papers from 2010 in the database, we adjusted the study period from 2011 to March 2023. To maintain the academic quality of the publications included in our analysis, we considered only journal articles with complete bibliographic data. This process resulted in a final dataset of 12,947 papers on WhatsApp. The search query was executed on April 1, 2023, and the bibliographic metadata was downloaded in .csv format. Figure 1 illustrates the search query developed for this study.

3.3 Bibliometric tools
Selecting an appropriate bibliometric tool is a crucial decision in the analysis. Different bibliometric software tools are available, each with its capabilities and limitations. For this study, bibliometric analysis was conducted using the Biblioshiny app of the Bibliometrix software (Aria and Cuccurullo, 2017) in conjunction with VOSviewer (Van Eck and Waltman, 2010) for network visualization.

Bibliometrix, an R-based program, offers effective bibliometric analysis. A significant advantage of Bibliometrix is its compatibility with other statistical tools. It also provides a user-friendly interface through Biblioshiny, facilitating analysis for non-coders. We downloaded Dimensions data in CSV (Comma-Separated Values) format and used Biblioshiny for analysis. CSV is a text file format that employs commas for value separation. In this format, tabular data is stored in plain text, with each line usually
corresponding to a single data record. These records maintain a consistent number of fields, and the values within each record are delimited by commas.

VOSviewer (Van Eck and Waltman, 2010) was employed to perform network analysis of research articles related to WhatsApp. Network visualization analysis included keyword co-occurrences, co-authorship relationships between countries involved in this research and citation links between journals publishing WhatsApp-related literature.

To count variants, we employed the fractional method and used several VOSviewer thesaurus files for merging. VOSviewer generated network visualization maps, density visualization maps and overlay visualization maps, collectively representing nodes such as countries, institutes, or authors. Links between nodes depicted relationships, while factors like publications and citations determined node sizes. Nodes and lines were assigned different colors to represent clusters or average appearing years (AAY) (Yeung et al., 2019).

The results of the bibliometric and network visualization analyses are presented in the subsequent section. Different software tools were used for statistical and graphic analysis, including rawgraphs.io for graphs, Excel for tables, VOSviewer for network analysis and mapchart.net for geographical analysis. Figure 2 provides an overview of the study and research methods.
4. Results
4.1 Research trend and scientific productivity
Between 2011 and March 2023, the scholarly community produced 12,947 papers and garnered 41,707 citations concerning WhatsApp. It’s essential to note that the 2023 data only reflects activity up to March of that year. Figure 3 presents a graphical representation of the number of publications and citations in the WhatsApp research domain. In the figure, the central circle symbolizes the years, while the middle and outer circles represent the number of publications and citations, respectively. The research development is illustrated in the chart, highlighting three distinct stages: the primary development stage (2011–2014), the intermediate growth stage (2015–2019) and the recent booming stage (2020).

The period between 2011 and 2014 marked WhatsApp’s primary development stage, characterized by limited academic research. Only one paper was published in 2011, followed by five in 2012 and nine in 2013. Throughout these years, 61 papers were published, receiving 16 citations. Scholarly interest in WhatsApp began to surge from 2015 onwards, with the number of papers escalating from 46 in 2014 to 115 in 2015, signifying the intermediate growth stage spanning 2015 to 2019. During this phase, 2,248 papers were published, encompassing diverse WhatsApp-related topics and amassing 4,675 citations. The most remarkable surge in the number of articles occurred during the recent period between 2020 and 2023. A total of 10,638 papers were published during this period, contributing 37,004 citations. The highest number of papers was also published in 2021 and 2022. It’s noteworthy that 82% of the literature was published after 2019. This evidence suggests that most scholarly works on WhatsApp emerged amid the coronavirus disease 2019 (COVID-19) pandemic. Additionally, the outbreak of COVID-19 saw WhatsApp emerge as one of the most widely used apps in several countries, including Russia, India and Italy (Statista, 2022a, b, c).
4.2 Research categories
In Dimensions.ai’s dataset of WhatsApp-related publications, we identified 12,947 documents distributed across 30 research categories. Figure 4 offers a graphical representation of the distribution of the top twenty categories. To categorize research papers, the Dimensions database utilizes the Fields of Research (FOR) classification system, which is part of the widely accepted Australian and New Zealand Standard Research Classification (ANZSRC). Notably, the four most prominent categories in WhatsApp research are education (2,035 documents with 6,965 citations), language, communication and culture (1,900 documents with 6,255 citations), health sciences (1,607 documents with 10,097 citations) and biomedical and clinical sciences (1,432 documents with 7,881 citations). These four categories collectively account for 55.4% of the entire sample.

4.3 Most influential journals
Table 2 lists leading journals based on the number of papers published (NP). The Journal of Physics Conference Series tops the list with 71 publications, followed by the International Journal of Environmental Research and Public Health, contributing 51 publications. Additionally, for assessing influence and impact, we present the total citations (TC) with h-index and g-index in the table. The Journal of Medical Internet Research leads the list regarding TC, followed by the International Journal of Environmental Research and Public Health. Notably, most of the prominent journals on this list belong to research categories such as health sciences, biomedical and clinical sciences and education. A surge in research publications in leading journals is a hallmark of a growing research area, stimulating further scholarly interest (Kuhn, 1970; Acedo et al., 2006). Interestingly, it is worth noting that we could not identify journals in the “human society” or “sociology” categories that have published research papers on WhatsApp since 2015. Furthermore, only two journals, the Journal of Medical Internet Research and the International Journal of Interactive Mobile Technologies, have published research papers on WhatsApp during this period. In addition, we conducted a co-citation analysis of 12,749 articles using VOSViewer to build a network of journals with a minimum of 50 citations, resulting in five clusters. Figure 5

![Figure 4. Research categories](source(s): Figure by authors)
portrays the co-citation network, where each node signifies a journal, with the node size indicating the NP and the lines representing co-citation intensity. Thicker lines indicate stronger connections.

In this co-citation network, the most prominent are the 135 nodes forming the red cluster. PLOS One is central in the red cluster and has one of the highest co-citation intensities within

<table>
<thead>
<tr>
<th>S.No</th>
<th>Journal</th>
<th>Research category</th>
<th>*NP</th>
<th>**TC</th>
<th>h-index</th>
<th>g-index</th>
<th>***PY Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Journal of Physics Conference Series</td>
<td>Physical Sciences</td>
<td>71</td>
<td>131</td>
<td>6</td>
<td>8</td>
<td>2018</td>
</tr>
<tr>
<td>2</td>
<td>International Journal of Environmental research and public health Cureus</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>51</td>
<td>656</td>
<td>11</td>
<td>24</td>
<td>2017</td>
</tr>
<tr>
<td>3</td>
<td>Sustainability</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>29</td>
<td>154</td>
<td>7</td>
<td>12</td>
<td>2016</td>
</tr>
<tr>
<td>4</td>
<td>PLOS One</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>28</td>
<td>248</td>
<td>9</td>
<td>15</td>
<td>2018</td>
</tr>
<tr>
<td>5</td>
<td>Frontiers in Public health</td>
<td>Health Sciences</td>
<td>26</td>
<td>481</td>
<td>7</td>
<td>19</td>
<td>2020</td>
</tr>
<tr>
<td>6</td>
<td>Journal of Medical Internet research</td>
<td>Health Sciences</td>
<td>25</td>
<td>752</td>
<td>13</td>
<td>25</td>
<td>2015</td>
</tr>
<tr>
<td>7</td>
<td>Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini</td>
<td>Education</td>
<td>25</td>
<td>202</td>
<td>7</td>
<td>13</td>
<td>2020</td>
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<tr>
<td>8</td>
<td>Jurnal Basicedu</td>
<td>Education, Language, Communication and Culture</td>
<td>18</td>
<td>155</td>
<td>6</td>
<td>12</td>
<td>2020</td>
</tr>
<tr>
<td>9</td>
<td>BMC Public Health</td>
<td>Health Sciences</td>
<td>16</td>
<td>251</td>
<td>10</td>
<td>15</td>
<td>2017</td>
</tr>
<tr>
<td>10</td>
<td>International Journal of Community medicine and public health</td>
<td>Health Sciences</td>
<td>15</td>
<td>115</td>
<td>4</td>
<td>10</td>
<td>2016</td>
</tr>
<tr>
<td>11</td>
<td>Research society and development</td>
<td>Education, Health Science</td>
<td>15</td>
<td>19</td>
<td>2</td>
<td>2</td>
<td>2020</td>
</tr>
<tr>
<td>12</td>
<td>BMC Medical education</td>
<td>Biomedical and Clinical Sciences, Education</td>
<td>14</td>
<td>307</td>
<td>7</td>
<td>14</td>
<td>2017</td>
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<tr>
<td>13</td>
<td>Education and Information technologies</td>
<td>Education, Information and Computing Sciences</td>
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<td>264</td>
<td>10</td>
<td>14</td>
<td>2017</td>
</tr>
<tr>
<td>14</td>
<td>First Monday</td>
<td>Information and Computing Sciences, Communication and Media studies</td>
<td>14</td>
<td>100</td>
<td>6</td>
<td>9</td>
<td>2017</td>
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<tr>
<td>15</td>
<td>Frontiers in Psychology</td>
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<td>13</td>
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<td>8</td>
<td>13</td>
<td>2016</td>
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<td>16</td>
<td>Heliyon</td>
<td>Health Sciences, Education</td>
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<tr>
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<td>Journal of Education and Health promotion</td>
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<td>2018</td>
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<td>19</td>
<td>Edukatif Jurnal Ilmu Pendidikan</td>
<td>Health Sciences</td>
<td>12</td>
<td>224</td>
<td>4</td>
<td>12</td>
<td>2020</td>
</tr>
</tbody>
</table>

Note(s): *NP: Number of papers, **TC: Total citations, ***PY: Publication year
Source(s): Table by authors

Table 2. Most influential journals
its field. The green cluster highlights Computer and Education as the most prominent node despite its relatively low NP in that domain. It maintains co-citation links with the other three clusters. The blue cluster encompasses 43 nodes, primarily related to Education and technology. In this cluster, *Computers in Human Behavior* account for the highest percentage of co-citations. These findings provide insights into the collaborative nature of WhatsApp research across various journal publications and their mutual influence.

### 4.4 Prolific researchers

Table 3 provides a list of the most prolific authors, based on the NP, along with a calculation of their TC, serving as a measure of their influence.

Topping the list is T.M. Alanzi, with 18 publications between 2011 and March 2023, Shiraishi Riadi with 16 papers and C. Montag with 12 papers. Notably, C. Montag has only 12 papers to their name but has garnered a substantial influence with a TC count of 805, remaining active in the field since 2015. Among the listed researchers, M. Amrullah stands out for publishing the most papers in a year, with ten publications in 2021. Most researchers are affiliated with categories like Health sciences, biomedical and clinical sciences and education. It’s noteworthy that C. Montag is the sole representative from the psychology category on the list.

We also used co-authorship analysis to explore collaborative research among authors. VOSViewer calculated the co-authorship of articles based on Dimensions data, generating 86 items when the minimum co-authorship threshold was set to five. Figure 6 provides a full visualization of the co-authorship network. The largest set of six connected items is highlighted in red, suggesting that it is challenging to identify a dominant scholar in WhatsApp research due to the field’s relatively early stage. Furthermore, this finding emphasizes the need for increased collaboration among researchers to explore WhatsApp’s potential across diverse fields.

Potential researchers and ongoing studies might benefit from this since journal editors prefer articles from a few highly productive researchers (Gaviria-Marin et al., 2019).

### 4.5 Publishing activity by country

The dataset reflects a diverse international engagement with WhatsApp research, originating from 120 countries. This analysis considers the number of papers (NP) and TC.
Figure 7 showcases the top ten countries based on the number of papers, highlighting the significant international participation in WhatsApp research.

Among these countries, Indonesia, Brazil and India have contributed the highest number of publications. Figure 8 extends the analysis to include the top ten countries by TC.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Affiliation</th>
<th>Research category</th>
<th>NP</th>
<th>TC</th>
<th>PY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alani, T.M.</td>
<td>Imam Abdulrahman Bin Faisal University, Saudi Arabia</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>18</td>
<td>147</td>
<td>2018</td>
</tr>
<tr>
<td>Riadi, I.</td>
<td>Universitas Ahmad Dahlan, Indonesia</td>
<td>Information and Computing Sciences, Law and Legal Studies</td>
<td>16</td>
<td>32</td>
<td>2017</td>
</tr>
<tr>
<td>Montag, C.</td>
<td>University of Ulm, Germany</td>
<td>Psychology</td>
<td>12</td>
<td>805</td>
<td>2015</td>
</tr>
<tr>
<td>Mars, M.</td>
<td>University of KwaZulu-Natal, South Africa</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>10</td>
<td>300</td>
<td>2016</td>
</tr>
<tr>
<td>Wang, M.P.</td>
<td>University of Hong Kong, China</td>
<td>Health Sciences, Communication and Media studies</td>
<td>10</td>
<td>185</td>
<td>2015</td>
</tr>
<tr>
<td>Achmad, Z.A.</td>
<td>University of Pembangunan Nasional Veteran, Indonesia</td>
<td>Communication and Media studies, screen and digital media</td>
<td>10</td>
<td>39</td>
<td>2019</td>
</tr>
<tr>
<td>Amrullah, M.</td>
<td>Universitas Muhammadiyah Sidoarjo, Indonesia</td>
<td>Education</td>
<td>10</td>
<td>1</td>
<td>2021</td>
</tr>
<tr>
<td>Alanezi, F. M.</td>
<td>Imam Abdulrahman Bin Faisal University, Saudi Arabia</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>10</td>
<td>18</td>
<td>2020</td>
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<tr>
<td>Scott, R.E.</td>
<td>University of KwaZulu-Natal, South Africa</td>
<td>Health Sciences, Information and Computing Sciences, Law and legal studies</td>
<td>9</td>
<td>218</td>
<td>2016</td>
</tr>
<tr>
<td>Pimmer, C.</td>
<td>Swiss Tropical and Public Health Institute, Switzerland</td>
<td>Health Sciences, Education</td>
<td>8</td>
<td>178</td>
<td>2015</td>
</tr>
<tr>
<td>Cherrez-Ojeda, I.</td>
<td>Universidad de Especialidades Espiritu Santo, Ecuador</td>
<td>Biomedical and Clinical sciences, Health sciences</td>
<td>8</td>
<td>47</td>
<td>2017</td>
</tr>
<tr>
<td>Yeshua-Katz, D.</td>
<td>Ben-Gurion University of the Negev, Israel</td>
<td>Communication and Media studies, Health sciences</td>
<td>7</td>
<td>33</td>
<td>2020</td>
</tr>
<tr>
<td>Garimella, K.</td>
<td>Rutgers, The State University of New Jersey, US</td>
<td>Information and Computing Sciences, Human society</td>
<td>7</td>
<td>97</td>
<td>2019</td>
</tr>
<tr>
<td>Felix, M.</td>
<td>Universidad de Especialidades Espiritu Santo, Ecuador</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>7</td>
<td>49</td>
<td>2018</td>
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<tr>
<td>Leon, J.F.R.</td>
<td>Fundacion Universitaria Sanitas, Colombia</td>
<td>Biomedical and Clinical sciences, Health sciences</td>
<td>7</td>
<td>66</td>
<td>2020</td>
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<tr>
<td>Lam, Tai-Hing H.</td>
<td>University of Hong Kong, China</td>
<td>Health sciences</td>
<td>7</td>
<td>143</td>
<td>2015</td>
</tr>
<tr>
<td>Cherrez, A.</td>
<td>Universitasmedizin Rostock, Germany</td>
<td>Health Sciences, Biomedical and Clinical Sciences</td>
<td>6</td>
<td>60</td>
<td>2017</td>
</tr>
<tr>
<td>Rambe, P.</td>
<td>Central University of Technology, South Africa</td>
<td>Education, Information and Computing Sciences</td>
<td>6</td>
<td>212</td>
<td>2013</td>
</tr>
<tr>
<td>Rahmawati, L. E.</td>
<td>Muhammadiyah University of Surakarta, Indonesia</td>
<td>Education, Information and Computing Sciences</td>
<td>6</td>
<td>11</td>
<td>2020</td>
</tr>
</tbody>
</table>

Note(s): *NP: Number of papers, **TC: Total citations, ***PY: Publication year
Source(s): Table by authors

Table 3. Prolific researchers
Regarding TC, Indonesia, India and the United Kingdom are the top three countries. Brazil, despite ranking second in the number of papers, does not rank among the highest-cited countries. This discrepancy prompts questions about the relative visibility of research from Brazil and Malaysia compared to more prominent countries like the United States of America, the United Kingdom and India. Previous studies have suggested that lesser-known outlets contribute substantially to scientific production, a trend confirmed by this study (Wu et al., 2009). While some countries have an extensive body of literature, their work might receive fewer citations, highlighting the value of diverse research outputs.
Furthermore, Figure 9 demonstrates the distribution of papers published by authors from a single country (SCP) and those from multiple countries (MCP). In papers with authors from multiple countries, the country corresponding to the corresponding author is identified. This analysis highlights that WhatsApp publications primarily originate from countries like Indonesia, India and Brazil, either as single-country or multi-country collaborations. Conversely, research originating from countries with high levels of development, such as the UK and the USA, is often the result of intra-national or multi-national collaborations. This international diversity underscores the global nature of WhatsApp research.

4.6 Most influential papers
Based on TC, Table 4 lists the top scholarly papers on WhatsApp. With a TC of 383, Kapasia et al. (2020) have the most influential research with 95.75 citations per year associated with their paper, “Impact of Lockdown on Learning Status of Undergraduate and Postgraduate Students during COVID-19 Pandemic in West Bengal, India.” In the study, the learning status, the devices and apps that learners used, psychological problems and the challenges they faced while using e-learning during the COVID-19 period are discussed.

The next influential paper is Bouhnik and Deshen (2014) entitled “Whatsapp Goes to School: Mobile Instant Messaging between Teachers and Students” with TC = 289. The study highlights the importance of WhatsApp class groups for communicating with students, nurturing a social atmosphere, encouraging sharing among students and as a learning platform. A study by Waterloo et al. (2018) ranks third with 259 citations, in which 1,201 young Dutch users aged 15 to 25 were examined for their behavior on social media, and they found that positive emotional expression and perceived appropriateness on WhatsApp was highest. Other influential papers in the list, such as Montag et al. (2015) and Johnston et al. (2015), studied the usage of WhatsApp.

Different from previous studies such as Dong et al. (2022), the findings of this study are contrary to those of previous studies where citation analysis was criticized for favoring older publications, as recent but potentially high-impact publications were less likely to be cited. However, the most influential paper found in our study was published in 2020. The paper generated a great deal of attention because of COVID-19.
When browsing the most cited or most read article's section on the website of a journal, scholars would notice a brightly colored donut with a central number. A donut or score is an alternative metric called altmetrics for defining research impact (Elmore, 2018). The AAS provides information about scholarly interactions through web-based media such as likes, comments, shares, blogs on Twitter, Facebook and news outlets relating to the article (Verma and Yuvaraj, 2022). While traditional metrics such as citations take time to generate after a paper is published (MacRoberts and MacRoberts, 1989), altmetrics measure research attention in real-time (Aung et al., 2019). The top five papers generating the highest online attention are listed in Table 5.
4.7 **Keyword analysis**

It is common for authors to use keywords in their papers to highlight the most important topics. During this portion, we evaluate the keywords, an effective tool for finding relevant literature and movements. To research keywords for this study, we analyzed the text content of keywords in documents. Additionally, we examined the co-occurrence of keywords, which refers to how often two keywords appear together. Keyword analysis was conducted to identify trends in the subject matter.

The minimum number of keywords for the development of the system was set at 60 (which corresponds to 20% of all found keywords as measured by the Pareto distribution). A total of 30 keywords have been identified by VOSviewer that meet the threshold, as shown in Figure 10. Among the top five most frequent keywords are pandemic (189), learning (162), Facebook (138), health (112) and patient (84). Most of the studies are related to Education or Health Sciences. The network visualization of co-occurrences of keywords is shown in Figure 11. This shows the impact of COVID-19 on WhatsApp research, as the pandemic is

<table>
<thead>
<tr>
<th>S.No</th>
<th>Title</th>
<th>Researcher(s)</th>
<th>AAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Wanted: a WhatsApp alternative for clinicians”</td>
<td>Thomas (2018)</td>
<td>354</td>
</tr>
<tr>
<td>2</td>
<td>“Can WhatsApp Counter Misinformation by Limiting Message Forwarding?”</td>
<td>Melo et al. (2019)</td>
<td>221</td>
</tr>
<tr>
<td>3</td>
<td>“Addictive Features of Social Media/Messenger Platforms and Freemium Games against the Background of Psychological and Economic Theories”</td>
<td>Montag et al. (2018)</td>
<td>197</td>
</tr>
<tr>
<td>4</td>
<td>“Psychosocial Outcomes Associated with Engagement with Online Chat Systems”</td>
<td>Kaye and Quinn (2020)</td>
<td>181</td>
</tr>
<tr>
<td>5</td>
<td>“#Drugsforsale: An exploration of the use of social media and encrypted messaging apps to supply and access drugs”</td>
<td>Moyle et al. (2019)</td>
<td>159</td>
</tr>
</tbody>
</table>

**Source(s):** Table by authors

![Figure 10. Density visualization of co-occurrence of keywords](image-url)
closely associated with most other keywords. Further, as can be seen, the keywords are divided into two clusters. Clustering in VOSviewer relies on minimizing distances between keywords (Van Eck and Waltman, 2010), i.e. the most related keywords are grouped.

4.8 Thematic map: a co-word analysis
Scientific mapping techniques use thematic maps to demonstrate a domain’s conceptual structure, as shown in Figure 12. Thematic maps analyze word occurrences in a field to find key themes and patterns (Jain et al., 2022). As far as bibliometrics are concerned, co-word analysis is the only method that uses actual content to measure similarity (Dekkers et al., 2022). Callon and his colleagues proposed Co-word Analysis to analyze bibliometric data (Callon et al., 1986). Through co-word analysis, using density, we can measure the degree of

Figure 11. Network visualization of co-occurrence of keywords

Source(s): Figure by authors

Figure 12. Thematic maps in WhatsApp research

Source(s): Figure by authors
consistency among nodes, whereas using centrality we can measure the degree of correlation between subjects (Jelvehgaran Esfahani et al., 2019). A thematic chart was drawn using 200 words from a bibliography collection of RStudio. On an X-Y axis, the themes were separated into four quadrants based on their position and level.

Motor themes: The research on WhatsApp is adequately developed in this theme and constitutes the center of the study. There is also a high degree of centrality and density among these themes. The research areas within this quadrant are related to educational uses of WhatsApp in learning, namely hasil belajar (learning outcomes) and meningkatkan (student learning), primarily because these facts indicate that most developed research areas in this domain relate to educational uses of WhatsApp in learning.

Niche Themes: They entail core knowledge on WhatsApp, as shown in Figure 12.

Peripheral Themes: The third quadrant concerns emerging COVID-19, social media and online learning. A low density and declining centrality are typical of the themes.

Basic Themes: Apilakasi WhatsApp (WhatsApp application), WhatsApp sebagai (WhatsApp) and system informasi (information systems) are evident in the fourth quadrant. Despite poor development, low and high density and centrality characterize them.

4.9 Bibliographic coupling analysis

Bibliometric analysis is not an analytical or predictive tool, so complementary methods are commonly used to enhance results (Dekkers et al., 2022). An alternative is to use content analysis (Evans and FitzGerald, 2002), which involves analyzing the actual content of publications and their bibliographic data. The connection between publications in a bibliographic database indicates latent research themes based on the bibliographic coupling of publications (Hasumi and Chiu, 2022). In bibliographic coupling analysis, VOSViewer utilizes a smart local moving algorithm to predict future research direction (Van Eck and Waltman, 2010). Figure 13 illustrates how the WhatsApp research is bibliographically coupled.

The results of the bibliographic coupling analysis showed that WhatsApp publications formed ten themes (Table 6). After narrowing down the initial sample of 11,297 articles to those articles containing at least 50 citations, the final sample comprises 70 articles. Researchers carefully read each typical article in each of those themes to name the themes. WhatsApp scholarly works are mostly dedicated to the COVID-19 pandemic, education, cyberpsychology and other psychological issues.

Figure 13.
Bibliographic coupling analysis

Source(s): Figure by authors
5. Discussion
The advent of online social platforms, such as instant messaging applications, has revolutionized how we interact, communicate and build personal networks (Sutikno et al., 2016; Raiman et al., 2017; Klein et al., 2018). WhatsApp, a versatile multiplatform messaging app, has become one of the most widely used platforms globally. This surge in popularity has not gone unnoticed by the scholarly community, with researchers exploring the multifaceted applications of WhatsApp across various domains such as education, health, communication and even laboratory settings. However, while WhatsApp’s influence continues to grow, scholarly work on this communication tool has yet to be subjected to comprehensive

<table>
<thead>
<tr>
<th>S.No</th>
<th>Key themes</th>
<th>Color</th>
<th>Representative citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Language learning tool</td>
<td>Peach</td>
<td>Belsti et al. (2021), Kanyike et al. (2021), Mohamed and Elseid (2021)</td>
</tr>
</tbody>
</table>

Table 6. Bibliographic coupling theme of WhatsApp

Source(s): Table by authors
This study addresses nine critical research questions employing bibliometric analysis. It delves into the research trends and scientific productivity of WhatsApp, aiming to paint a comprehensive picture of this dynamic research domain (Donthu et al., 2021; Linnenluecke et al., 2020). The analysis covers a vast dataset of 12,947 publications from 2011 to 2023, providing valuable insights into WhatsApp research. The most remarkable finding is the impressive surge in scholarly interest in WhatsApp, particularly between 2020 and 2023. During this period, the highest number of research papers was published, coinciding with the global COVID-19 pandemic. The pandemic acted as a catalyst, propelling WhatsApp research into the forefront, with 82% of the literature emerging after 2019. This surge aligns with the increased use of WhatsApp as a vital tool for communication and information dissemination during the pandemic, a trend reflected in reports of elevated WhatsApp usage in various countries (Statista, 2023).

The research landscape of WhatsApp spans diverse fields, with research papers from areas such as education, language, communication, culture and health Sciences. The study highlights underrepresented research domains where WhatsApp’s potential remains untapped. These findings underscore the multidisciplinary nature of WhatsApp’s impact, transcending a singular domain and finding applications in many sectors. The breadth of research categories emphasizes the platform’s versatility and relevance to various aspects of society.

The role of journals in shaping the trajectory of WhatsApp research is evident in our findings. Journals serve as the primary conduits for disseminating research findings and often play a pivotal role in guiding the direction of a field (Huang et al., 2023; Huang, 2022). Within the context of WhatsApp research, the Journal of Physics Conference Series and the International Journal of Environmental Research and Public Health stand out as leaders in the number of published papers. However, it’s crucial to consider the impact and influence of these journals. The Journal of Medical Internet Research emerges as the most influential journal based on TC, underscoring its substantial contribution to the field. Significantly, many influential journals are affiliated with research categories such as Health sciences, biomedical and clinical sciences and education. The limited presence of journals in the “human society” or “sociology” categories highlights potential research gaps in these areas. Additionally, the co-citation analysis reveals that Computer and Education has the strongest network. This co-citation network provides valuable insights into the intellectual structure of WhatsApp research, highlighting key themes and their interconnections (Basumatary et al., 2023).

Among the prolific authors in the field, T.M. Alanzi, associated with the Health Sciences and Biomedical and Clinical Sciences category at Imam Abdulrahman Bin Faisal University, Saudi Arabia, is the most productive author. However, regarding citations, C. Montag, with research interests in Psychology, takes the lead in WhatsApp research. These researchers represent diverse research categories, emphasizing the interdisciplinary nature of WhatsApp research. Encouragingly, this diversity indicates a collaborative approach among scholars from different fields. However, WhatsApp research is still early, leaving ample opportunities for future collaboration and exploration. The co-authorship analysis reveals a relatively weak collaborative network among authors. Researchers can consider the list of influential authors identified in this study to strengthen collaborative patterns and increase productivity.

The study also identifies the most influential papers based on citations and AAS. Recognizing influential papers is crucial for understanding core themes and impactful contributions. Kapasia et al.’s (2020) study on the impact of lockdown on learning during the COVID-19 pandemic in India emerges as the most influential paper based on TC. This paper delves into critical issues related to Education and the adoption of WhatsApp during the pandemic. Other influential papers emphasize WhatsApp’s role in education, social
interaction and psychological behavior. Notably, the most influential paper in this study was published in 2020, challenging the convention that citation analysis primarily favors older publications. The rapid recognition and impact of this research can be attributed to the COVID-19 pandemic.

Keyword analysis provides valuable insights into the focal points of WhatsApp research. The analysis reveals that the most frequent keywords are related to the pandemic, learning, Facebook, health and patient. These keywords underscore the platform’s significance in educational contexts, health-related discussions, and its role in social interaction during the pandemic. The prominence of COVID-19 in the keyword analysis underscores WhatsApp research’s immediate relevance and impact in addressing contemporary challenges.

Thematic mapping and co-word analysis offer a deeper understanding of the conceptual structure of WhatsApp research. The analysis identifies four thematic quadrants: motor themes, niche themes, peripheral themes and basic themes. Motor themes, centered on education and learning outcomes, represent the most developed research areas. Niche themes encompass core knowledge, while peripheral themes include emerging topics like COVID-19 and online learning. Basic themes reflect foundational concepts related to WhatsApp. This thematic map provides researchers with a visual representation of the research landscape, enabling them to identify areas of interest and potential collaboration.

Bibliographic coupling analysis identifies ten thematic clusters in WhatsApp research, highlighting dominant themes such as COVID-19, education, cyberpsychology and psychological issues. This analysis reveals the latent research themes within the field and can guide future research directions. The findings underscore the multidisciplinary nature of WhatsApp research, as it intersects with fields like psychology, education and health.

In essence, WhatsApp plays a pivotal role in our interconnected world and research surrounding it will undoubtedly continue to flourish, offering abundant opportunities for scholars to explore, learn and innovate. This paper identifies the significant potential for WhatsApp’s integration into library practices, unlocking avenues for enhanced user engagement, efficient reference services, streamlined information dissemination, community building, informed collection development, promotion of information literacy, real-time user support and robust feedback mechanisms. This integration aligns seamlessly with the Library Hi Tech journal’s commitment to technological innovation and its potential to drive positive transformations within the library and information sector.

6. Conclusion
In conclusion, this comprehensive analysis of WhatsApp research has unveiled numerous dimensions of the research landscape, offering critical insights into this ever-evolving domain. Our meticulous exploration of research trends, interdisciplinary contributions, influential journals, prolific researchers, global impact, influential papers, keyword patterns, thematic structures and bibliographic coupling networks has provided a multifaceted view of WhatsApp research.

One of the most significant findings is the rapid evolution of WhatsApp research, profoundly influenced by global events, most notably the COVID-19 pandemic. This pivotal historical moment accelerated the adoption of WhatsApp as a critical communication tool, resulting in a surge of research activities and underlining its profound relevance in contemporary society.

WhatsApp research has emerged as a genuinely multidisciplinary field, bridging diverse areas of study and presenting unique opportunities for collaboration and exploration across various domains. The intersections of education, communication, health sciences, psychology and more have expanded the boundaries of knowledge within WhatsApp research, offering fertile ground for cross-disciplinary dialog and innovative breakthroughs.
For researchers, policymakers and scholars interested in bibliometric analysis, this study provides a rich dataset and a nuanced understanding of WhatsApp research. It serves as an illuminating guide to navigate the multifaceted facets of this domain and offers insights into its future potential and avenues for exploration. However, it’s essential to acknowledge certain limitations inherent in this study. The analysis may have overlooked articles that did not explicitly mention the specific phrases used for shortlisting, which could have had some impact on the statistical analysis. Additionally, the study focused exclusively on peer-reviewed research, excluding gray materials like government reports. Despite these limitations, the study offers a comprehensive snapshot of the current state of WhatsApp research and provides a valuable reference point for future investigations.

Regarding future research directions, this study opens the door to intriguing avenues of exploration. Researchers can delve deeper into the nuanced themes uncovered in WhatsApp research, further dissecting the implications of its applications in education, healthcare and beyond. Additionally, longitudinal studies can track the continued evolution of WhatsApp research and its enduring impact post-pandemic. Furthermore, comparative analyses with other messaging platforms can shed light on the unique attributes of WhatsApp. Investigations into the ethical and privacy dimensions of WhatsApp usage in research and practice could offer critical insights into responsible application.

References


Further reading


Corresponding author
Mayank Yuvaraj can be contacted at: mayank.yuvaraj@gmail.com

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